THIN BONDED CONCRETE OVERLAYS OF ASPHALT PAVEMENTS

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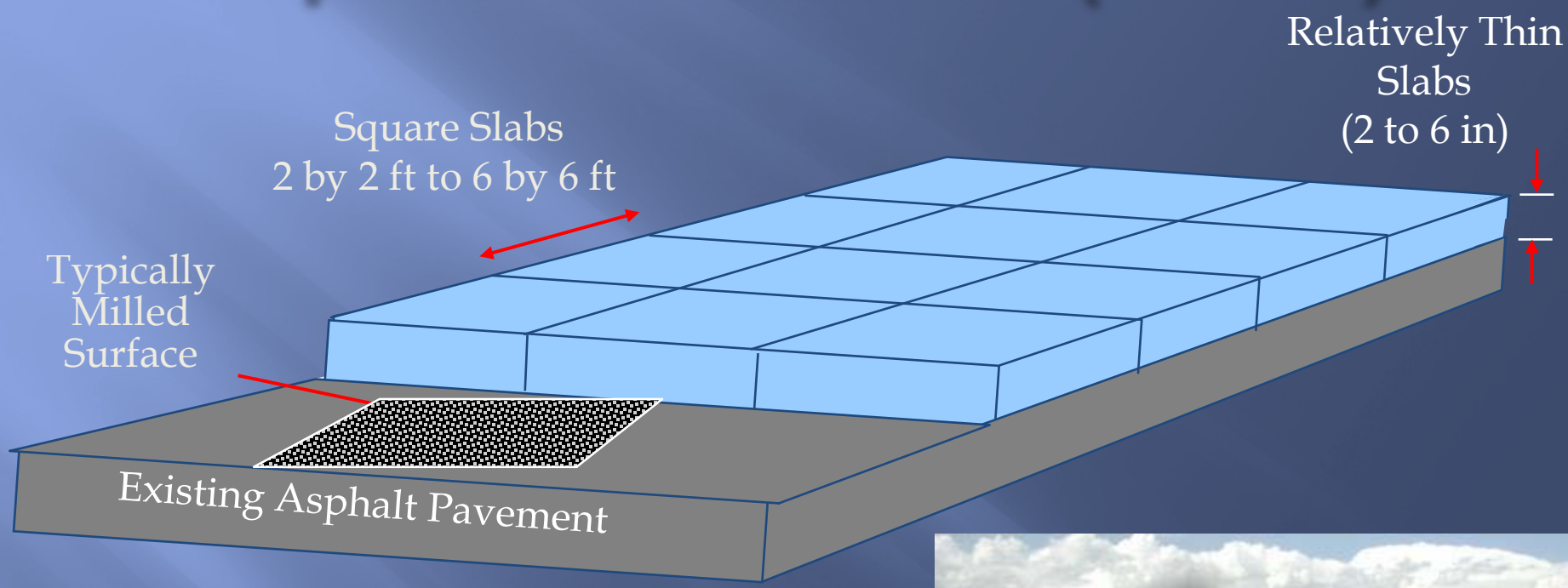
Dr. Michael Ayers

Global Pavement Consultants

Bonded Concrete Overlays of Asphalt Pavements (BCOA)



