PCC Overlay IA 3 in Iowa

Accelerated staging

Greg Mulder, P.E.

Nov. 10, 2022

IA 3 Overlay

- Concept
- Construction
  - PCC overlay typical (historical)
  - PCC overlay new theory
  - HMA overlay typical
- Materials Data
- Conclusions

Today's Learning Objectives

- Report the success of concrete overlays.
- Learn another perspective on concrete overlay designs.
- Understand how a slight change of concept can help concrete overlays to be constructed with the minimum amount of traffic interruption.
- Safety can be engineered into a project.

Project Scoping

Project Phase	Related Task	Project Type1
Planning and Scoping (Chapter 2)	Preliminary Planning and Needs Assessment	1R, 2R, 3R, 4R, NL
	Establish Project Purpose and Need	2R
		3R, 4R
		NL
	Establish Project Scope	2R
		3R
		4R
		NL

https://safety.fhwa.dot.gov/hsm/fhwasa16106/ch1.cfm

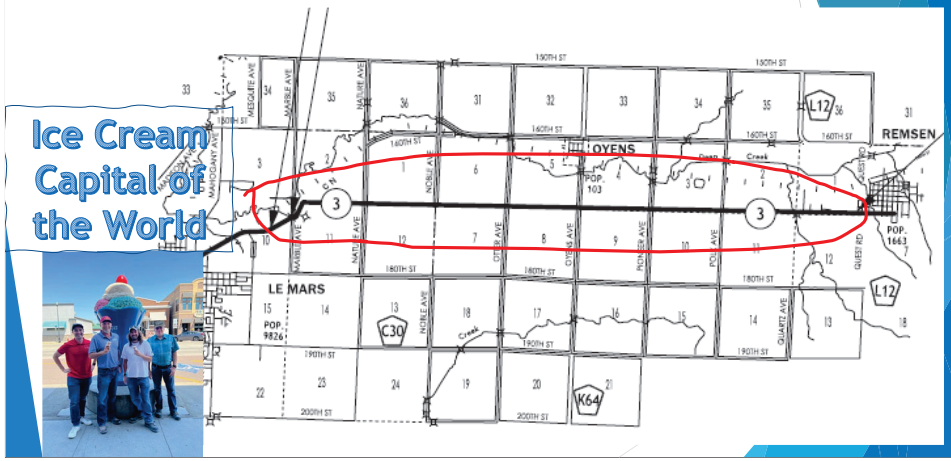
Project Scoping

Project Type	Example Description
1R	The 1R project type designation is often associated with routine maintenance activities. This type of project could include a pavement overlay, roadside maintenance, or a minor upgrade to existing roadside hardware. For 1R projects, there are very few, if any, new improvements.
2R	The 2R project type designation is generally associated with resurfacing existing facilities or restoring road characteristics that are in need of an upgrade. As part of the 2R project, a limited number of new design or operational changes may be incorporated. These enhancements are minor and do not change the overall character of the facility.
3R	The 3R project type is often associated with major rehabilitation of an existing facility. This could include pavement improvements for the existing road, minor roadway widening, roadside shoulder improvement projects, and construction of select low-cost safety improvements at the site or system-wide level.
4R	The 4R project type includes major retrofit construction efforts including modification of the design to meet geometric criteria standards. This type of project generally includes substantial changes to the character of the road (significant widening, realignment, major operational modifications).
NL	The NL project type indicates constructing a highway at a new location. This type of project has all new construction for the majority of the alignment.

What are we trying to research?

- Compare PCC overlay construction times to other overlay schedules.
- Accelerate project schedule while maintaining quality project and increasing safety.

Project Location

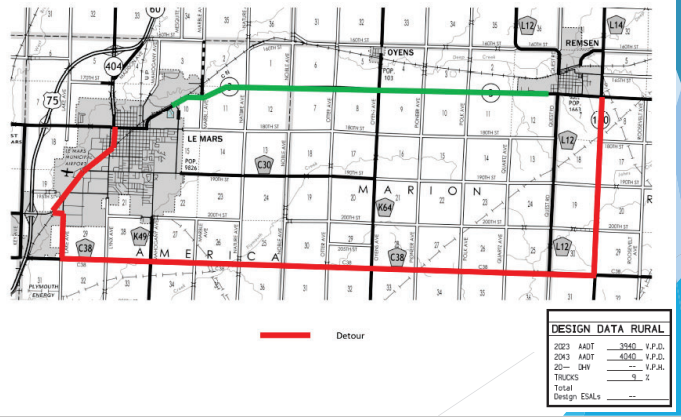


Project typical

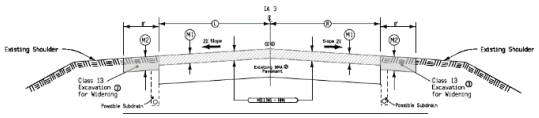
Old DOT Philosophy

- PCC overlay – like a PCC Reconstruction
  - Close the road from end to end for months to allow contractor to do **everything** safely under closure.
  - Traffic out of distance detoured for most of a summer
  - Local traffic mixing with construction traffic
  - Communicate…

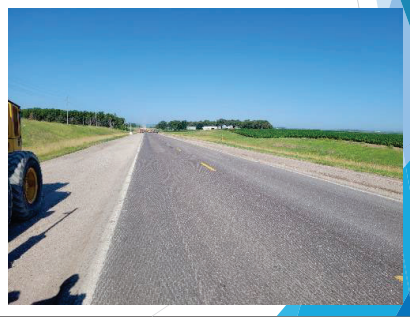
Standard PCC staging plan



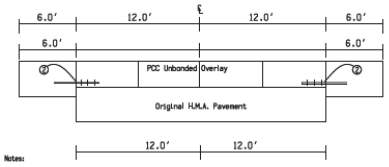
Profile Milling



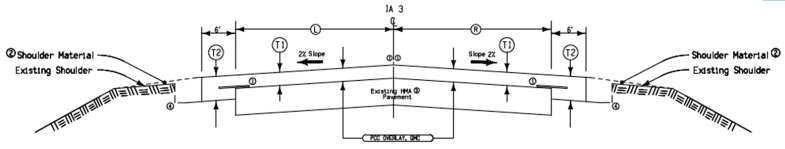
2-inch nominal milling of existing HMA



Design



- Originally designed as 12’ x 12’ panels with 6’ shoulders and macrofibers
- Fibers were removed to save money. Design changed to 6’ x 6’ panels.



Old DOT philosophy

Close the road for **60 working days (90 calendar days)** to complete **all the work, including** the profile survey, milling, overlay, sideroads, and etc…

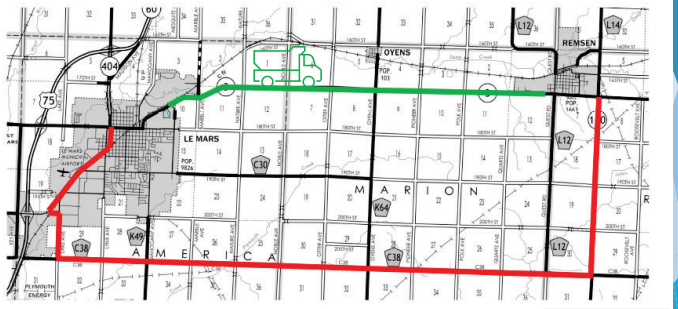
Local Traffic only from end to end of the project the entire duration

LDs for days over contract period

Test DOT Philosophy

- PCC overlay - Accelerated Construction Schedule
  - Focus on the mainline thru traffic, reducing impacts to thru traffic
  - Allow some work to be done under lane closures and pilot vehicles as appropriate
  - Thru traffic detoured for the shortest amount of time possible by only using full closures when needed for mainline work
  - Communicate…

Test DOT philosophy



Test DOT philosophy

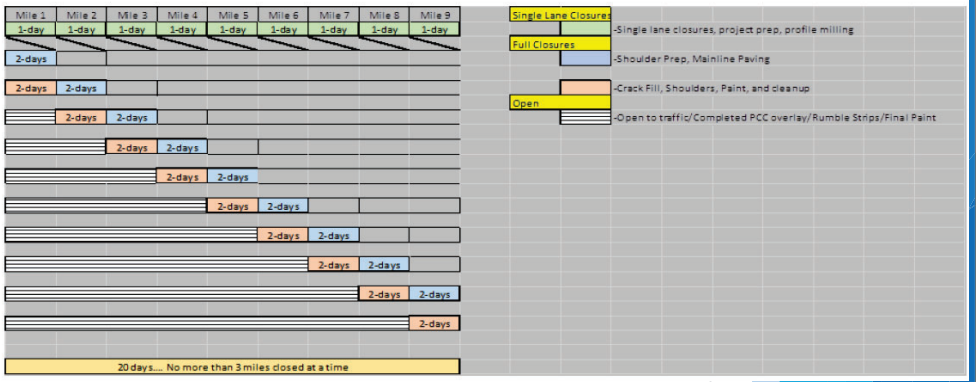
Close the road for **24 calendar days** to thru traffic

Maintain traffic up to 1 mile ahead and 1 mile behind paving/finishing operations (3 mile moving closure)

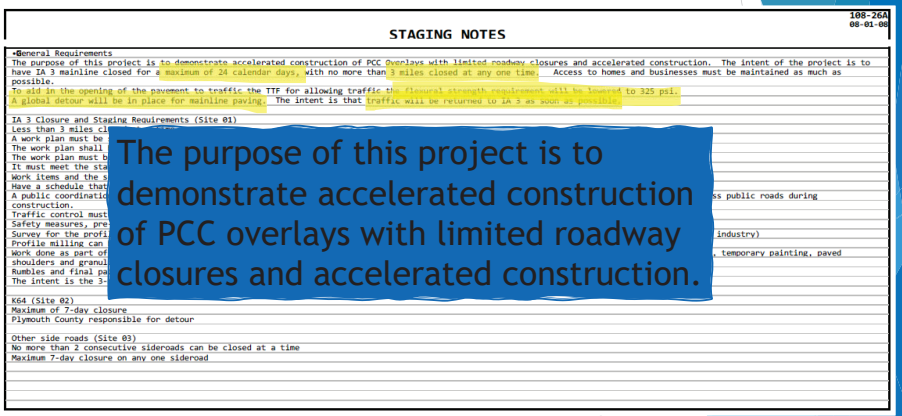
Keep project finishing details as close as possible to the paving operations

Heavy incentives/disincentives for time over contract period

Test DOT Philosophy - Concept



Staging notes



108-26A
08-01-08

STAGING NOTES

•General Requirements
The purpose of this project is to demonstrate accelerated construction of PCC Overlays with limited roadway closures and accelerated construction. The intent of the project is to have IA 3 mainline closed for a maximum of 24 calendar days, with no more than 3 miles closed at any one time. Access to homes and businesses must be maintained as much as possible.
To aid in the opening of the pavement to traffic the TTF for allowing traffic the flexural strength requirement will be lowered to 325 psi.
A global detour will be in place for mainline paving. The intent is that traffic will be returned to IA 3 as soon as possible.

