Precast Concrete Pavement State Experience - Indiana

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Motivation and goals to use Precast Concrete Pavement

- To test PCP as a concrete pavement option and for use as a tool for improving and increasing effectiveness of pavement rehabilitation/reconstruction operations.
- The intermediate goals:
  - To fully develop standard specifications and drawings for use and implementation by INDOT
  - To review the implementation in the field so adjustment can be made in the spec and construction procedures
- The ultimate goal is to achieve effectiveness in faster pavement construction and rehabilitation with a minimum disruption in short projects
  - Through contracts or INDOT in-house resources

Systems of INDOT's interest

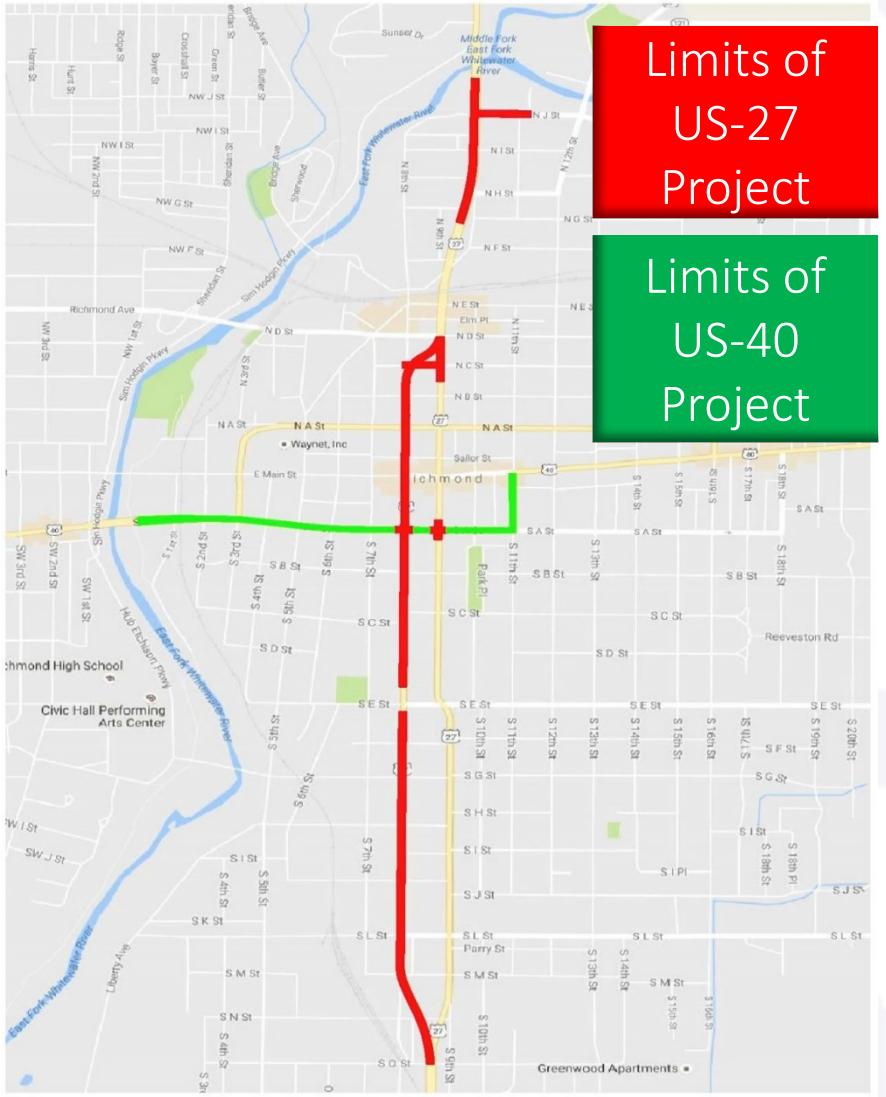
Michigan Generic System

Fort Miller System

Illinois Toll Road System

The First Contract Project

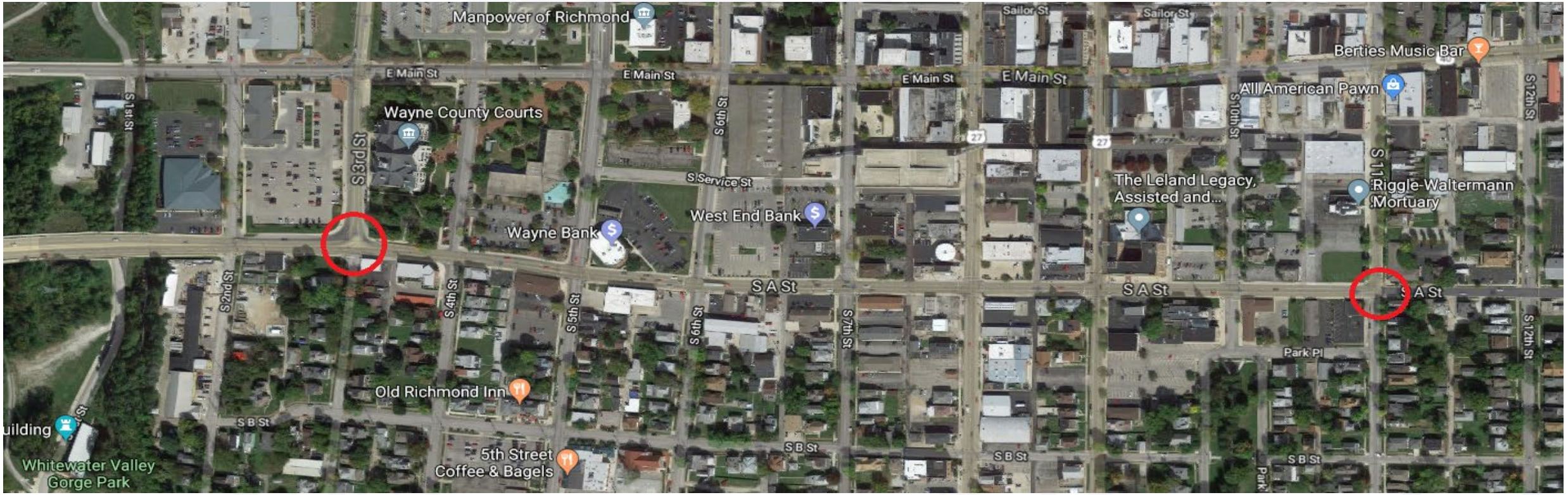
- The project's urban setting proved a suitable location for this experiment.
- It is a 100 year old section of the historic National Road US Route 40 that never had a major reconstruction project.
- It was also a project INDOT had been talking about for nearly 20 years.
- Low risk side of the scale if it doesn't work out, not in the Interstate.