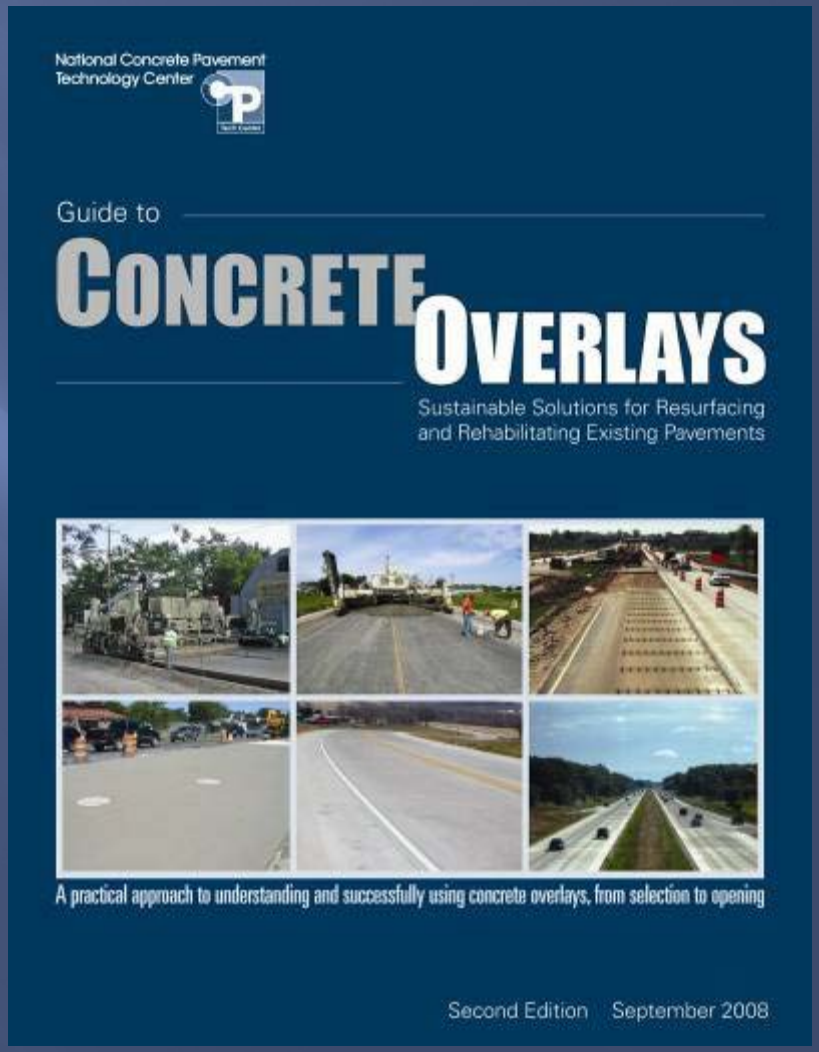
Reasons to Consider a BCOA

- BCOA pavements provide the following benefits:
  - A durable, long lasting, deformation free surface.
  - Low maintenance and rehabilitation costs.
  - Well-established construction techniques.
  - Added structural capacity.
  - Relatively thin overlays (minimal clearance issues).
  - Cost effective.
  - Quick to construct.
  - Sustainable solution.
  - Many others……..