IA 3 Closure and Staging Requirements (Site 01)
Less than 3 miles cl
A work plan must be
The work plan shall
The work plan must b
It must meet the sta
Work items and the s
Have a schedule that
A public coordinatio
construction.
Traffic control must
Safety measures, pre
Survey for the profi
Profile milling can
Work done as part of
shoulders and granul
Rumbles and final pa
The intent is the 3-

K64 (Site 02)
Maximum of 7-day closure
Plymouth County responsible for detour

Other side roads (Site 03)
No more than 2 consecutive sideroads can be closed at a time
Maximum 7-day closure on any one sideroad

ss public roads during
industry)
, temporary painting, paved

The purpose of this project is to demonstrate accelerated construction of PCC overlays with limited roadway closures and accelerated construction.

Determining success

- Instrumentation (strain gauges) in overlay
- Traffic study/review (no accidents!)
- Less impact to the community/travelers
- Communication review
- Feedback from DOT inspection staff
- Feedback from homeowners/businesses
- Feedback from County

Key strategies

- ✓ Required work plan
- ✓ Required Communications plan
- ✓ Focus on reducing mainline closure time, minimizing detoured thru traffic
- ✓ Maturity strength for opening reduced from 500psi to 325psi

Open Communication

CROELL

2010 Kenwood Avenue
P.O. Box 430
New Hampton, IA 50659
Phone: 641-394-6789
Fax: 641-394-2340

Resident along Hwy 3,

Very shortly we will begin construction on Hwy 3 from Le Mars to Remsen. Surveyors have already been working, setting monuments next to the shoulders, along the road, that will be used during construction. June 20th, we plan to start milling the road using single lane closures. We plan to close 1 lane for a mile at a time, moving through the project. This portion of construction should take 2 weeks to complete. **We ask that you travel cautiously through the road during construction.**

After July 4th weekend the construction of a new 36' concrete road will start. We will pave the full width of the road with 6' shoulders all at once. The project is being built under an accelerated work schedule which means we will be shouldering and opening newly constructed portions daily. We hope to complete all the new Hwy 3 mainline in 21 days.

Immediately after Hwy 3 paving, the intersection of K64 will be reconstructed to match the new roadway. We plan to have K64 closed for 7 days. All the intersecting roads will get new paved intersections also.

As we pave past your residence you will need to access your residence from the shoulder on the same side of the road where you live, and travel to the nearest side road and away from Hwy 3 to detour around. The shoulders should be between 8 and 10' wide so you will not be able to meet any vehicles. Please watch what's coming down the shoulder before traveling in or out. You will not be able to cross the new road at your residence or drive on the new concrete for approximately 30 hours. We may be able to adjust this number but will not know what it is until we start paving and get some test data established. I will do what I can to keep you informed as to what portions of the new road are able to be driven on.

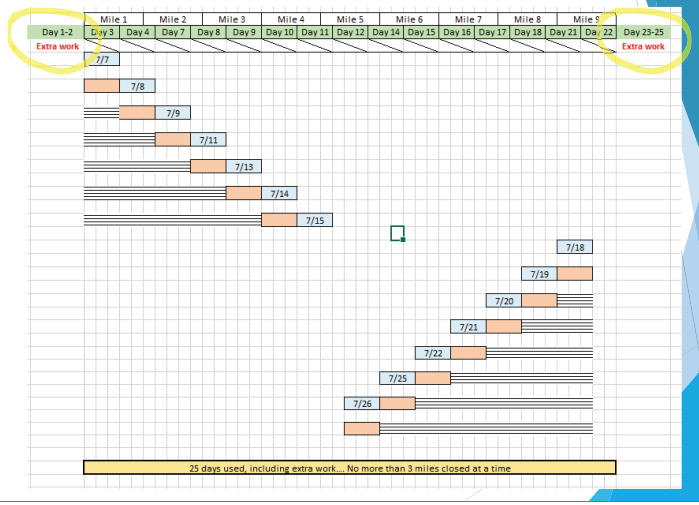
In order to stay in contact with you during this process I ask that **you please send me an email with your name, address and phone number, or a text with your name, address, and email. My email address and cell phone number are below**. I plan on sending out emails to all residents almost daily when we get to concrete paving, to let them know the progress of the project, and where you can and cannot drive. We will build rock ramps at the intersections and at your driveways once we can safely get a dump truck onto the new road. Keep in mind that this is under construction. **Please travel with caution**. Until shoulders get placed there will be a **9"** drop off on the edge of the road.

We understand this may be an inconvenience through this process, feel free to contact me with any questions.
Thank you.

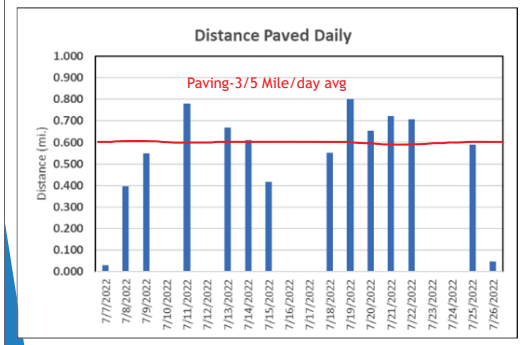
Jason Meihost
Project Manager
2010 Kenwood Avenue
New Hampton, IA 50659
Mobile: 319-930-5760
Jason.meihost@croell.com

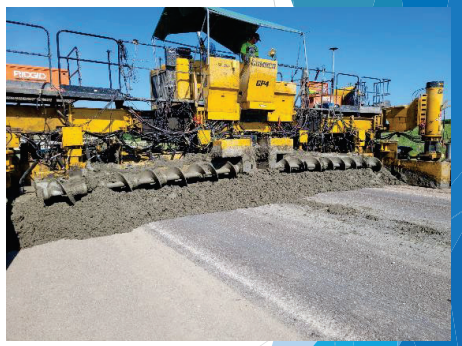
Actual Placement

Actual Placement

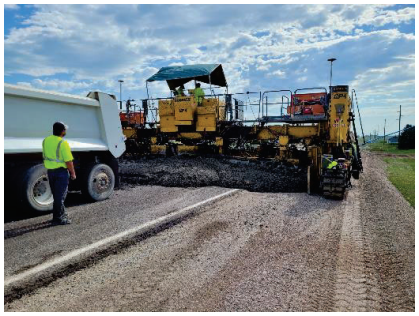


Pavement Placement

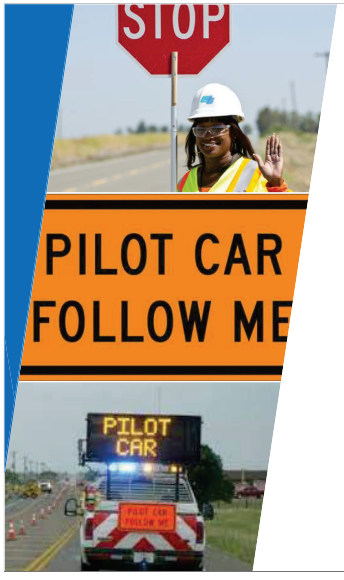




Paving Pics



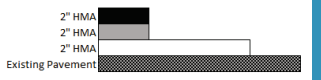
Paving Pics

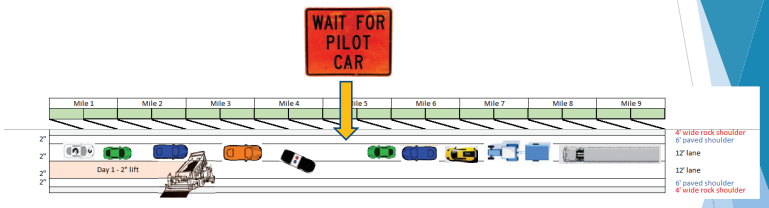


DOT Philosophy for HMA overlays

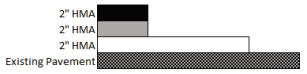
- HMA overlay –
  - Allow for single lane closures
  - Traffic stopped and controlled with flaggers and pilot cars
  - Local traffic mixing with construction traffic
  - Local traffic within inches of construction traffic