Locations of the Precast Concrete Panels

US-40 Project Limits

US-40 Eastbound (South A Street) from South 3rd Street to South 11th Street, and (South 11th Street) from South A Street to East Main Street



Precast Concrete Pavement System Selected

- Fort Miller System
- Cost considerations
  - PCP higher than conventional PCCP. PCCP PCP, Removable price 12,165 SYS @ $355/SYS versus +/- $300/SYS PCCP
- Anticipated longer life
  - Improved durability of the concrete is anticipated, attributable to more controlled placement and curing conditions at a precast plant.
  - Potentially minimized warping and curling stresses (built-in).
- Speed of installation may also be improved

Project Information

- US 40 - Des. No. 0013790 (PCP Pavement)
- City of Richmond, Indiana
- INDOT Greenfield District
- Letting Date: February 8, 2017
- Substantial Completion: Summer, 2019
- Prime Contractor: Gradex, Inc.
- Subcontractor for Panel Installation: E & B Paving, Inc.
- For more information, see Fort Miller's website and/or visit the INDOT project website. (https://www.in.gov/dot/div/contracts/slab/30397.htmINDOT Vision)

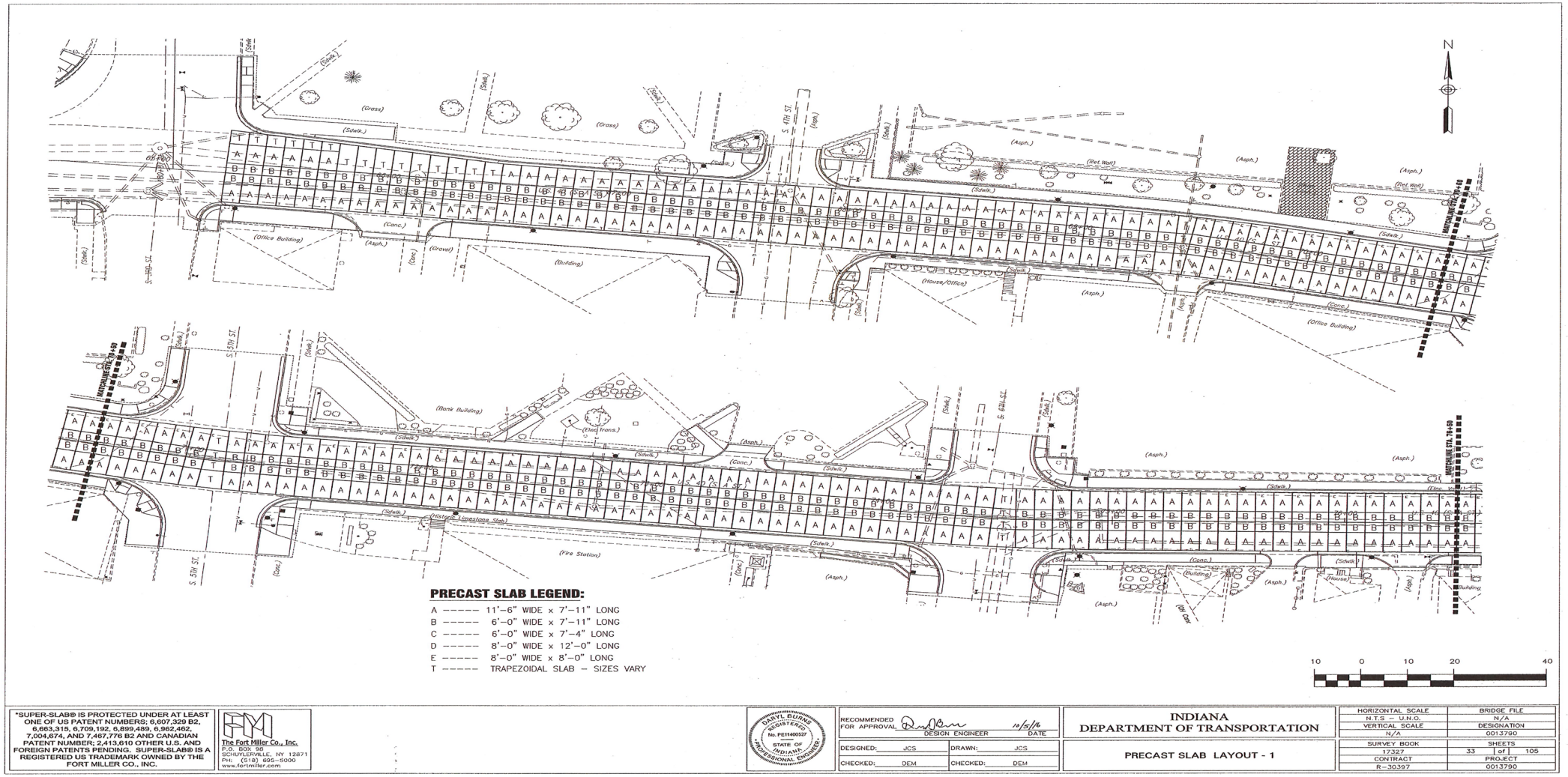
Approval Process and Follow Up Items

- FHWA approval was needed for the Fort Miller, Inc. Super Slab system (proprietary).