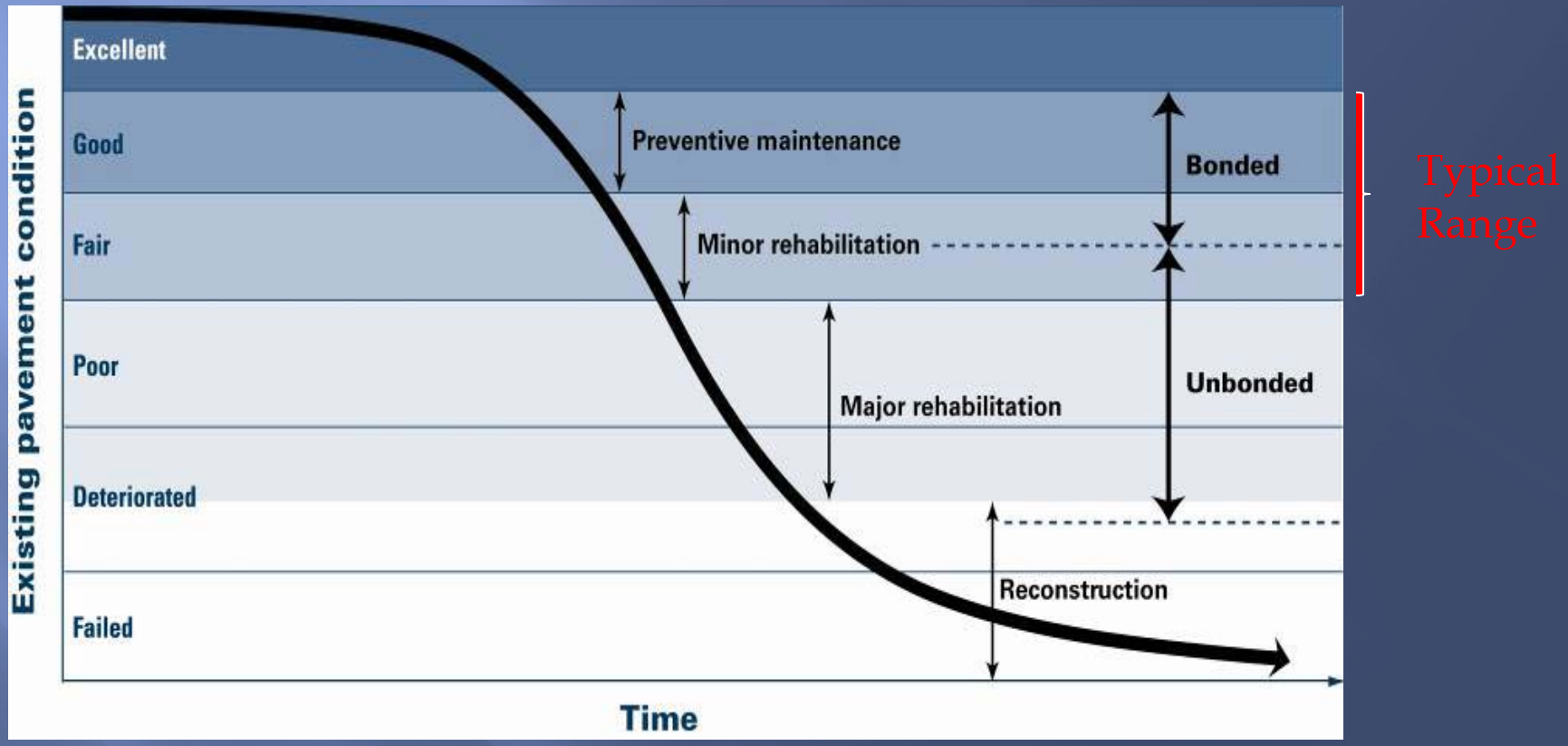
Concrete Overlay Guide, Second Edition

Contents:

- Overview of Overlay Families
- Overlay types and uses
- Evaluations & Selections
- Six Overlay Summaries
- Design Section
- Miscellaneous Design Details
- Overlay Materials Section
- Work Zones Under Traffic
- Key Points for Overlay Construction
- Accelerated Construction
- Specification Considerations
- Repairs of Overlays



Overlay Solutions for Rehabilitation and Maintenance



Over 200 miles in Iowa

Classes of Concrete Overlays

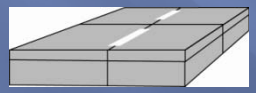
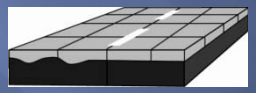
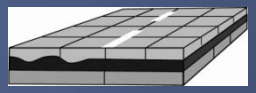
Thin

Concrete Overlays

Thick

Bonded Resurfacing Group

- Bonded Concrete Resurfacing of Concrete Pavements
- **Bonded Concrete Resurfacing of Asphalt Pavements**
- Bonded Concrete Resurfacing of Composite Pavements

Bond is integral to design

Unbonded Resurfacing Group

- Unbonded Concrete Resurfacing of Concrete Pavements
- Unbonded Concrete Resurfacing of Asphalt Pavements
- Unbonded Concrete Resurfacing of Composite Pavements