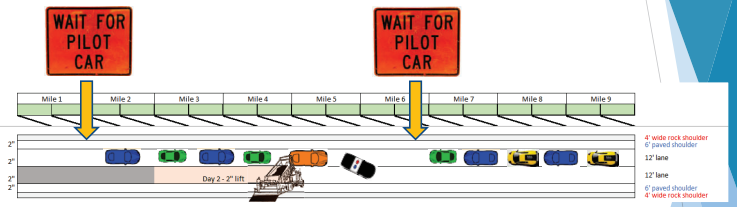
2” Overlay – day 1



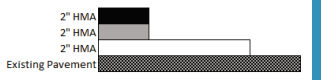


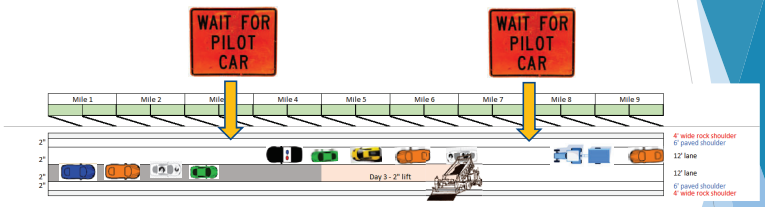
2” Overlay – day 2



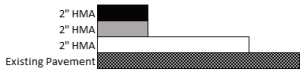


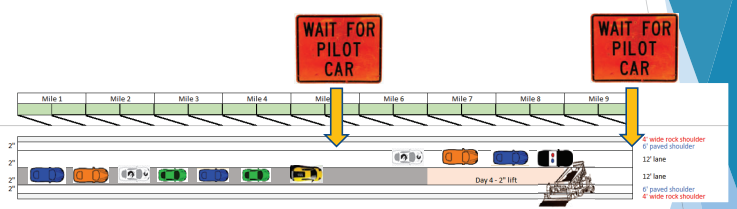
2” Overlay – day 3



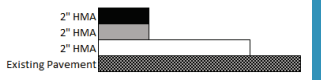


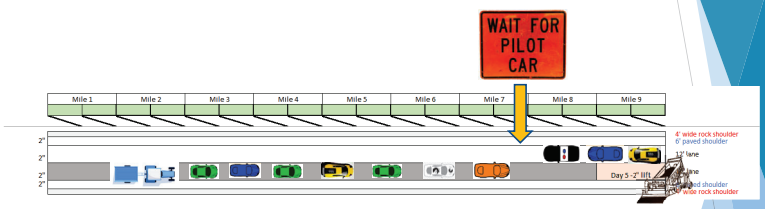
2” Overlay – day 4



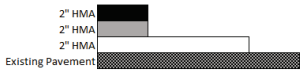


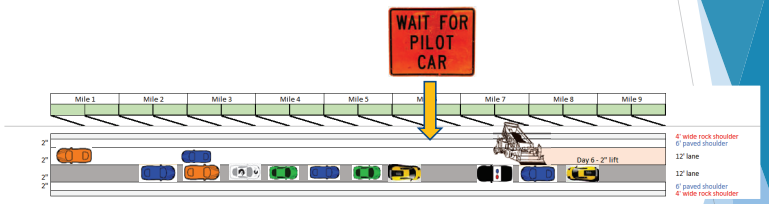
2” Overlay – day 5



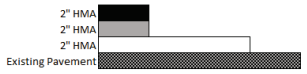


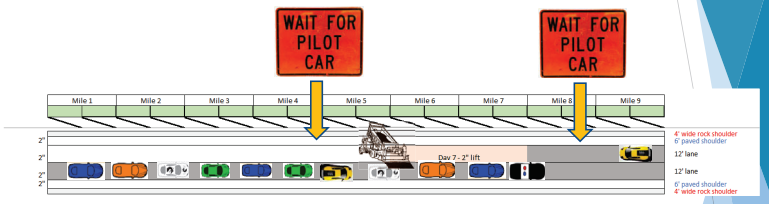
2” Overlay – day 6



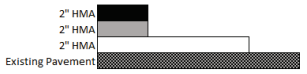


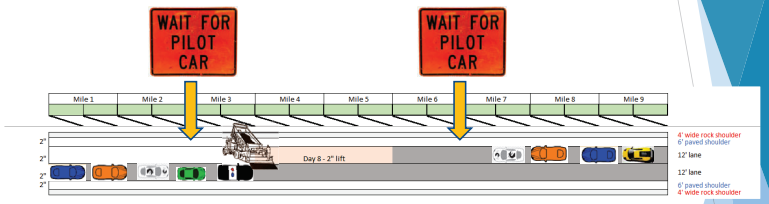
2” Overlay – day 7



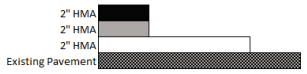


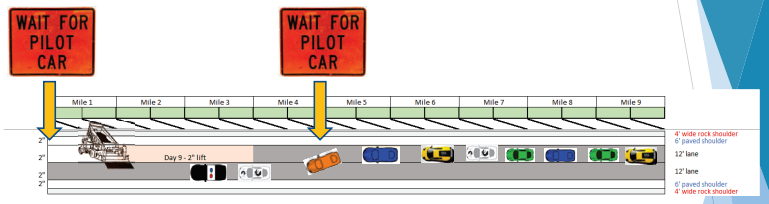
2” Overlay – day 8



