SR 151 in Harrison County
HAS-151-12.90  PID:98696  Project #160187

Lloyd MacAdam, District 11 Deputy Director

Paul Herman, Pavement Engineer

Jason Beranek, Project Manager, Design Engineer

Dan Moir, Project Engineer

Jerred Giaque, Area Engineer
MEMO
27APR2015
Overlay Technical Support Program
Subject: Ohio SR-151 Site Visit
To: Aric Morse, ODOT
From: Gary Fick, Mark Snyder and Dale Harrington

Introduction
A site visit was held on March 31, 2015 to review the proposed SR-151 bonded concrete overlay project. Attending the site visit were:
- Gary Fick, CP Tech Center
- Mark Snyder, CP Tech Center
- Aric Morse, Ohio DOT
- Paul Herman, Ohio DOT
- Craig Landefeld, Ohio DOT
- Dan Miller, Ohio DOT
- Mark Pardi, Ohio Concrete, ACPA Ohio Chapter

The project is located near Jewett, Ohio, beginning at the junction of SR-151 and SR-9, then extending northwest for approximately 3 miles.

Expert Team Approach
The HAS 151 project expert team consisted of Ohio DOT Construction, Design, and Materials personnel, industry representative, and FHWA/CP Tech Center experts.

The site visit occurred on March 31, 2015
BONDED CONCRETE OVERLAY ON ASPHALT
BONDED CONCRETE OVERLAY ON ASPHALT
BONDED CONCRETE OVERLAY ON ASPHALT

On a structurally sound flexible pavement

Milled surface to enhance bond

Jointing details to control cracking

Fibers to enhance performance

New software from University of Pittsburgh
Overview of Concrete Overlay Phase 2 Field Application Program
(Concrete Overlay Technical Assistance for State & Local Highway Agencies)

The need for engineered preservation and rehabilitation strategies for maintaining the nation’s highway pavements has never been greater. To advance the use of concrete overlays as cost-effective solutions for a wide variety of pavement conditions, the Federal Highway Administration (FHWA) and the National Concrete Pavement Technology Center (CP Tech Center) are implementing the second phase of the Concrete Overlay Field Application Program.

Program Objective
The overall objective of this program is to increase awareness and knowledge and strengthen confidence in concrete overlay applications among state DOTs, cities, counties, contractors, and engineering consultants.

A lot was accomplished in Phase I of the Field Application Program and it is important to continue to increase awareness and knowledge of concrete overlay applications. In the Phase I program a total of 24 states were given either workshops, site visits to evaluate potential overlay candidates or consultation on projects on design or early construction.

States’ Involvement
Each participating state agency will have an opportunity to develop in-house expertise on overlays with these states if they desire:

- Meetings with state DOT upper management regarding the benefits of concrete overlays and to answer state DOT questions on issues they perceive.
- An initial 2-day workshop on concrete overlay best practices.
- Site visits and remote meetings with an expert team who will provide ongoing recommendations and guidance on the states’ candidate for a concrete overlay.

Sharing Experiences
Following the site visit, the team will provide written summaries with recommendations. The findings of each site visit, as they occur, will also be sent to head of the FHWA state DOTs for their information. This will go a long way in sharing information with 24 states throughout the country.

Expert Team
An expert team consisting of a state DOT, CP Tech Center, and when possible an industry member or FHWA member will be assigned to each state to share their knowledge and experiences about:

- Overlay technology
- Project evaluation and selection
- Design details
- Construction traffic control suggestions
- Constructability issues

The number of team members will vary depending on the state’s position on what input they desire. This expert team will meet with their assigned state to field review its potential project site. The team will:

- View proposed project site
- Review evaluation data
- Discuss design and construction elements
- Discuss Traffic control criteria and accelerated construction options

August 2013

Rehabilitation Strategies for Bonded Concrete Overlays of Asphalt Pavements

Authors:
J. M. Vandenbosch
S. Sacks

2013
WHY CONCRETE OVERLAYS?

Fracking Increase in truck traffic has its drawbacks (3/29/15)
A road near Cadiz, Ohio has been restricted to prevent damage from trucks. “NO RIG TRAFFIC”

“Absolutely there’s more traffic in that area of the state then there has been in the past.”
“Whenever there’s more traffic there’s more conflict and more opportunity for crashes.”

State routes are designed to handle the increased traffic but the influence of heavier vehicles will cause the roads to break down faster.

(Jerry Wray)
WHY CONCRETE OVERLAYS?

Fracking – Increase in truck traffic has its drawbacks 3/29/15

Truck tires rolling over the edges of narrow roads, for example, are wearing out those edges faster, said Lloyd MacAdam, the district's deputy director.

...deeper potholes have become common in Harrison County, said Kathy Cusick, a Cadiz resident. We have never had truck traffic like we have now.

Harrison County has had to relax its “frost laws”, which reduced load ratings on roads from November to April, said Robert Sterling, county engineer.
WHY CONCRETE OVERLAYS?

1. Because of the wide range of overlay thicknesses that can be used, combined with minimal pre-overlay work required, concrete overlays provide cost-effective solutions for almost any pavement type and condition, desired service life, and anticipated traffic loading.

2. The existing pavement does not need to be removed. In fact, it is factored into the overlay design to continue to help carry some of the traffic load.