Old pavement is base

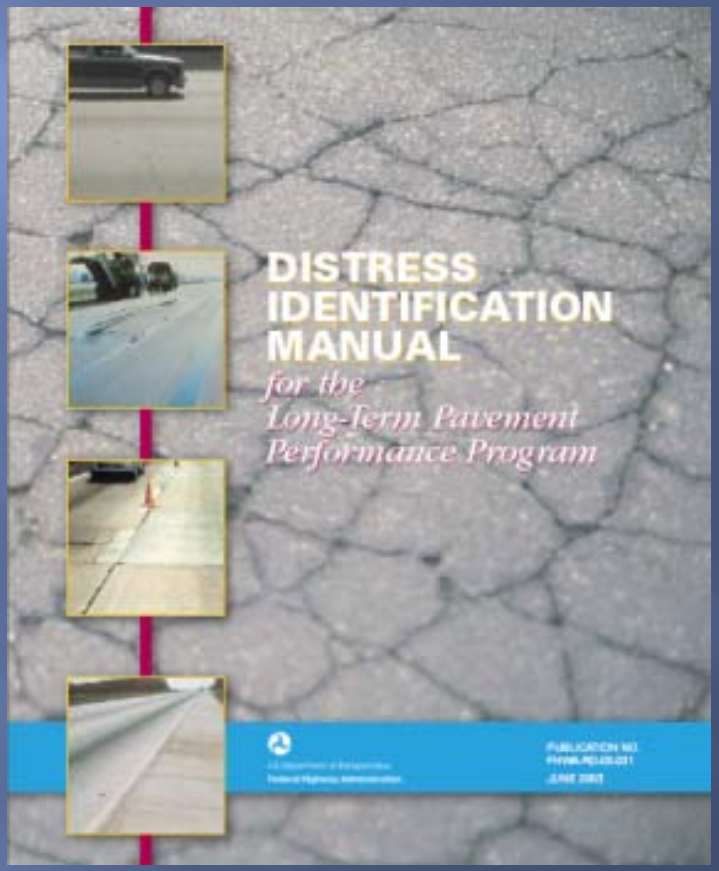
Evaluation of Existing Pavements for Bonded Overlays

- A detailed evaluation is required to establish if a bonded overlay is an effective strategy.
- The ultimate goal is to assess the stability and structural capacity of the existing pavement.
- The survey information is also used to determine if pre-overlay repairs are required and to what extent.
- The condition of the asphalt as well as residual asphalt thickness after milling are critical issues.

Visual Distress Surveys - Required

- A visual distress survey consists of mapping individual distresses for a specific pavement.
  - Distress type.
  - Severity.
  - Extent.
- The use of a detailed distress identification handbook is recommended.
- Standardized distress forms are highly desirable.
- The survey crew must be adequately trained.
- Take photos for later reference.