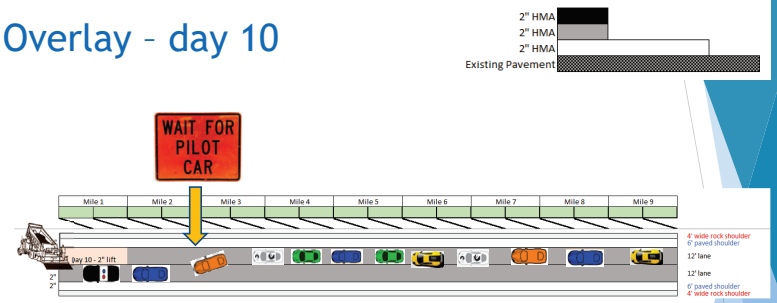


2” Overlay – day 9

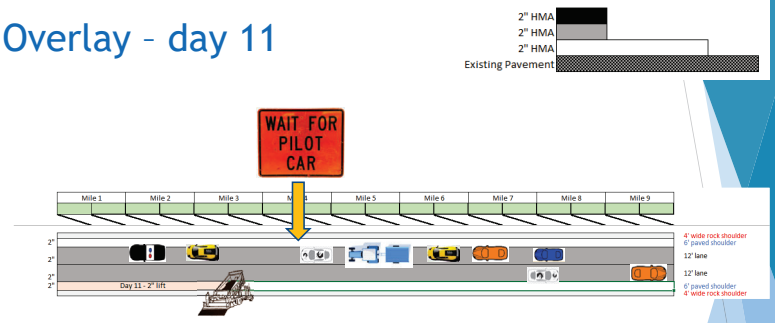




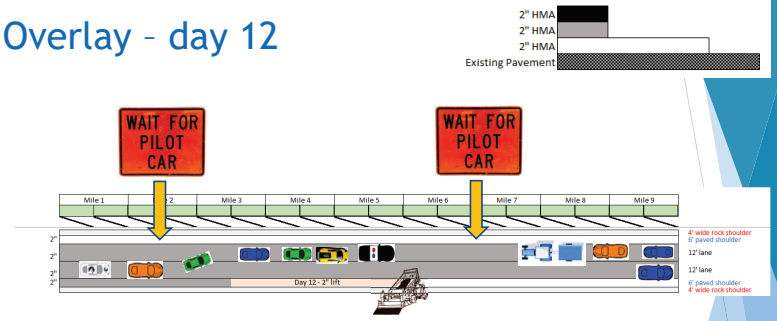
2” Overlay – day 10



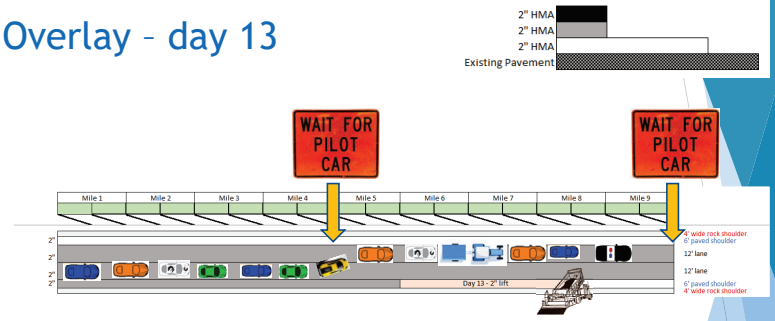
2” Overlay – day 11



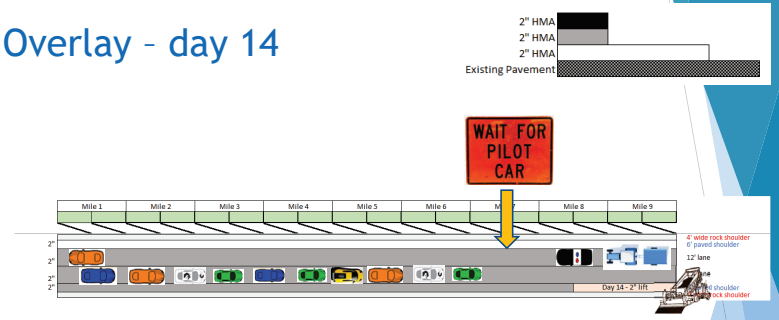
2” Overlay – day 12



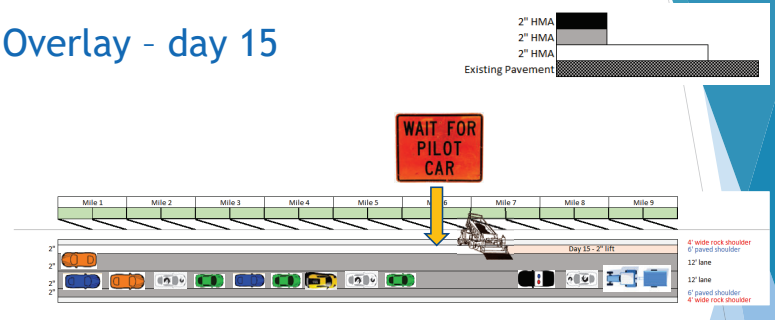
2” Overlay – day 13



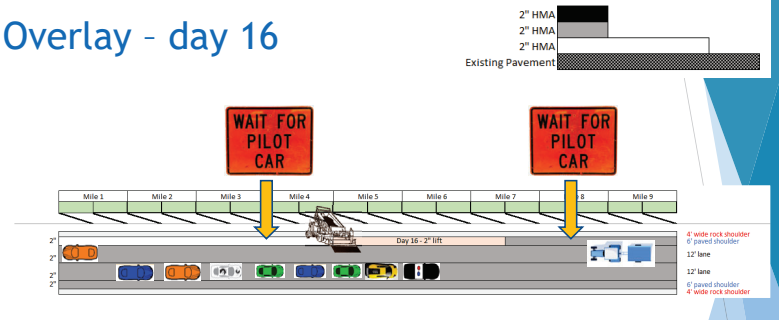
2” Overlay – day 14



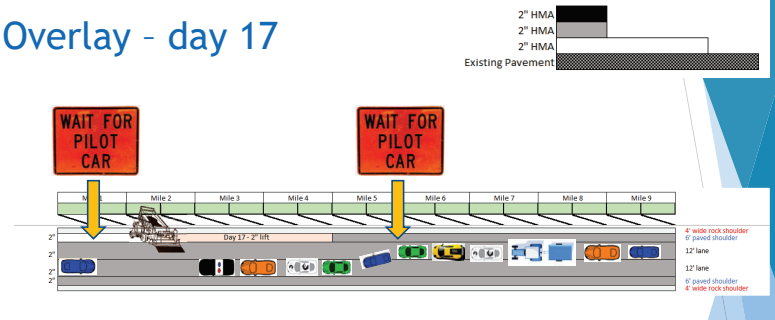
2” Overlay – day 15



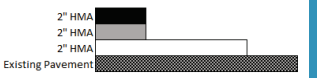
2” Overlay – day 16

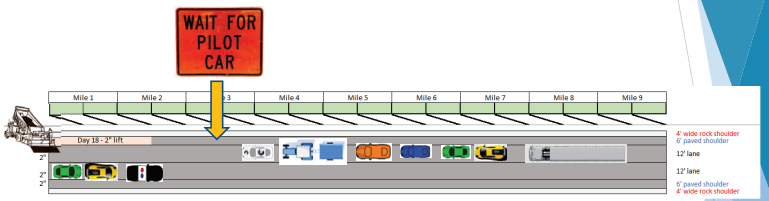


2” Overlay – day 17



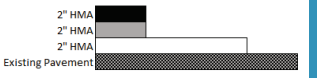
2” Overlay – day 18

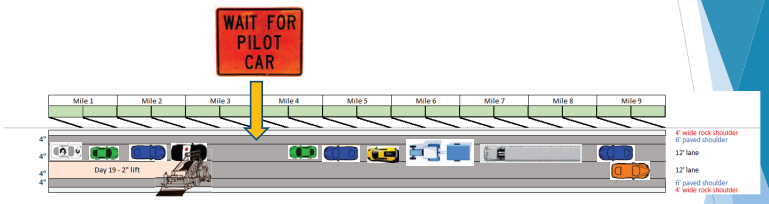




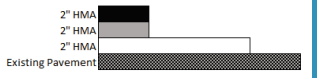
YAY! Lift 1 is done!