3. Concrete overlays are easy to maintain.

4. Thin overlays constructed without reinforcement can be easily and economically milled out and replaced with a new concrete surface. Small panels can be replaced much easier than conventional concrete, if needed.
BONDED CONCRETE OVERLAY ON ASPHALT

KEYS TO SUCCESS

• Bonding is critical - Remove any standing water
• Small square panels reduce curling, warping, & shear stresses in bond (joint approx. 1.5 times thickness).
• Mill to remove surface distresses, or improve bonding.
• Be sure to leave 3” to 4” of HMA after milling.
• HMA surface temperature below 120 F before paving.
• Joints in the overlay should not be placed in wheel paths, if possible
• Application of curing compound is critical
DOES CONCRETE ADHERE TO ASPHALT?
HOW DO BONDED CONCRETE OVERLAYS ON ASPHALT WORK?

- Concrete bonds to the asphalt
  - Lowers the neutral axis
  - Decreases stresses in the concrete

- Short joint spacing
  - Controls cracking
  - Slabs act as paver-blocks

- Fibers improve concrete toughness
Short joint spacing allows the slabs to deflect instead of bend. This reduces slab stresses to reasonable values. Joint load transfer is improved by decreased joint openings from reduced slab movements and thin saw cuts.
**Bonded**

Use to eliminate surface defects; increase structural capacity; and improve surface friction, noise, and rideability.

**Unbonded**

Use to restore structural capacity and increase pavement life equivalent to full-depth pavement. Also results in improved surface friction, noise, and rideability.
LONGITUDINAL JOINT LAYOUT-AVOID THE WHEEL PATH
• No increase in concrete’s compressive strength, but in fatigue capacity

• Increases toughness

• Increases post crack integrity
  • Helps control plastic shrinkage cracking

• 3 to 5 # minimum dosage of macro fibers
  • 2” +/- Apparent slump loss

• ODOT developed a macro fiber plan note for HAS-151
HAS-151 BONDED CONCRETE OVERLAY PROJECT REVIEW
Construction Sequence

- Mill and clean surface thoroughly
- Place concrete when surface temperature < 110°F
- Conventional fixed form or slip form placement can be used
- Grout or epoxy bonding agents are not required
- Pavement textured with longitudinal tining
- Apply 2 applications (1 gal/300 sf) of curing compound within 30 minutes
- Begin sawing as soon as possible - use multiple early entry saws
- Test mix throughout placement for QC. Beams for early open to traffic
MILLING: BONDED CONCRETE OVERLAY ON ASPHALT

- A minimum of 3”- 4” of good asphalt should remain after milling because of the reliance on the asphalt pavement to carry a portion of the load.

- Milling depths within an inch of an existing layer may come loose and should be removed.

- Millings can be used for temporary access roads or compacted shoulder material.
Surface Cleaning Methods:
- Pressure washing, no standing water should be allowed prior to paving.
- Power Broom Sweeping
- Compressed Air Blasting
PRE - PAVING: THE DUCK TAPE TEST

• This is not rocket science

• It is simple

• If you hear it

• It pulls up with a moderate amount of resistance
SLIP PAVE CONCRETE OVERLAYS
PAVING OPERATION
FIBER REINFORCED CONCRETE MIX SPECIFICATIONS

- ODOT Class QC3
- Uniform Aggregate Gradation for improved density, workability and durability (#57’s & #8’s)
- Macro fibers - minimum 4#/cy. Minimum residual strength, Re3=25%
- Permeability-2000 coulomb max. Requires SCM, fly ash, slag or silica fume.
- Max cement = 625lb/cy
- 600 PSI flexural strength
- W/CM = 0.40
- AE = 6+/- 2 % Air
- Slip Form 2” +/- 1”
- Super-P 6” +/- 2”
FIBER REINFORCED BONDED CONCRETE MIX

- **Concrete Mix Quality Control**
  - Air Temperature = 72.8°F
  - Air Content = 6.57%
  - Unit Weight = 144.5 pcf
  - Thickness = 4.6 inches
  - Concrete Temperature = 82.9°F
  - Slump = 1.44 inches
  - Compressive Strength = 7,570 PSI
PAVING OPERATION

Began Paving Eastbound Lane July 5th, 2016

4-1/2” thick concrete Placed over milled asphalt
BONDED CONCRETE OVERLAY ON ASPHALT
PAVING OPERATION IS FOLLOWED BY TINING
BONDED CONCRETE OVERLAY - TINING
Curing immediately follows the paving and timing operations.
EVAPORATION RATE CHART

- Enter with Air Temperature
- Up to Relative Humidity
- Right to Concrete Temperature
- Down to Wind Velocity
- Left to Evaporation Rate

Maximum 0.2 lb/sf/hr for paving operations

Importance of Curing
DETERMINING EVAPORATION RATE - KESTREL INSTRUMENT

REAL TIME MEASURE
• Ambient Temperature
• Relative Humidity
• Concrete Temperature
• Surface Temperature
• Average Wind Speed

• Calculates Evaporation Rate
BONDED CONCRETE OVERLAY ON ASPHALT
BONDED CONCRETE OVERLAY ON ASPHALT

Paving second half after concrete beams attain 600 PSI flexural strength.