

Precast Concrete Pavement Systems

Tommy Nantung, INDOT Division of Research and Development

Gary Fox, INDOT Pavement Division

Jeff Brechbill, First Group Engineering, Inc.

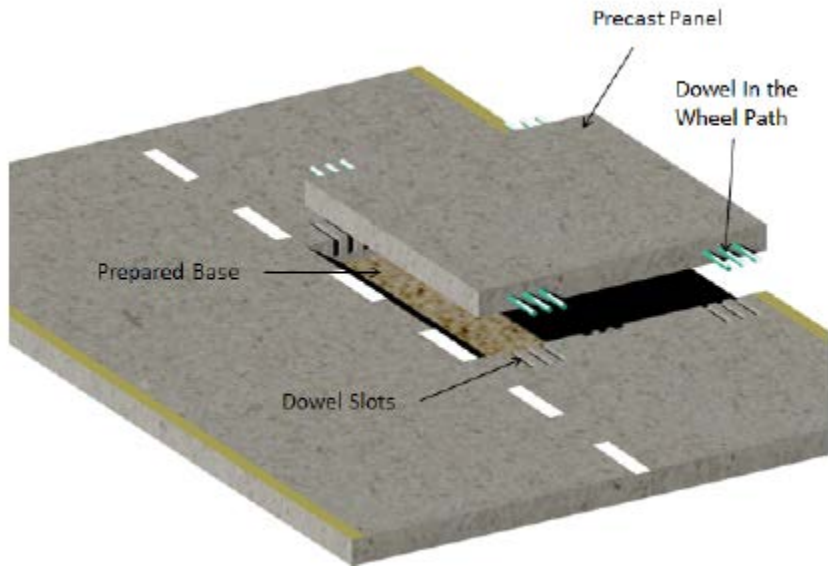
Rob Gill, INDOT Project Engineer

Short History of the Precast Concrete Pavement

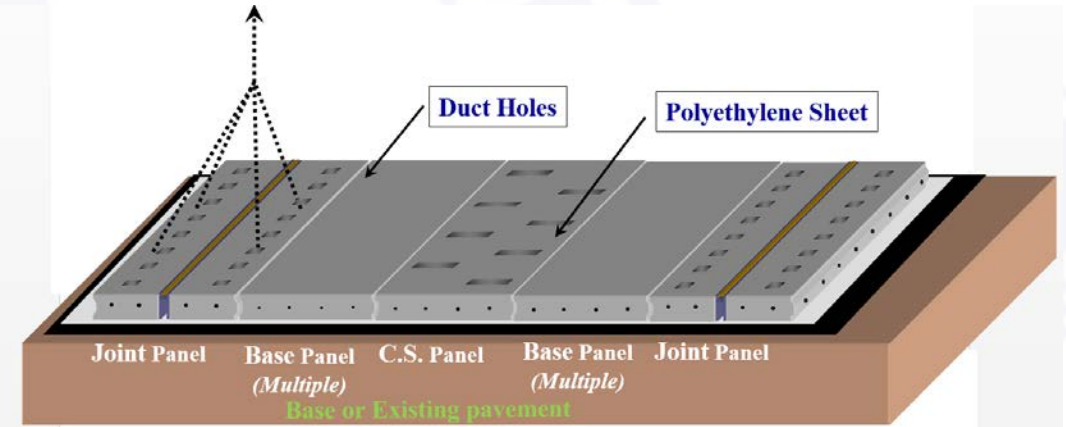
- Implemented in runways in some countries, mainly in Russia and Japan.
- Highway applications began in the US in 1970s by Michigan and Virginia for pavement repair using reinforced concrete panel.
- Rapid Development from 2000 to 2010
 - FHWA/University of Texas: Pre-stressed Precast Concrete Pavement (PPCP)
 - Development of proprietary and non-proprietary system
 - Jointed/dowelled panels for intermittent short repair and replacement of long pavement sections
- AASHTO Technical Implementation Group Efforts for PCP
- SHRP-2 Rapid Renewal: at least 15 State DOTs received funding

Several Available Types of PCP

- Intermittent Repair (Generic)



- Pre-stressed Precast (Generic)

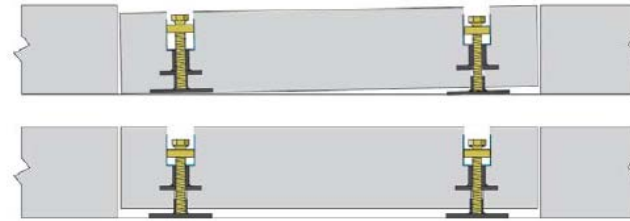
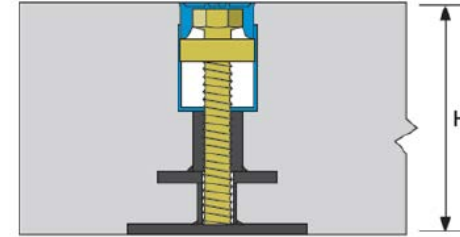


Several Available Types of PCP

- Illinois Toll Road System (Generic)