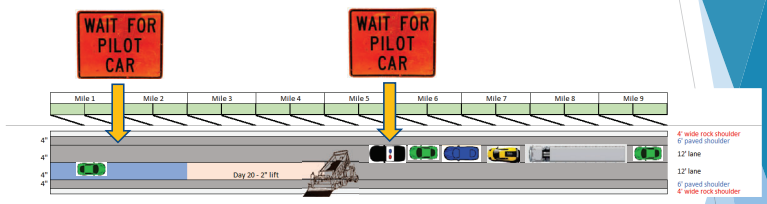
2” Overlay – day 19



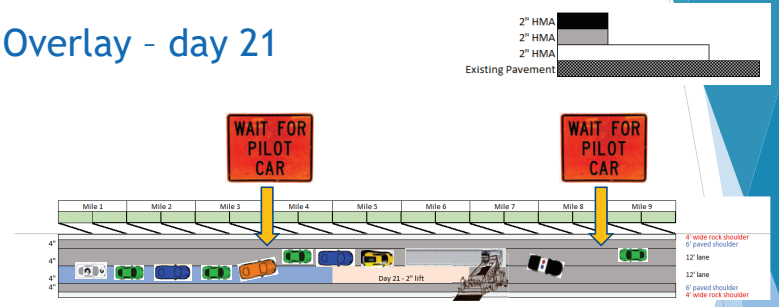


2” Overlay – day 20

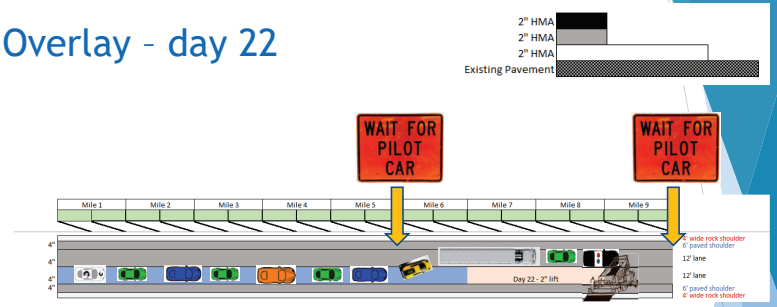




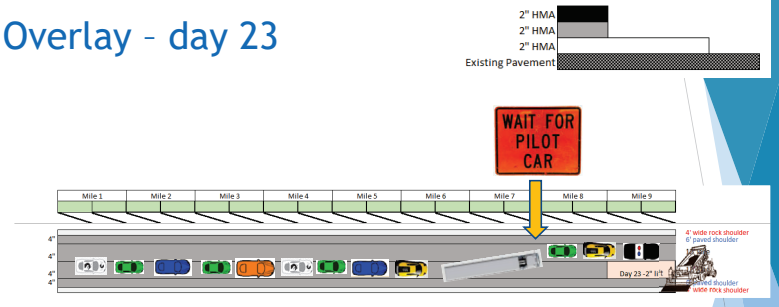
2” Overlay – day 21



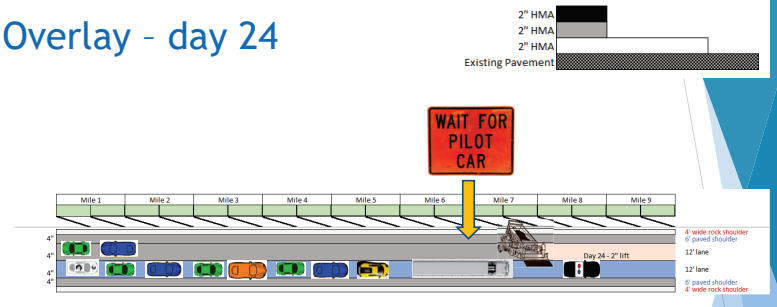
2” Overlay – day 22



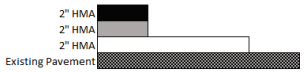
2” Overlay – day 23

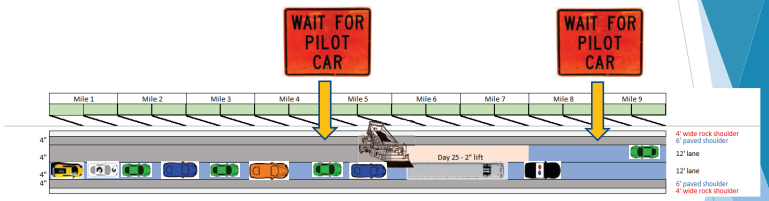


2” Overlay – day 24

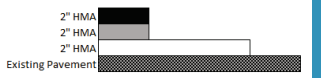


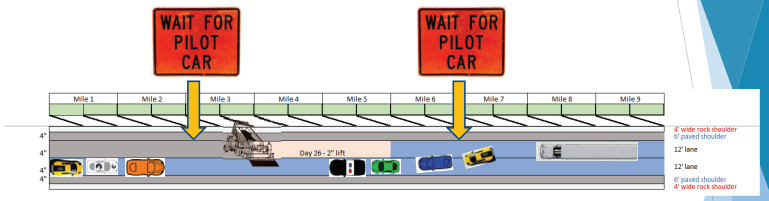
2” Overlay – day 25



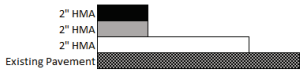


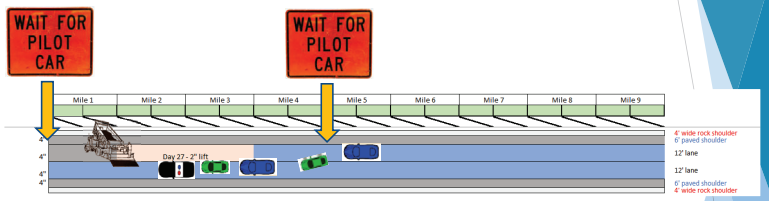
2” Overlay – day 26



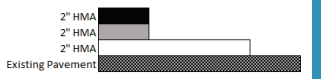


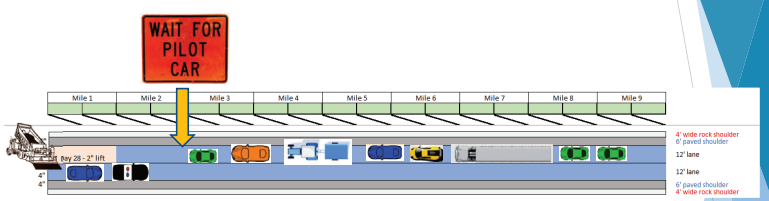
2” Overlay – day 27



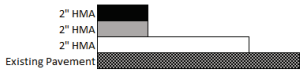


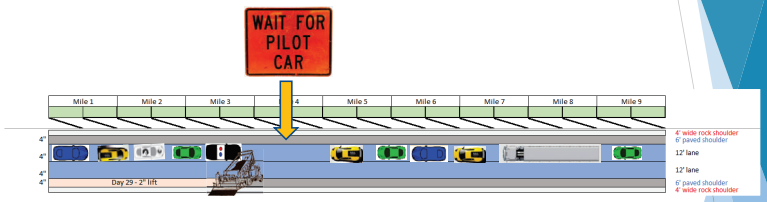
2” Overlay – day 28



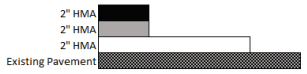


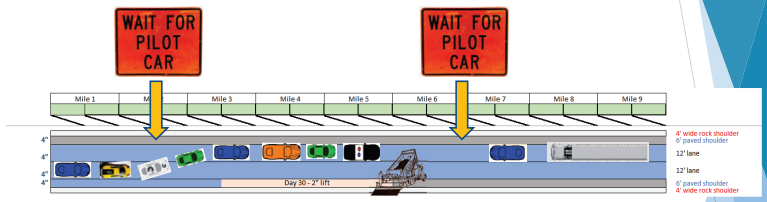
2” Overlay – day 29



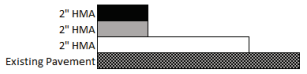


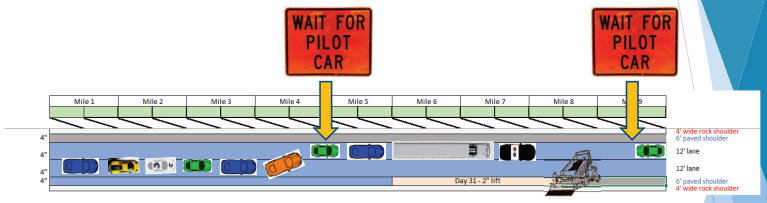
2” Overlay – day 30



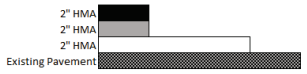


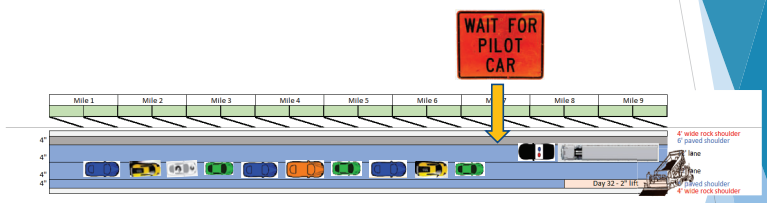
2” Overlay – day 31



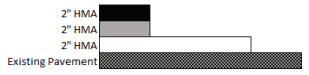


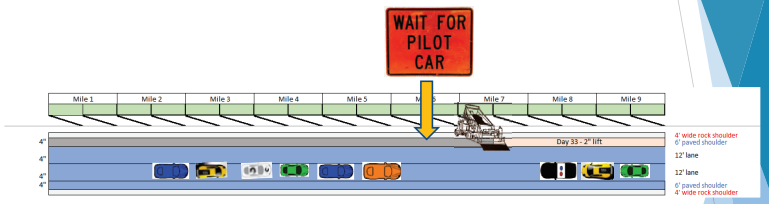
2” Overlay – day 32



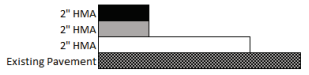


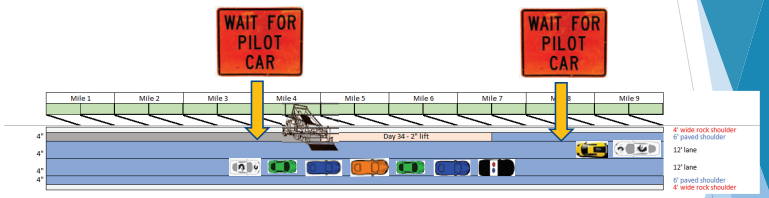
2” Overlay – day 33



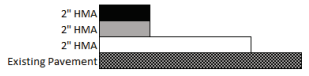


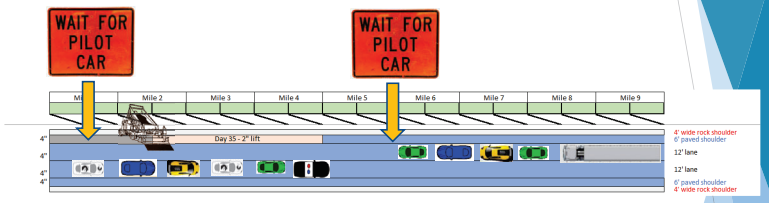
2” Overlay – day 34



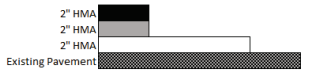


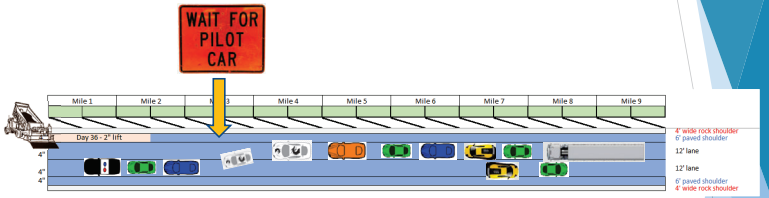
2” Overlay – day 35





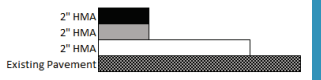
2” Overlay – day 36

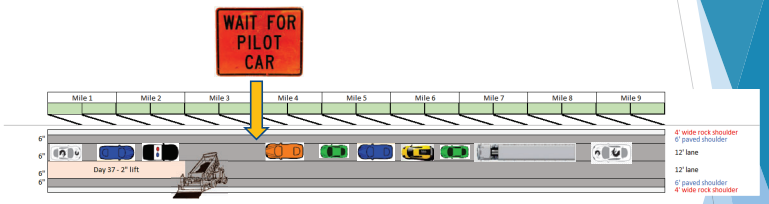




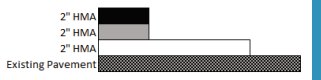
YAY! Lift 2 is done!