Example of a Pavement Distress ID Manual

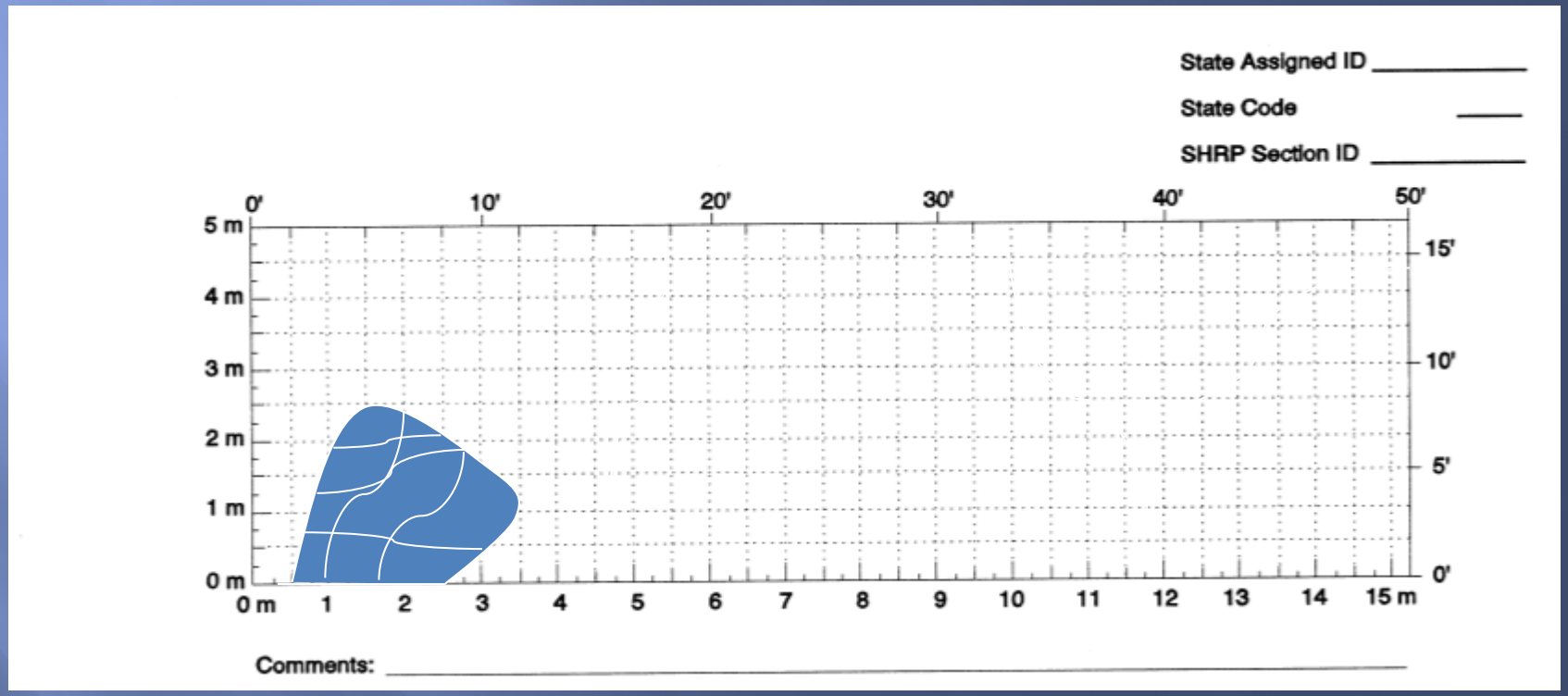


http://www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltpp/reports/03031/