- Due to nature of proprietary systems and their patents, there is expected to be more stringent QC expectations due to strategic risk to a proprietary system.
- INDOT, with assistance from NPCA, has developed specifications for a generic PCP system for pavement construction, rehabilitation and patching.
- Long term goals or future foreseeable applications of PCP contracts:
  - Determine suitability for use of PCP in urban or other environments.
  - Expedite concrete pavement repairs on interstates and other state owned roadways. Expected advantages are shorter lane closures for MOT and extended life of patches .

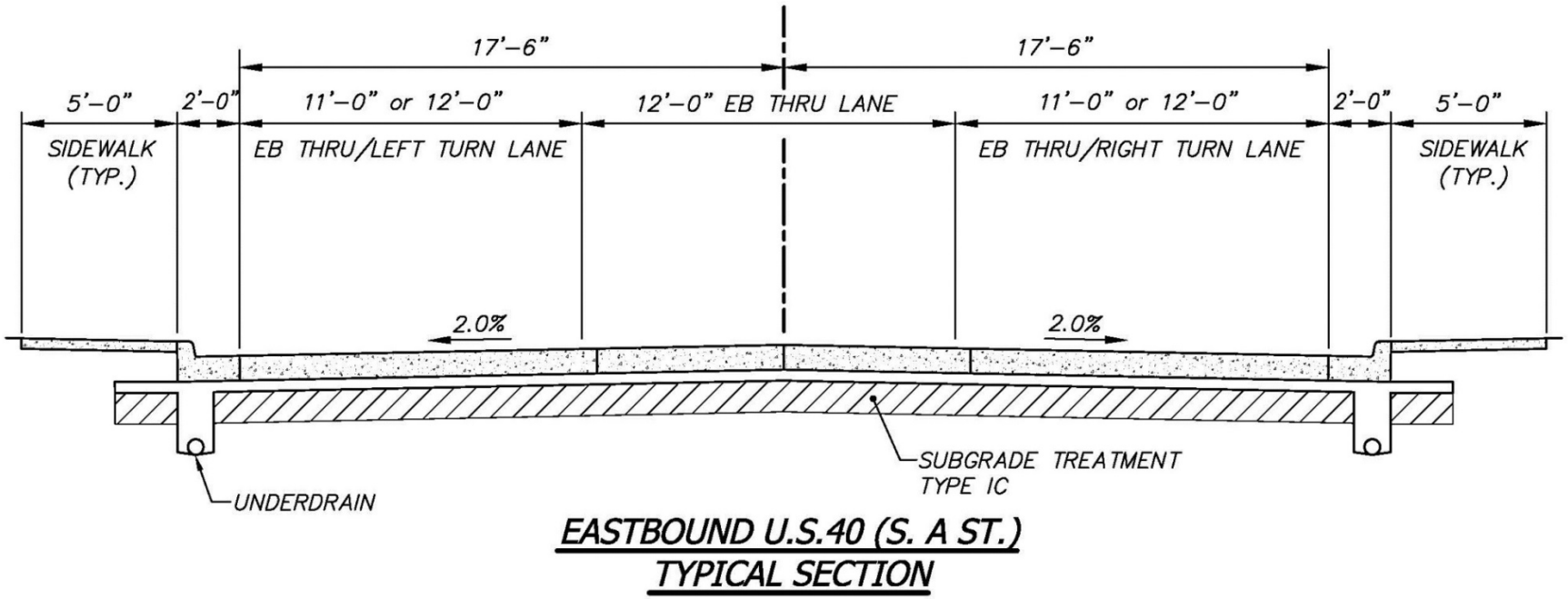
Pre-Bid Meeting and Challenges

- Public Outreach – Contractor Presentation before bidding:
  - Designer assisted INDOT in preparing and delivering a presentation for Contractors for informational Pre-Bid meeting. Informational project website was established for bidders who did not attend so all bidders could get information and had equal opportunity.
  - Local Contractors were unfamiliar with using Precast Concrete Pavement.
- Maintenance of Traffic Considerations:
  - Joints between panels were designed to line up with MOT plan and lane lines.
  - Large brick sewer beneath center of US-40 required lining with CIPP.
  - All underground sewer and utility work required completion before panel placement. Final locations were surveyed for use in panel design and layout.