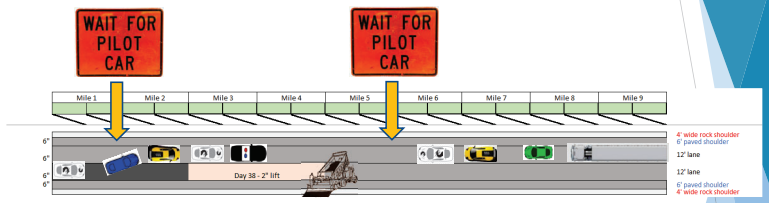
2” Overlay – day 37



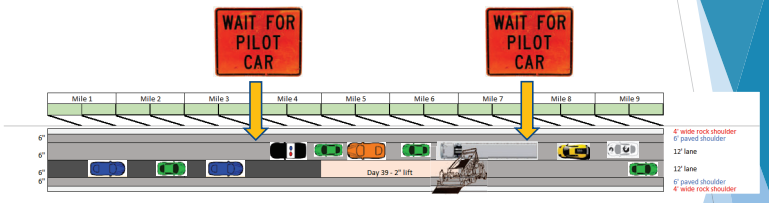


2” Overlay – day 38

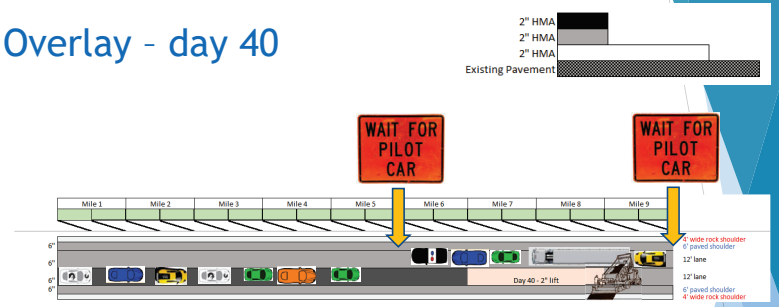




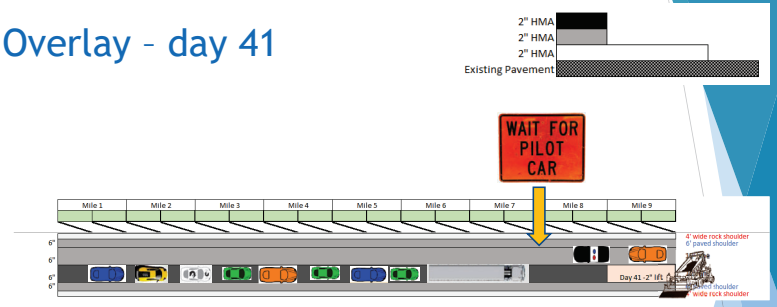
2” Overlay – day 39



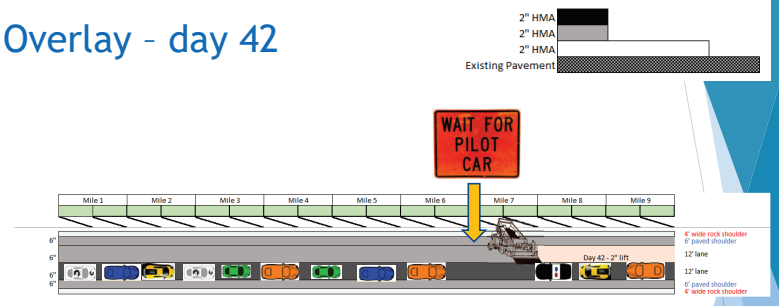
2” Overlay – day 40



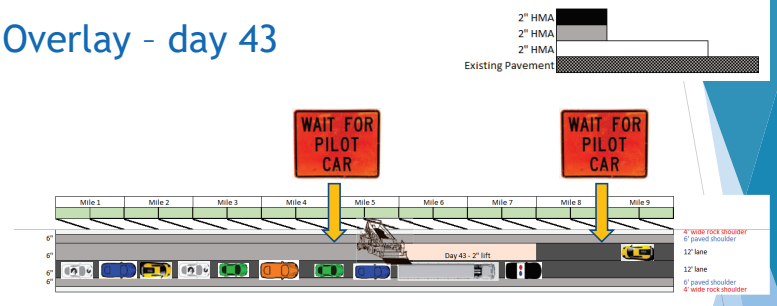
2” Overlay – day 41



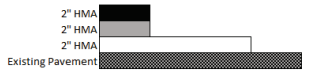
2” Overlay – day 42

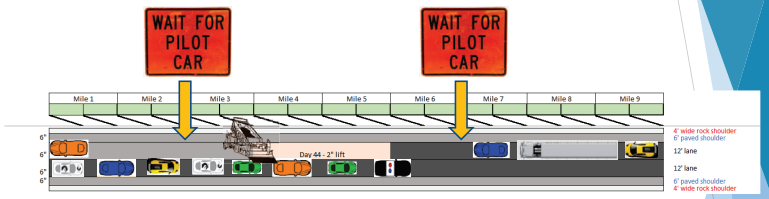


2” Overlay – day 43

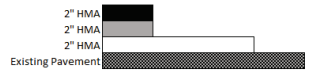


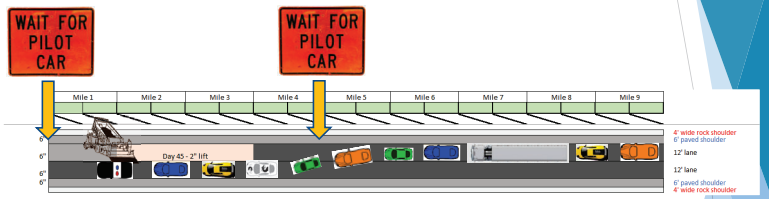
2” Overlay – day 44



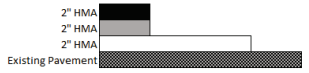


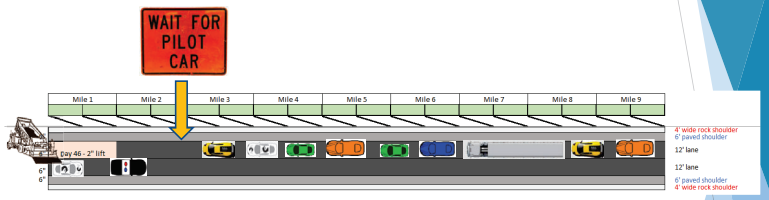
2” Overlay – day 45



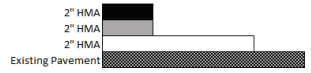


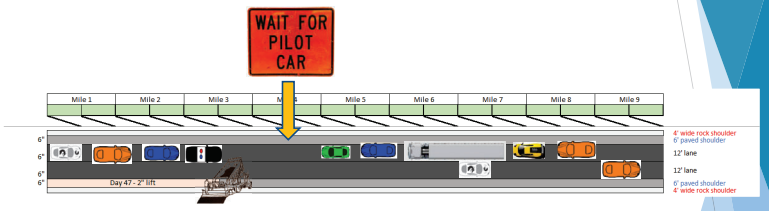
2” Overlay – day 46



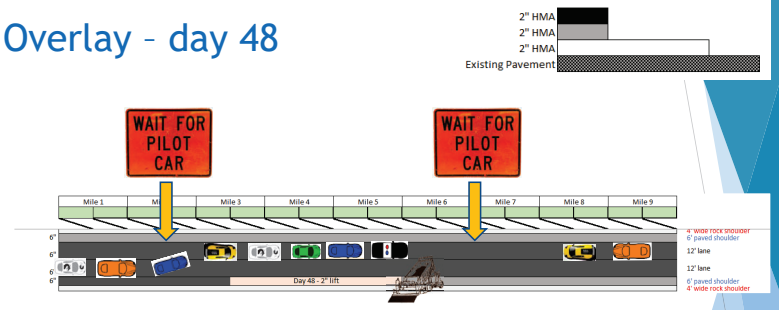


2” Overlay – day 47

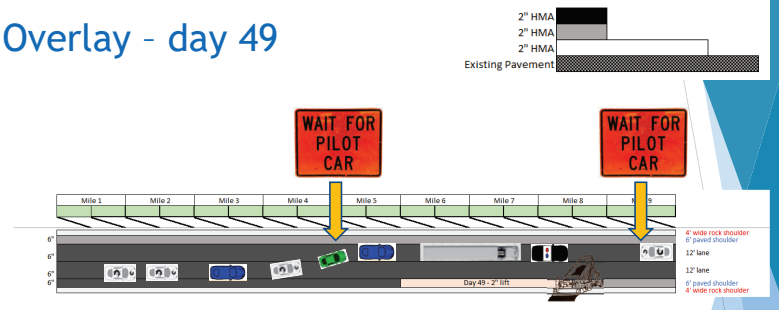




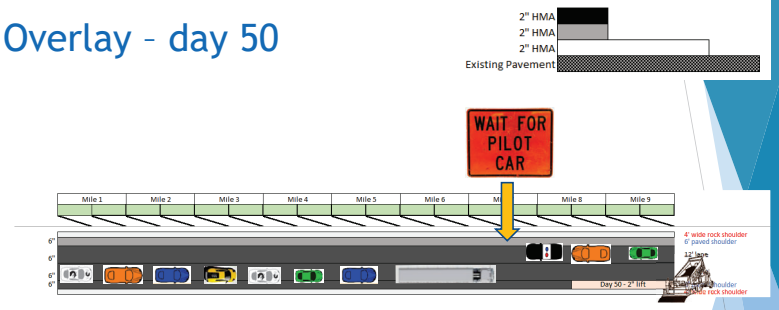
2” Overlay – day 48



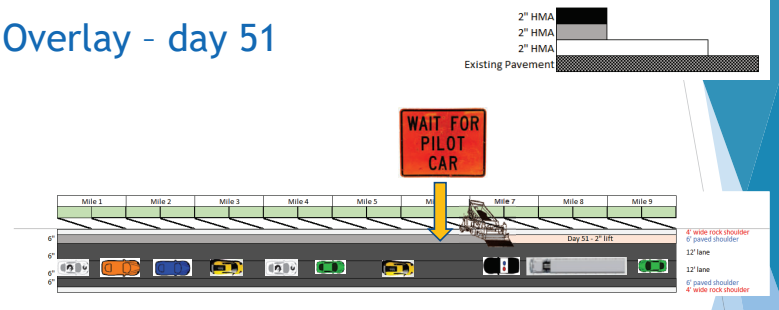
2” Overlay – day 49



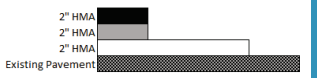
2” Overlay – day 50

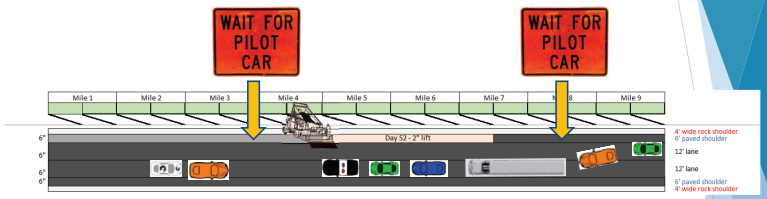


2” Overlay – day 51

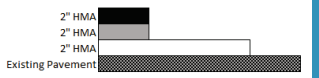


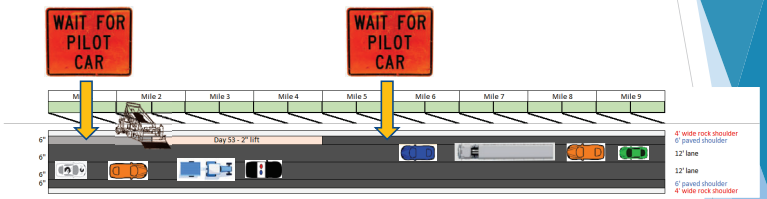
2” Overlay – day 52



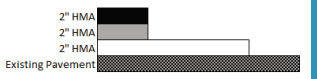


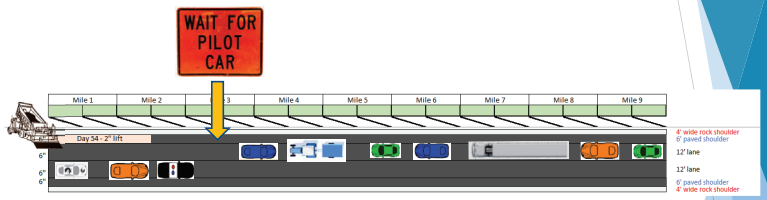
2” Overlay – day 53





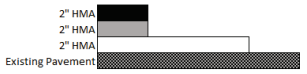
2” Overlay – day 54

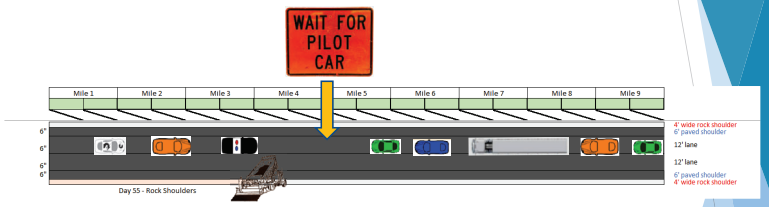




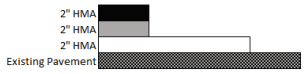
- YAY! Lift 3 is done!
- Now lets do the rock shoulders