or

Search….LTPP Pavement Distress Manual

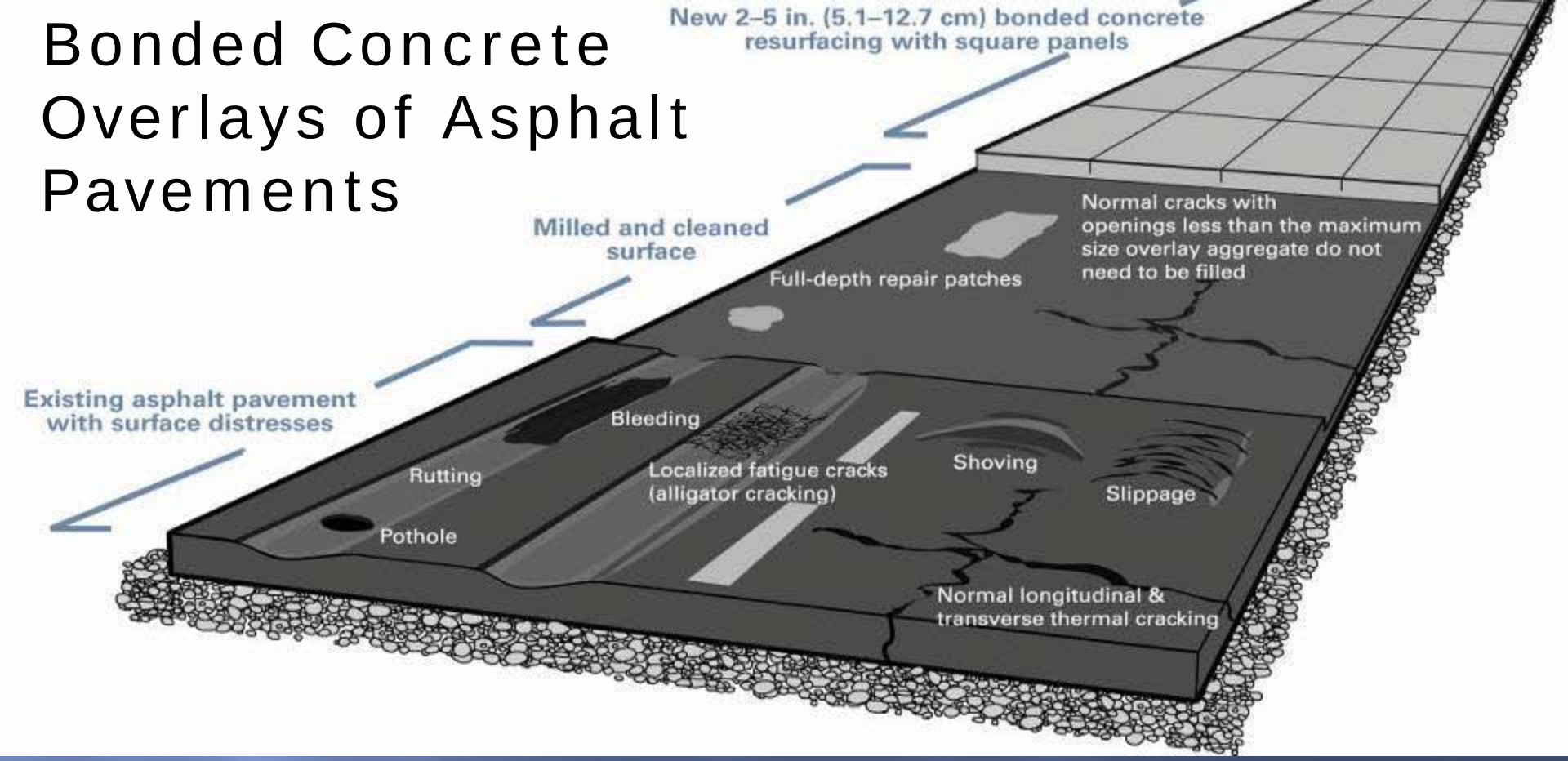
Example Distress Form



Visual Distress Surveys

- Many rehabilitation decisions are based on the results of the visual distress survey.
- It is very important to note localized areas of failure and probable causes.
- Look for obvious signs of problems such as water standing in ditches, localized settlement near a buried culvert or structure, presence of drainage outlets, performance differences due to terrain and other factors.
- Note that the entire pavement structure must be evaluated including shoulders, ditches, etc.

Bonded Concrete Overlays of Asphalt Pavements



- Localized distress can be determined through a visual distress survey, coring, deflection testing and other methods .
- Isolated weak zones can be strengthened by patching. Milling can be used to remove a number of asphalt surface distresses.

Designing Bonded Concrete Overlays of Existing Asphalt Pavements

Thickness Design

- 1993 AASHTO slab thickness design procedures do not account for bonding with HMA.
- The M-E PDG is also not well suited to this type of design.
- Interim procedures available that account for key design inputs:
  - ACPA
  - Colorado DOT.
  - New guidelines available later this year.
- Procedures must provide guidance on suitable thickness and joint spacing.

ACPA Design Method

http://apps.acpa.org/apps/bcoa.aspx

Materials

- Concrete mix is selected based on requirements for traffic opening.
- Fibers are an integral part of mix design.
- Smaller top-size of coarse aggregate.
- Fast track paving projects typically use mixes with compressive strengths > 3000 psi in 24 hours.

Mix Design

- Higher strength concrete is typically used.
- Low water/cement ratio.
- Synthetic or steel fibers are optional (structural in some cases).
- Fast track construction techniques are typically used.
- Consider durability aspects of the mix.

Bond

- The bond between the concrete and asphalt is one of the most critical elements in thin bonded overlays.
- If the bond fails, the project will fail much sooner than desired.
- The surface must be rough, clean, approximately at SSD moisture state, and less than 120 degrees F. when the concrete is placed.