Typical Plant Sheet and Slab Arrangements

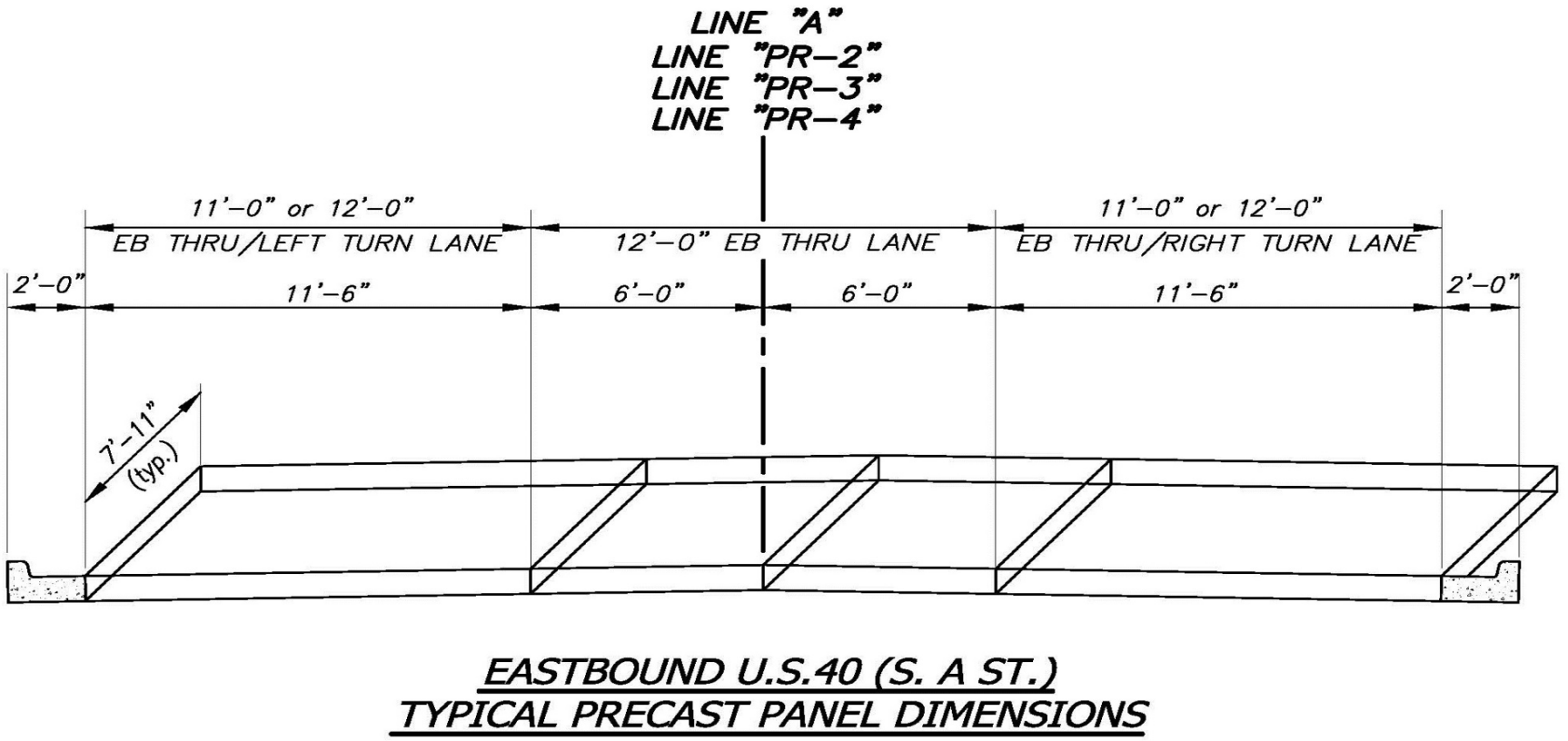


PCP Typical Cross Section



- S. A St. - Three Lane Roadway Section
- 9.5” Precast Concrete Pavement, Removable
- Precision Grading Fine Aggregate on 4” Compacted Aggregate (Drainable Subbase)
- 12,165 SYS of Precast Concrete Pavement (over 1,100 panels)
- 0.60 miles total length along US 40