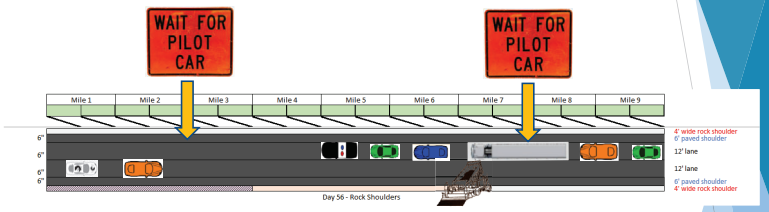
Rock Shoulders- day 55



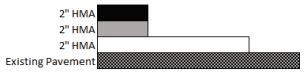


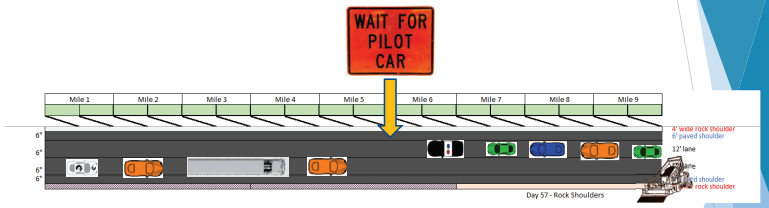
Rock Shoulders- day 56



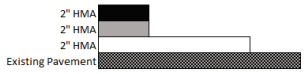


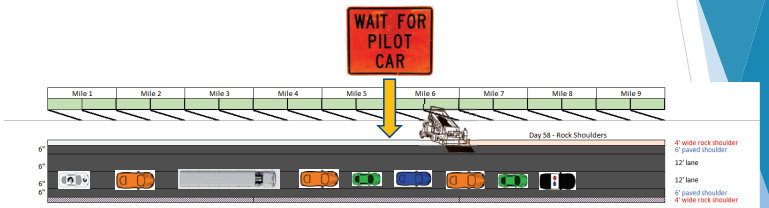
Rock Shoulders- day 57



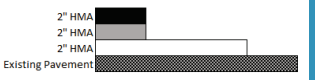


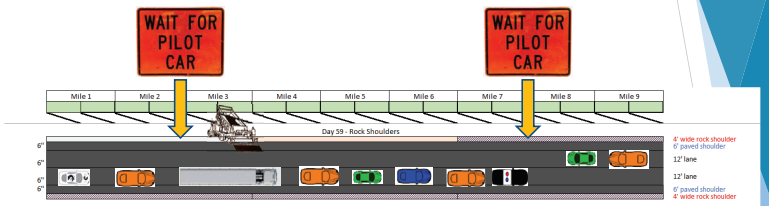
Rock Shoulders- day 58



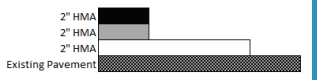


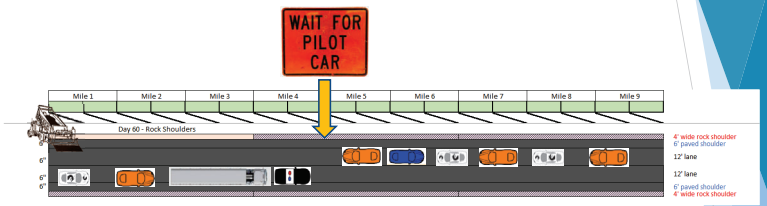
Rock Shoulders- day 59





Rock Shoulders- day 60





▶YAY! Overlay and ▶shoulders complete

Comparison times – Does it work?

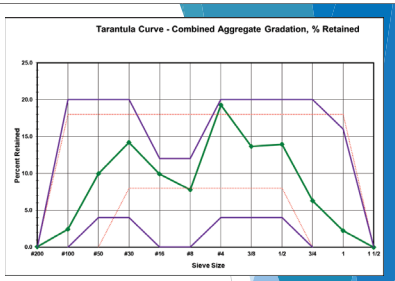
- Conventional HMA Overlay – 60 days of work – Roughly 90 calendar days – Traffic single lane
- Conventional PCC Overlay - 60 days of work – Roughly 90 calendar days – Traffic Detoured for all project work
- Accelerated PCC Overlay – 25 days of work = 25 calendar days – Thru traffic detoured with minimal closures

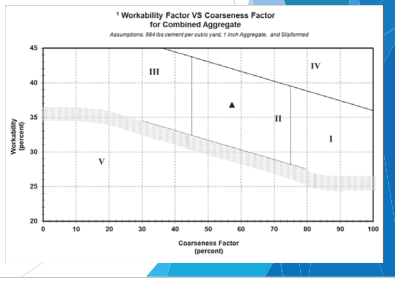
How did we get it done

Mix Design

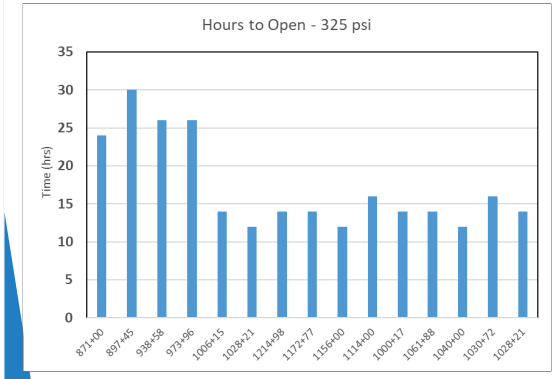
Material	lb/cy
Cement	448
Fly ash	112
Water	224
Coarse Gravel Agg	1413
Intermediate Pea Gravel	378
Fine Agg	1339

- Supposed to get Type IL, Type I/II supplied
- Class C fly ash 20%



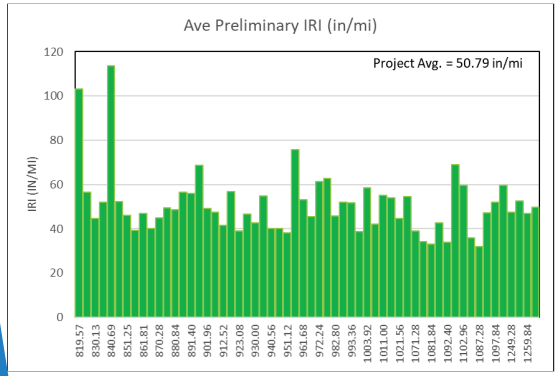


Time for Opening to Traffic



- Initially using higher dosage of retarder
  - Opening TTF =1102 °C-hr
  - 24-30 hours to open
- Switched to hydration stabilizer
  - Opening TTF =575 °C-hr
  - 13-16 hours to open
- 150 psi for sealing equipment

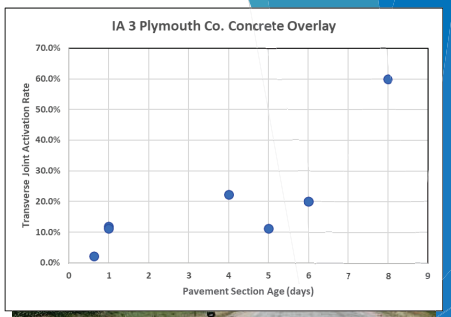
Smoothness

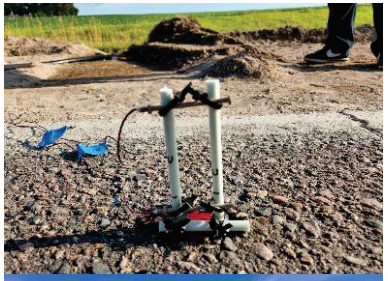


- Beginning of project had mix issues, required diamond grinding
- Average preliminary IRI for project was 50.79 in/mi

MIRA Testing – Joint Activation

- Early Joints likely to be wider
- Generally, every other joint activated
  - Occasionally every 6ft.
- 12 x 12 ft. panels okay





Strain Under Slab

- Strain sensors under slab
- Loaded truck at 24 and 48 hrs.
- Results somewhat noisy data
  - Sensors?
- Very minimal strain at bottom of slab
- *Thanks* to MNDOT Tom Burnham for equipment

Conclusions

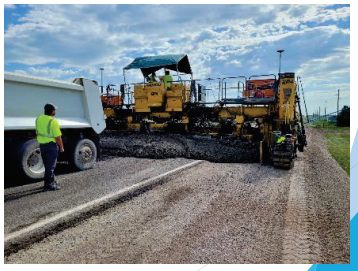
- Concept worked well
  - Issues with material supply
- 28 days allowed and opened in 25 days –Traffic impact was for a short duration
- 12 x 12 ft panels viable option
- Very good way to reduce traffic impacts while increasing safety
- Get in/Get out/Stay out

How-to manual

- Find a great candidate project PCC overlay
- Design a concrete overlay
- Write spec requirements for contractor to schedule project tightly
- Enjoy your new PCC overlay for years to come!

Questions

Submit any questions on-line..sorry



Contract Unit Price

	MATERIAL			
0080	2301-1003100 STANDARD OR SLIP-FORM PORTLAND CEMENT CONCRETE PAVEMENT, QM-C, CLASS 3 DURABILITY, 10 IN.	3,173.500 SY	69.89	221,795.92
0090	2310-5151600 PORTLAND CEMENT CONCRETE OVERLAY, QM-C, FURNISH ONLY	35,292.840 CY	99.00	3,493,991.16
0100	2310-5151605 PORTLAND CEMENT CONCRETE OVERLAY, QM-C, PLACEMENT ONLY	181,506.040 SY	7.00	1,270,542.28
0110	2315-8275055	400.000		

U.S. Department of Transportation
Federal Highway Administration

TOPS

Targeted Overlay Pavement Solutions

A solution for extending the life of an existing pavement investment.

Every Day Counts
Innovation for a Nation on the Move

FHWA TOPS EDC-6 Team

Tim Aschenbrener
FHWA Headquarters

Bob Conway
FHWA Resource Center

Derek Nener-Plante
FHWA Resource Center

Every Day Counts

Program Coordinator Contact
Julie Zirlin
Julie.Zirlin@dot.gov
202-366-9105

Every Day Counts

- Select EDC innovations
- Virtual summit
- States finalize their selection of innovations, establish performance goals, and begin to implement the innovations
  - Support and assistance of the technical teams established for each innovation

EDC-6 Innovations (2021-2022)

EDC-6 Overview Video


Crowdsourcing for Advancing Operations


e-Ticketing and Digital As-Builts


Next-Generation TIM: Integrating Technology, Data, and Training


Strategic Workforce Development


Targeted Overlay Pavement Solutions (TOPS)


UHPC for Bridge Preservation and Repair


Virtual Public Involvement (VPI)

EDC-1: 2011-2012

Background

- Over 25% of all State DOT infrastructure funds go to pavements overlays.
- State DOT manage 2.8 million miles of pavements.