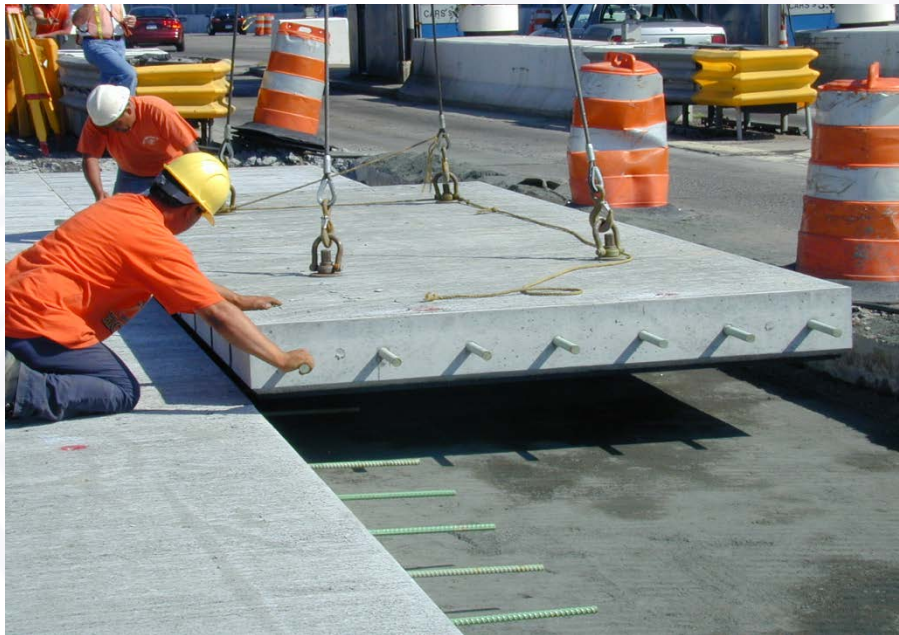


- Caltrans System (Proprietary)

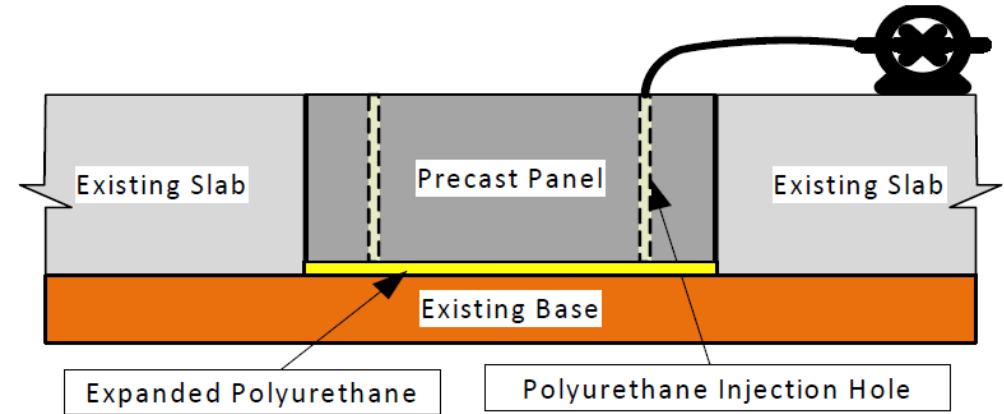


Several Available Types of PCP

- Fort Miller System (Proprietary)



- Roman Stone (Proprietary)



Precast Concrete Pavement (PCP) Department Overview

- INDOT is testing implementation of PCP as a concrete pavement option.
- Cost considerations - First costs for PCP is expected to be higher than conventional PCCP. However, longer service life is anticipated.
- Potential advantages:
 - Improved durability of the concrete is anticipated. This would be attributable to more controlled placement and curing conditions at a precast plant.
 - Speed of installation may also be improved.
- The US 40, Richmond project is the first INDOT PCP Prototype project. The project was designed to utilize the Fort Miller system. For more information, see the Fort Miller booth and/or visit the INDOT project website.
(<https://www.in.gov/dot/div/contracts/slab/30397.htm>INDOT Vision)
- Use of PCP is a tool for improving and increasing the effectiveness of the Department's pavement operations. The goal is to fully develop INDOT's in house expertise.

Precast Concrete Pavement (PCP) Department Overview

- Additional prototype projects are being evaluated by the Department. This will involve further testing and development of PCP systems.
- The Department has developed specifications for a generic PCP system that includes PCP for pavement construction, rehabilitation and patching.
- Long term goals or future foreseeable applications of PCP:
 - Determine suitability for use of PCP in urban or other environments.
 - Expedite concrete pavement repairs on interstates and state roadways. The expected advantage is shorter lane closures and better results with extended pavement life .
- Important concepts for US 40, Richmond:
 - The project's urban setting is a suitable test location for this experimental feature. The Fort Miller, Inc. Super Slab System with removable panels will facilitate any future utility work or other repairs.
 - Due to nature of proprietary systems and their patents, we are seeing what appears to be more stringent QC expectations due to strategic risk to a proprietary system.
 - FHWA approval was obtained for the proprietary Fort Miller, Inc. Super Slab system.