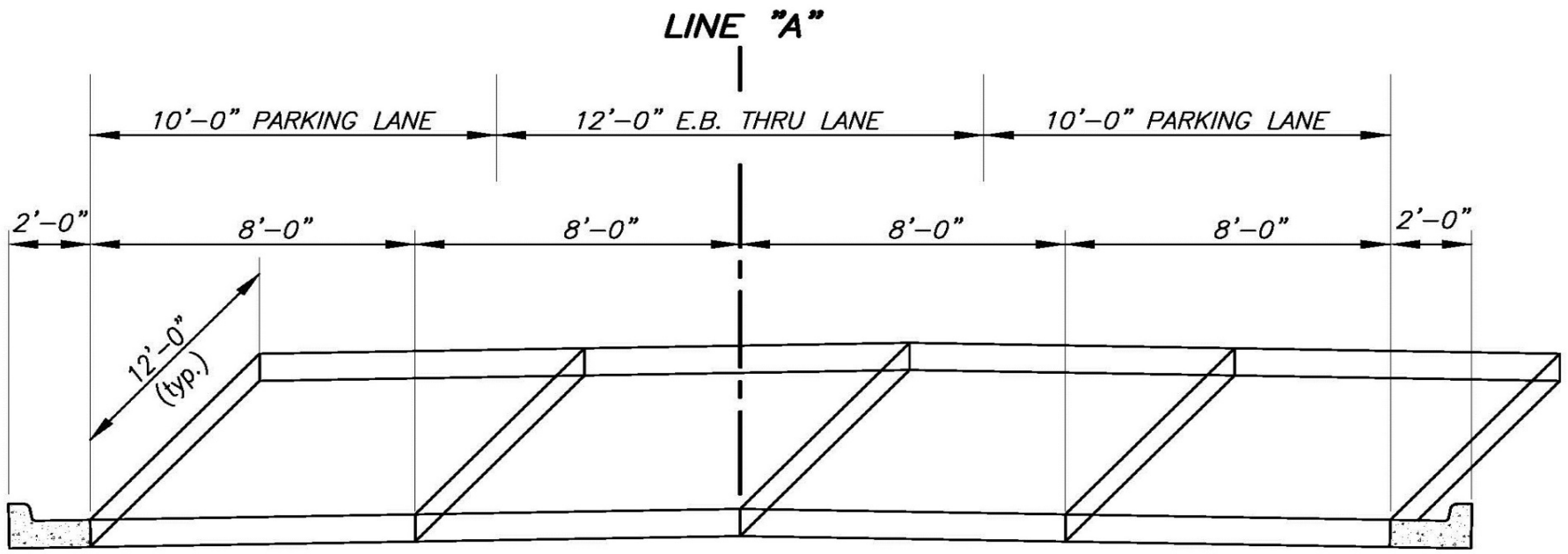
PCP Typical Panel Sizes



EASTBOUND U.S.40 (S. A ST.)
TYPICAL PRECAST PANEL DIMENSIONS

- U.S. 40 (S. A St.)
- Typical Size and Layout of Precast Concrete Panels
- Large panel wt. +/-11,000 lbs (5.5 Tons)
- Small panel wt. +/- 5,700 lbs (2.9 Tons)