Joint Spacing

- Joints in thin bonded overlays are spaced much less than in conventional pavement construction.
- Jointing patterns are established to divide the pavement into squares (or close to).
- The joint spacing depends on slab thickness.
- Saw depths are generally specified at 1/3 the slab thickness for longitudinal joints and ¼ for transverse joints.

Joint Design

- Maximum spacing of 2’ to 6’
  - Limit 1.0 to 1.5 times thickness in feet.
  - Some agencies include tie bars at longitudinal joints > 4 inches.
  - No dowels (aggregate interlock relied upon for load transfer).

Existing Asphalt Pavement Requirements

- The thickness of the asphalt after milling must be a minimum of 3 inches.
- The remaining asphalt must be intact with no stripping or raveling.
- Although specific requirements are not stated, the asphalt must provide a uniformly stiff platform for good performance.

Construction Details

Construction Details for Bonded Concrete on Asphalt Overlays

- The following slides represent some of the critical elements in constructing this type of overlay.
- Attention to detail is absolutely CRITICAL.
- A thorough review of design assumptions, plans and specifications, and construction approach is highly recommended.

Construction Steps

- Mill and clean surface.
- Pre-overlay repairs, if required.
- Set forms for roller screed.
- Prepare surface.
- Place concrete.
- Texture pavement.
- Apply curing compound.
- Saw cut joints.
- Monitor strength gain (maturity).

Pre-Overlay Repairs

- The purpose of pre-overlay repairs is to restore uniform support.
- These repairs are generally required for potholes and localized areas of severe fatigue cracking
(alligator cracking).
- The preferred method of repair is with concrete rather than asphalt (due to bond).
- Cracks can be filled, but generally are not.

Surface Preparation

- Milling AC surface.
  - Remove rutting.
  - Restore profile.
  - Enhance bond.
- Minimum AC thickness remaining after milling: to 3 to 5 in.
- Surface cleaning.

Surface Preparation

- The milled surface is typically broomed to remove loose material and to allow for detailed inspection of the pavement for determining if and what pre-overlay repairs are required.

Surface Cleaning

Pre-overlay Repairs

Concrete Placement

- Concrete placement should follow standard placement procedures.
- Do not allow the concrete to freefall more than a few feet to avoid segregation.
- Place the concrete as uniformly as possible in front of the screed.
- Do not overwork the surface.
- Do not add water in excess of the specified w/c.

PCC Placement and Finishing

Finishing

- Although generally not specified, the use of a 12 to 16 foot straightedge immediately behind the paver or screed can greatly improve ride quality.
- Do not over-finish and bring excessive paste to the surface.

Curing

- Curing must be done as soon as possible after placement.
- The curing should completely encapsulate the slab, top and sides.
- Because of the large surface area and small volume of concrete, this is even more critical than in normal construction operations.
- The slab should be uniformly white.