- *Information source: FHWA at https://www.fhwa.dot.gov/innovation/everydaycounts/edc_6/targeted_overlay_pavement.cfm*


Image source: Iowa State University

How is this different from typical overlays?

TOPS matches treatments to high-priority, high-need locations.

TOPS EDC Mission


Image source: Skip

Extend pavement life, increase load-carrying capacity, and improve safety, mobility, and user satisfaction in a cost-effective and sustainable manner by delivering targeted pavement overlay solutions to Federal, State, and local transportation agencies.

EDC-6 Goals

- Increase the number of participating agencies that demonstrate, assess, or institutionalize an additional TOPS technology not previously institutionalized.
- Build awareness and expand TOPS usage
  - Identify a champion at each State agency
  - Share information at conferences/workshops
  - Train people (webinars/peer exchanges)

What's in the TOPS toolbox? (1 of 2)

Asphalt overlay products:

- High-Performance Thin Overlay (HPTO)
- Crack Attenuating Mixture (CAM)
- Highly Modified Asphalt (HiMA)
- Enhanced friction overlay
- Stone matrix asphalt (SMA)
- Asphalt Rubber Gap-Graded (ARGG)
- Open-Graded Friction Course (OGFC)
- Ultra-thin bonded wearing course (UTBWC)

What's in the TOPS toolbox? (2 of 2)

Concrete overlay products:

- Concrete on Asphalt – Bonded (COA-B)
- Concrete on Asphalt – Unbonded (COA-U)
- Concrete on Concrete – Bonded (COC-B)
- Concrete on Concrete – Unbonded (COC-U)

TOPS Potential Benefits

- Improved Safety
- Improved Performance
- Retained Investments
- Cost Savings
- Environmentally Sound

COA-B

Concrete Overlay on Asphalt - Bonded

U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
Innovation for a Nation on the Move

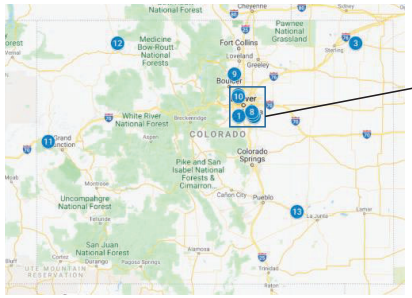
13

COA-B in Colorado

Eric Prieve, P.E.
Concrete & Physical Properties Program Manager

Thin Overlays (6" & less)

1. SH 121 - C-470 to Parkhill
2. SH 121- 104th to US 36
3. US 6 - Fleming to Haxtun
4. SH 83 - Pine Ln to Arapahoe
5. SH 83 - Rice to Orchard
6. SH 83 - S. of Jamison Ave.
7. SH 83 - Arapahoe to Orchard
8. SH 83 - N. of Quincy
9. SH 66 - US 36 to US 287
10. SH 121 - 88th to 104th
11. I-70 East of Mack
12. SH 13 - N. of Craig
13. US 50 - Fowler to Manzanola



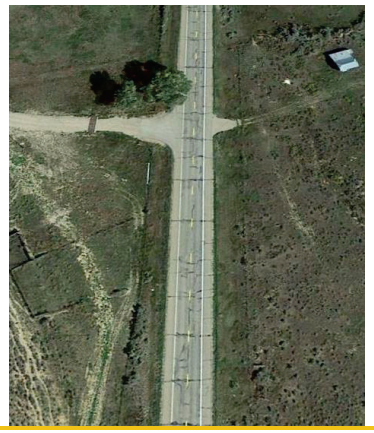
Graphics developed with Google Maps

CDOT has built over 1.5 million SY of 6" concrete overlays & over 10 million SY of concrete overlays of all thicknesses

TOPS

U.S. Department of Transportation
Federal Highway Administration

Project Description



- SH 13 North of Craig, CO
- 6 miles
- 20% Truck Traffic
- Alternate Bids:
  - 6" HMA on Full Depth Reclamation
  - 6" PCCP on Existing Asphalt Pavement

Existing Asphalt Prior to Concrete Overlay
Source: Google Earth Image dated 09/02/2014

TOPS

U.S. Department of Transportation
Federal Highway Administration

Milling

Photo: Castle Rock Construction Company, used with permission

- Profile milled to optimize volume of concrete and final smoothness
- Maintaining a consistent thickness was key to success (pay item by square yard only)

TOPS

U.S. Department of Transportation
Federal Highway Administration

Shoulder

- Millings used in shoulder
- Reuse asphalt materials
- Provides a weather resistant surface
- Smoother pavement due to stable track

Photo: CO/WY Chapter - ACPA, used with permission

Performance Engineered Mixtures

Photo: Castle Rock Construction Company, used with permission

- Optimized aggregate gradation
- 20% Class F fly ash
- Reduced cementitious content

Paving Operation

- Portable concrete batch plant located within project limits
- Half-width (19')
  - 12' lane + 7' shoulder

Photo: CO/WY Chapter - ACPA, used with permission

Traffic Control: Pilot Car

Photo: CO/WY Chapter - ACPA, used with permission

Completed Project

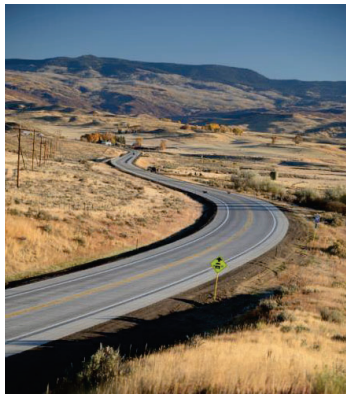


Photo: HDR, used with permission

- Compliments from motorists and CDOT maintenance
- 44 inch/mile IRI
- Awards:
  - CO/WY ACPA Award for Excellence in Concrete Pavement - Overlays
  - ACI – State Award for Excellence in Concrete
  - ACPA National Gold Award for Excellence in Concrete Pavement - Overlays

TOPS

U.S. Department of Transportation Federal Highway Administration

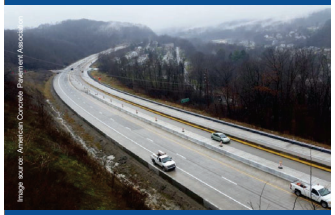


Image source: American Concrete Pavement Association

COC-U

Concrete Overlay on Concrete - Unbonded

U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
Innovation for a Nation on the Move

COC-U on I-85 in North Carolina

Clark Morrison, P.E.
State Pavement Design Engineer

- I-2508, Granville County (1997, 1998, 2000)
  - 10.3 miles, 7.8 miles, 17.2 miles
- I-2810, Vance County (2010)
  - 5 miles (2 directions)
- **I-0914, Vance and Warren Counties to VA State Line**
  - **17.2 miles, both directions**
  - **Let: 3/17/2015 Complete: 12/28/2020**

TOPS

U.S. Department of Transportation Federal Highway Administration

I-0914 Project History

- Original Pavement constructed in 1960, 9” JCP on 4” ABC (54 years old)
- Band-Aid project in 2007: Asphalt patches of worst slabs, Ultra-Thin Bonded Wearing Course Overlay

TOPS

U.S. Department of Transportation Federal Highway Administration

Distresses in UTBWC

Concern with Asphalt Patches

- Would they provide uniform support?
- Do they need to be removed and replaced with concrete?
- If so, can they be found under the UTBWC?
- Patches located with GPR
  - 189 lane-width patches
  - Length ranged from 9.5’ to 883’, 80% less than 70’ long

Concern with Asphalt Patches

- Project Review and Workshop held through the Concrete Overlay Technical Assistance Program (FHWA and CP Tech Center) in 2013
- Recommended leaving asphalt patches in place unless there was severe distress apparent in the UTBWC surface. Repair could be either asphalt or concrete.
- FWD testing done on asphalt patches and concrete slabs
  - Deflections on Concrete: 4.29 to 12.63 mils
  - Deflections on Asphalt Patches: 8.67 to 10.51 mils
  - Asphalt patches were left in place

Pavement Structure

Pavement Structure – Main Line:

Unbonded Concrete Overlay – Jointed Dowels ……10”

PADC……..2”

Total: 12”

Pavement Structure – Shoulders:

S9.5C…..…3”

I19.0C…….....3”

B25.0C…..…4”

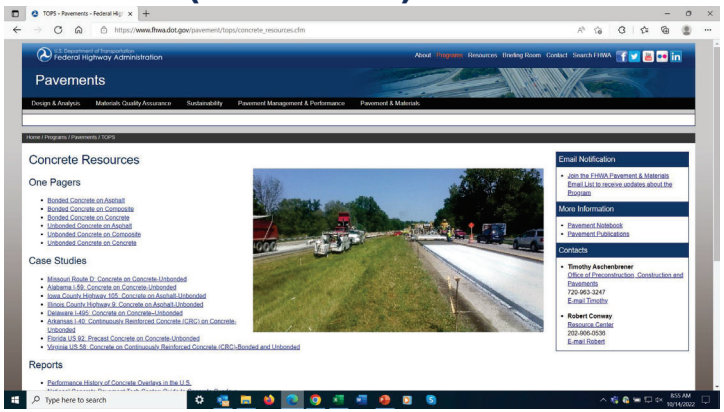
PADC…….2”

Total: 12”

Paving Operations

Finished Product

TOPS Website (Concrete)



https://www.fhwa.dot.gov/pavement/tops/concrete_resources.cfm

TOPS Storyboard

TOPS Innovation Spotlight Video

Sign up for EDC News and Innovator

EDC News Weekly Newsletter

INNOVATOR Bi-monthly Newsletter

Get on your mobile device! Text "FHWA Innovation" to 468311

Find out more at: https://www.fhwa.dot.gov/innovation/

Concrete Resources

- One Pagers
- Case Studies
- Reports
- Webinars
- Technical Support
- Workshops (starting 2023)
  - FHWA
  - ARA/Transtec/Weris Team
  - CPTech Center

EDC-6 TOPS Concrete Lead
Robert Conway
Robert.Conway@dot.gov
202-906-0536