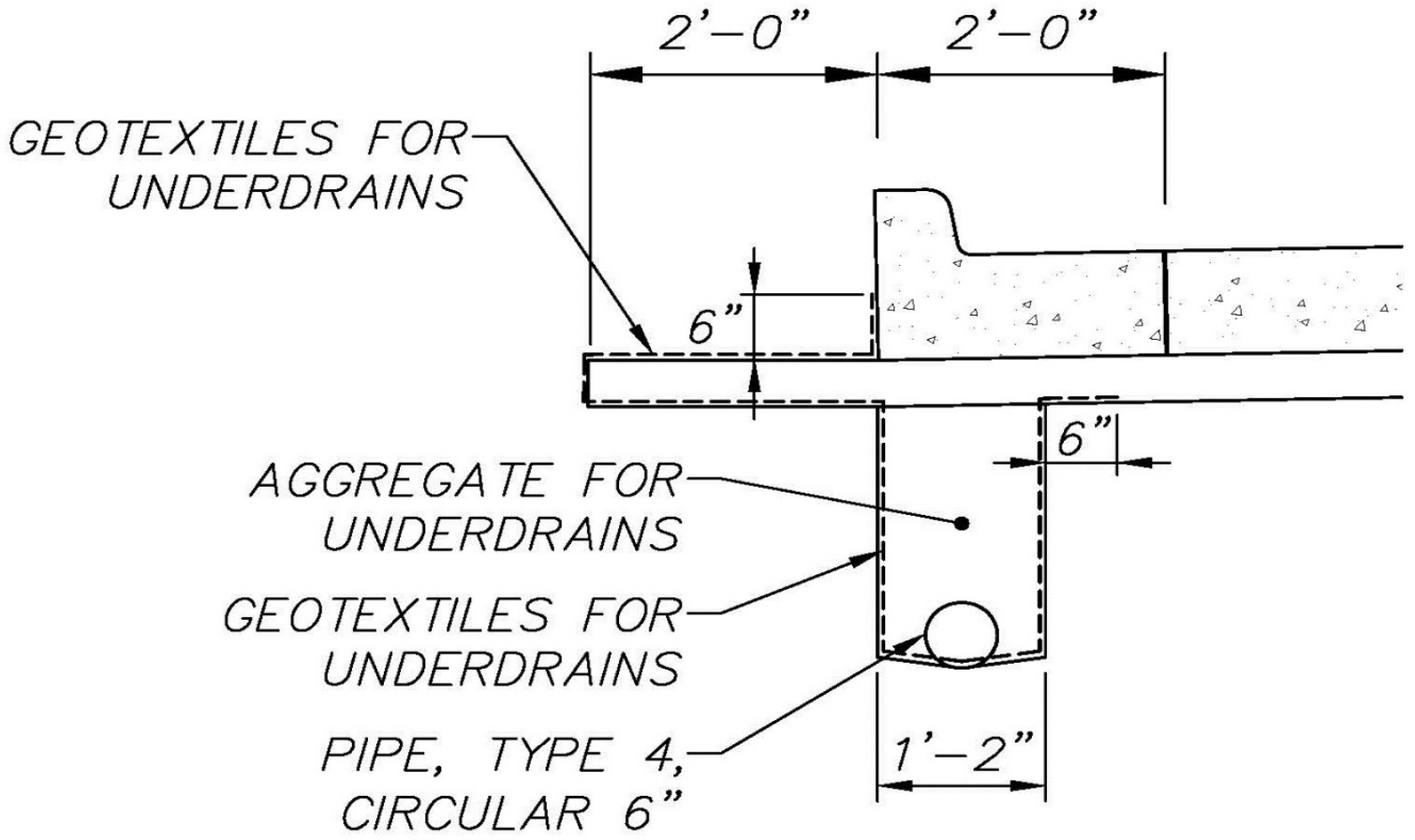
PCP Typical Panel Sizes



EASTBOUND U.S.40 (S. 11TH ST.)
TYPICAL PRECAST PANEL DIMENSIONS

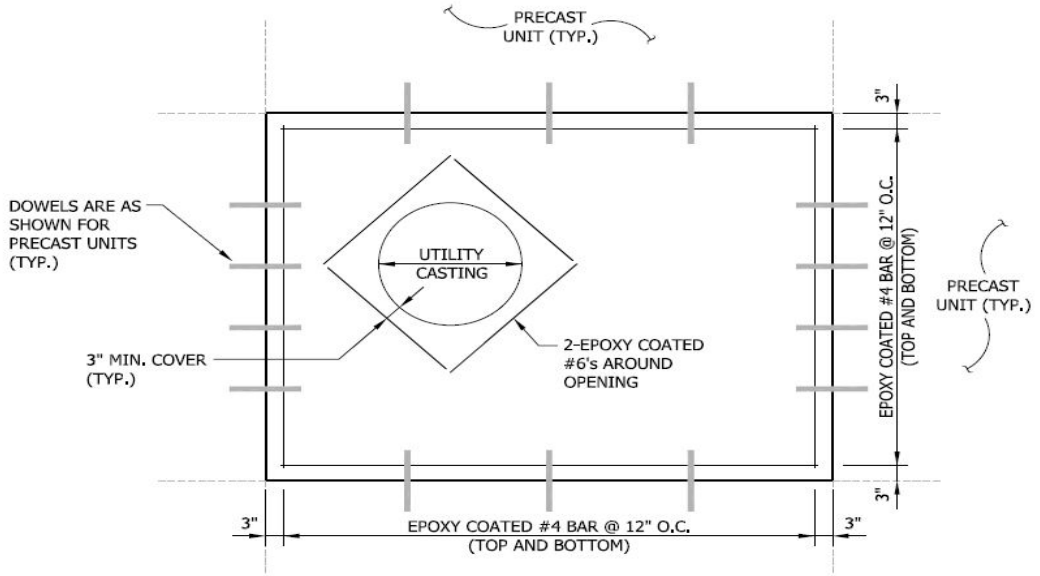
- U.S. 40 (S. 11th St.)
- Typical Size and Layout of Precast Concrete Panels
- Panel wt. +/-11,400 lbs (5.7 Tons)

PCP Drainage Details



- 2' Concrete Curb & Gutter – not attached to Precast Concrete Panels
- Placed by slip form after Precast Concrete Panels were in place
- Bituminous Mastic placed between precast panels and curb face to seal the joint

PCP Utility Details



ISOLATION SLAB AT UTILITY CASTINGS
(CAST-IN-PLACE CONCRETE PAVEMENT)

NOT TO SCALE

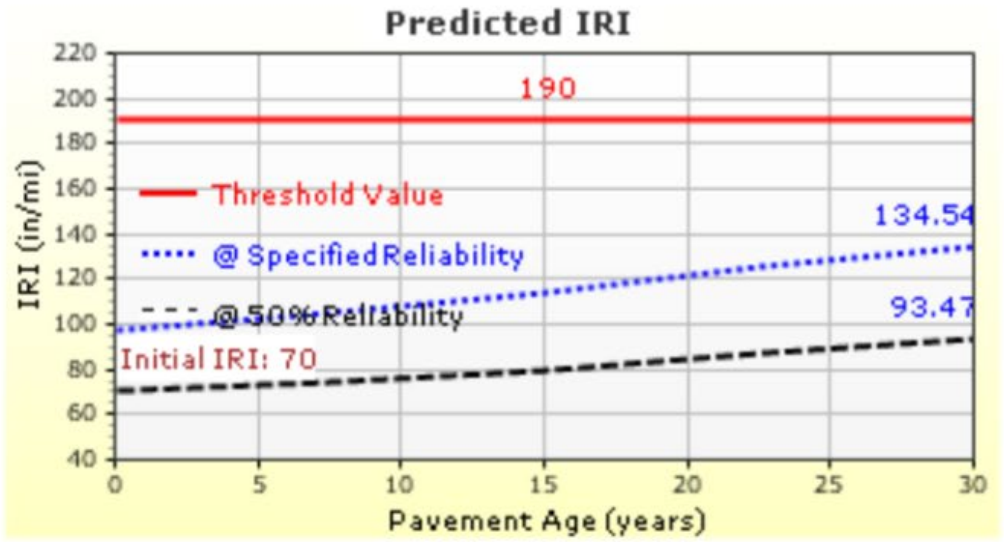
NOTES:

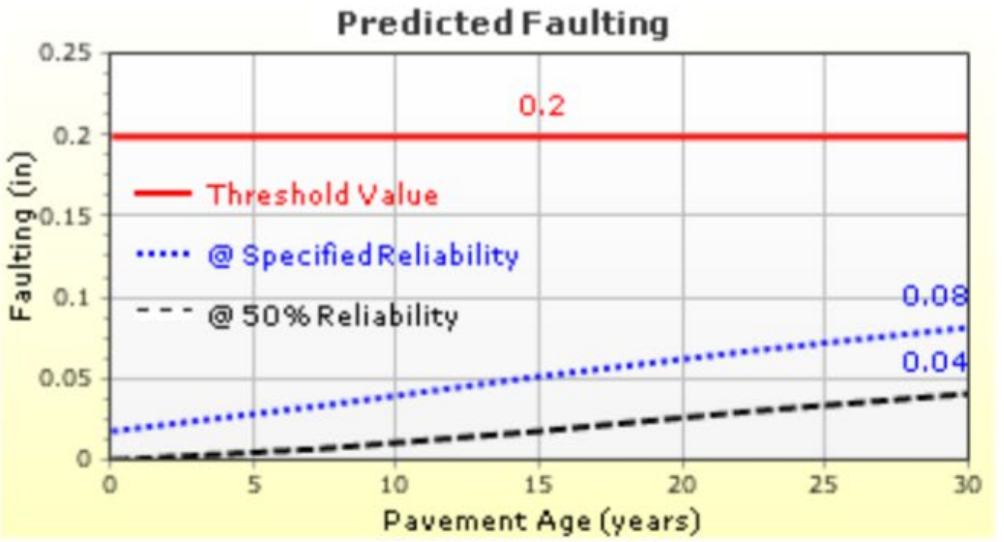
1. PRECAST UNITS AND DOWELS ARE TO BE SET ON ALL FOUR SIDES OF CAST-IN-PLACE PORTION FIRST.
2. CAST-IN-PLACE PORTION IS TO BE POURED ENCLOSING DOWELS FROM PRECAST UNITS.
3. #4 BARS IN VICINITY OF OPENING ARE TO BE CUT SO THAT COVER OF BARS IS 3" MIN.
4. #6 BARS ARE TO BE INSTALLED IN PAIRS BOTH TOP AND BOTTOM, EIGHT (8) TOTAL.
5. THICKNESS OF CAST-IN-PLACE PORTION SHALL MATCH THE THICKNESS OF THE ADJACENT PRECAST UNITS.

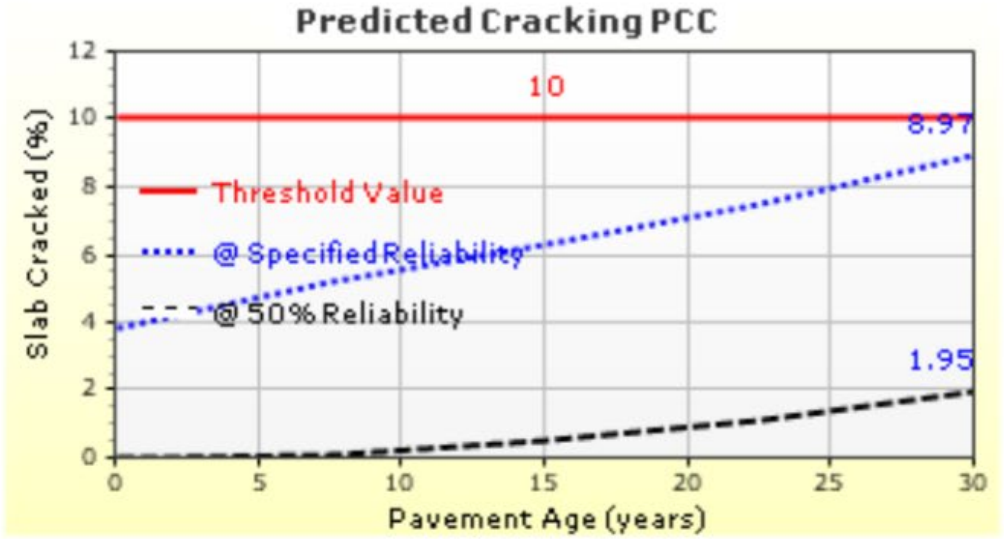
- Manholes, Utility castings, and other appurtenances surveyed
- Portions of Precast Concrete Pavement omitted
- Cast-in-Place Concrete Pavement with Reinforcing Steel placed

Pavement Design

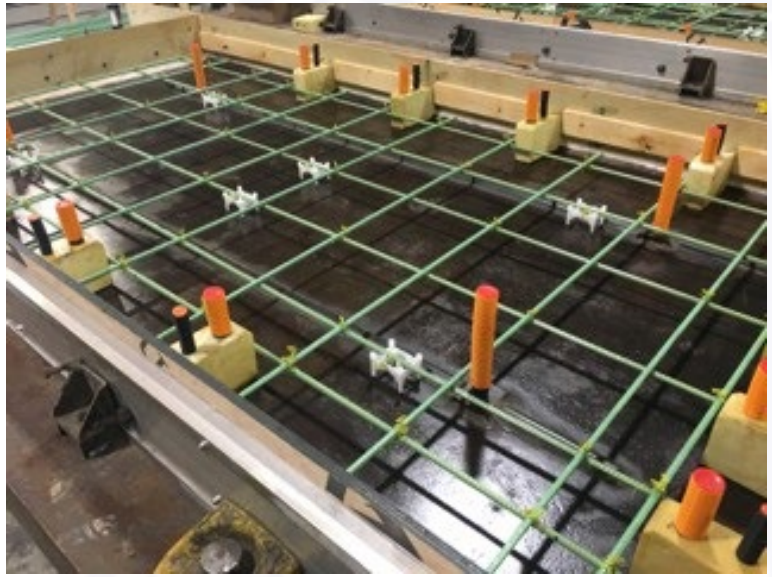
Distress Charts







Panels Production by Norwalk Concrete Industry



Panels Production Challenges

- Second trial batch on October 16th and 17th 2017. Ran test on 16th test passed.
- ODOT assisted with spot checks at plant throughout production cycle.
- Norwalk handled all shipping to jobsite. No significant damage to panels, just some scheduling issues. (over size loads at night, etc.)
- Paid 70% stockpile.
- Reinforcing steel for cracking resistance during panel handling.
- Forms stripped@24 hrs, stockpiled.
- Transport 28 days

Pavement Base and Subbase

- Planned to place panels on typical #53 subgrade + #43 drainage layer. 1/8th inch tolerance instead of usual ½ inch. Also thin sand layer for placement of panels.