Curing

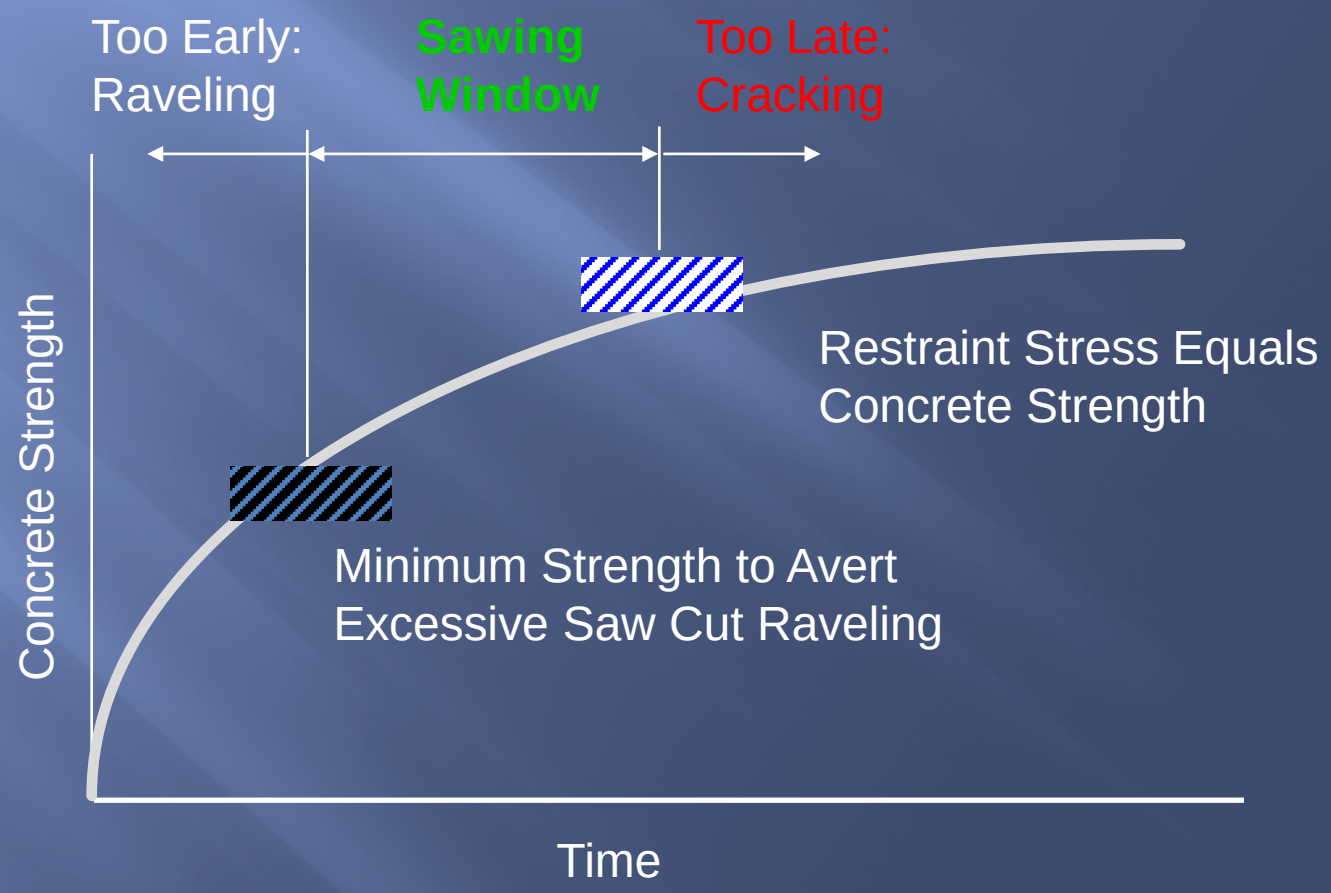
Texturing

Sawing Joints

- One of the most important construction steps in thin bonded overlays is timely joint sawing.
- Due to the large surface area of the thin slab, moisture loss and temperature differentials are key issues.
- If the joints are not sawed efficiently, random cracks will occur rapidly.
- Consider the mix and the environment when timing saw cuts.

Sawing Joints

Crack Control Window



Bonded Concrete Overlays of Asphalt Pavements - Keys to Success

- Bonding is critical.
- Small square panels reduce curling, warping, & shear stresses at bond (1 to 1.5 times thickness).
- Mill if necessary to correct crown, remove surface distresses, improve bonding. Be sure to leave 3” of HMA after milling.
- HMA surface temperature below 120 F before paving.
- Transverse joints must be sawed T/3.
- Joints in the overlay should not be placed in wheel paths, if possible.
- Application of curing compound or curing methods must be timely and thorough.

Thank You!

Mike Ayers
Global Pavement Consultants, Inc.
mayers@globalpavements.com
Cell: 217-621-3438

Barry Sanders or Greg Smith
Kentucky Concrete Pavement Association
(502) 695-3538