Bedding Layer

- Used UTS on small tracked skid steer for fine grading or “Super-grading”.
- Grading tolerances needed to be very precise, held to .01’.
- Generally successful with only few small issues. (1 manhole off by about 6 inches, one manhole missed, 2 manholes missed due to utility changes not communicated to designer).

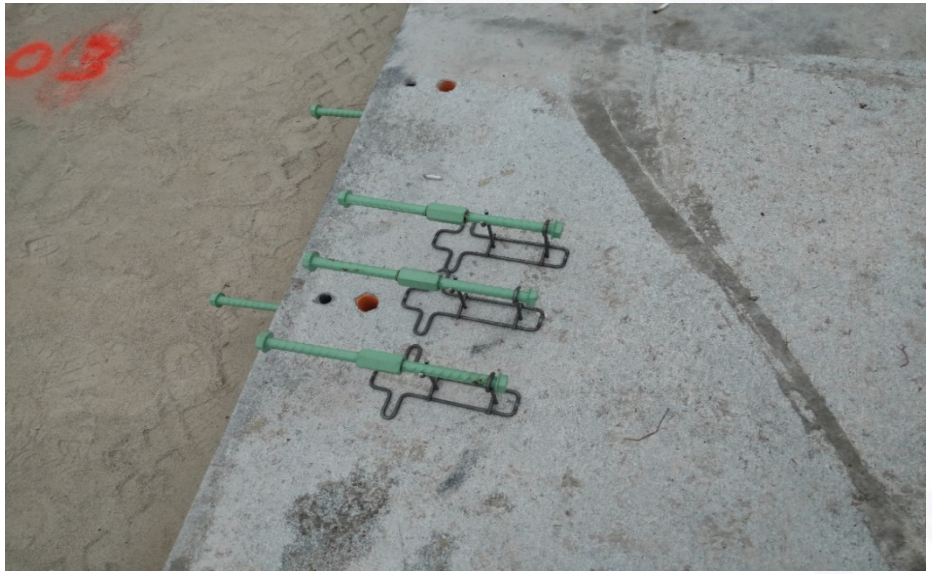
Placement Ready Surface

- Nails set by survey in finished fine grading for placement control, horizontal and vertical. Panel numbers marked on grade.

Panel Installation

Dowels, Tie Bars, and Slab Interlock

- Dowels, tie bars, matching inverted dovetail slots and lifting inserts are cast in the slab.
- Slab interlock is achieved by placing each slab over the dowels protruding from the previously set slab



Construction Issues

- Traffic control
  - Panels could not be placed at night due to shipping issues, temporary closures were implemented on US 40 for placement, which impacted the local Stellar LPA project schedule due to inability to close a section of Main street.
- Placement rate
  - The number of panels placed in a day started in the mid 30's but increased to the mid 50's once the crew was comfortable with practice. E&B had planned for mid 40's rate during planning.
- Generally able to follow the 20-30 min per truck closure periods, though there were some issues with late trucks.

Construction Issues

- 2nd set of panels had some issues with grade along centerline, able to field adjust to within grade tolerances.

Construction Issues

- Manholes, Utility castings, and other appurtenances surveyed
- Portions of Precast Concrete Pavement omitted
- Cast-in-Place Concrete Pavement with Reinforcing Steel placed

Construction Issues

- Completed section of roadway with final diamond grind surface completed-for surface texture, smoothness, friction. Actually could have been done with no grinding.

Finished Project

- South A Street (Eastbound US 40) at S 3rd Street, begin PCP

Finished Project

- South A Street (Eastbound US 40) at S 4th Street

Finished Project

- South A Street (Eastbound US 40) at S 6th Street

Finished Project

- South A Street (Eastbound US 40) at S 7th Street

Finished Project

- South A Street (Eastbound US 40) east of S 8th Street

Finished Project

- South A Street (Eastbound US 40) west of S 11th Street

Finished Project

- South A Street (Eastbound US 40) at S 11th Street

Finished Project

- South 11th Street (Eastbound US 40) South A Street

Finished Project

- South 11th Street (Eastbound US 40) North of South A Street

Conclusions and Lesson Learned

- Bidding/estimating for a new pavement type.
  - Still photos online and information provided by Fort Miller. Needed to estimate daily productions for super-grading, panel installation and grouting.
- Super-grading was performed with UTS instruments installed on a Level Best Box mounted on a tracked skid steer
  - Tolerances for super-grading needed to be held to .01
- The logistics of trucking the slabs from Ohio to the project
  - Has to follow both Indiana's as well as Ohio's interstate guidelines regarding weight, width, sun up, sun down and holiday restrictions.
  - Slabs had to be loaded strategically so they could be unloaded in a precise, predetermined order.
  - Trucks needed to be spaced appropriately due to the lack of free space in downtown area.

Conclusions and Lesson Learned

- Lay out of all four corners of the Super Slabs with nails to ensure proper alignments as well as leading edge (transverse) placement.
- Panel installation was a tedious process
  - Approved shims were used to maintain proper alignments and a large excavator was used to smoothly set the panels.
  - It was always a challenge to set a 12,000 pound slab location precisely.
  - Filling in the gaps was the toughest part of the panel installation process.
- It is a successful project with very good coorperations.
- The next task is to learn the contractual and construction procedures before more contracts will be implemented
- Short patching (6 feet to 1 slab) becomes a priority to open to traffic in a short time.
- Urgent short patching by in-house maintenance crew is also a priority.

Questions?