Richmond Project Information

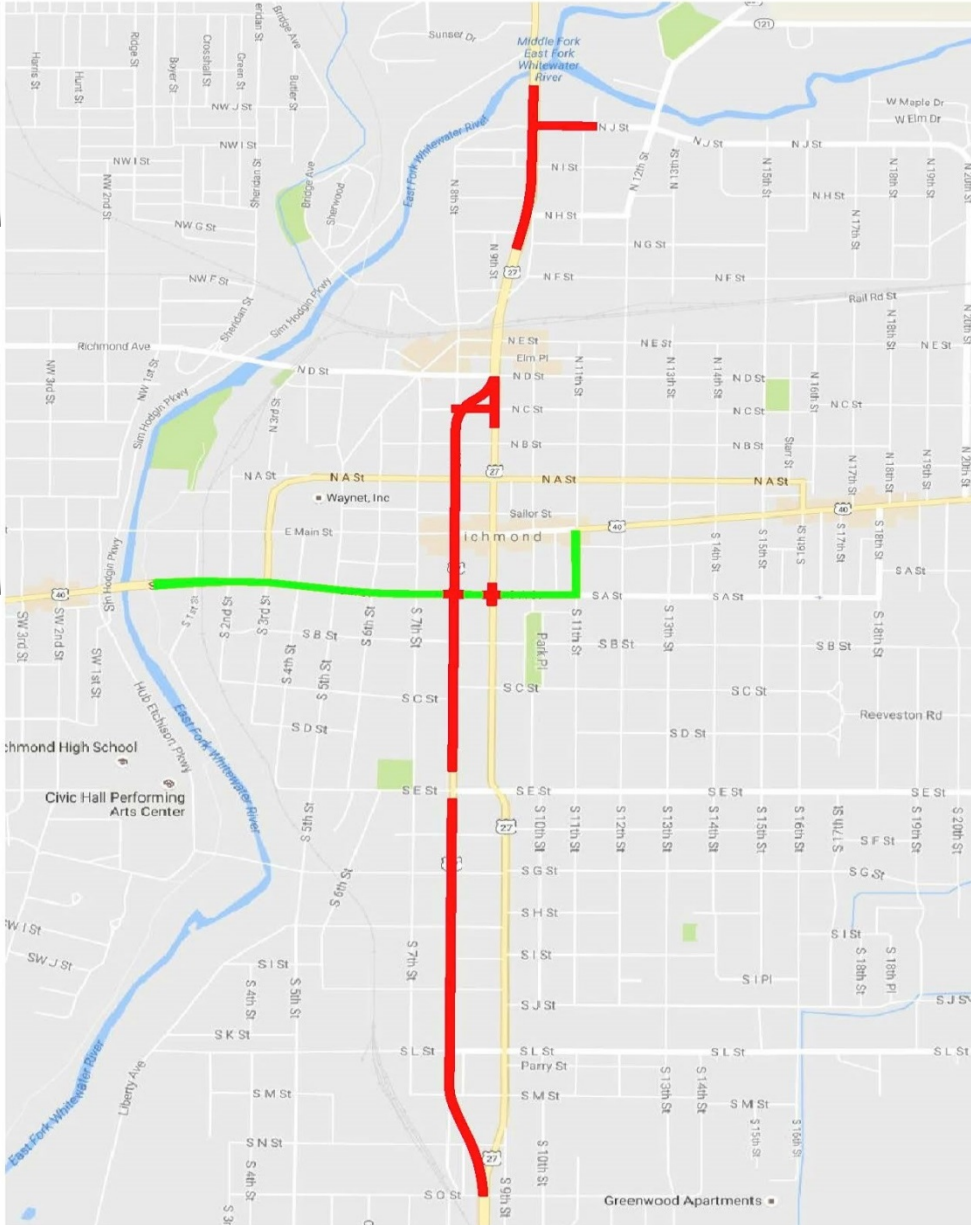
- Contract R-30397
 - Includes
 - US 40 - Des. No. 0013790 (PCP Pavement)
 - US 27 – Des. No. 0100701 (HMA Pavement)
 - City of Richmond, Indiana
 - INDOT Greenfield District
 - Letting Date: February 8, 2017
 - Anticipated Completion Date: Late April/early May, 2019
 - Prime Contractor: Gradex

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

Area Map: Richmond, IN – U.S. 27 and U.S. 40 Project Limits

U.S. 27
Limits of
Project

Limits of
U.S. 40
Project



U.S. 40 Project Limits
U.S. 40 Eastbound (South A Street)
from South 3rd Street to South 11th
Street, and U.S. 40 (South 11th
Street) from South A Street to East
Main Street

Precast Concrete Pavement (PCP) Design Overview

Plan Development & Coordination:

- Very quickly needed to make the change to Precast Concrete Pavement
- Needed to combine and bid with US 27 - designed by another firm
- No INDOT Standard Drawings, Pay Items, or Specifications were available
- Extensive coordination was required
- Utility Considerations were very important
- Importance of accurate locations of existing and relocated utilities
- No saw cut traffic signal loops – used wireless vehicle detection

Precast Concrete Pavement (PCP) Design Overview

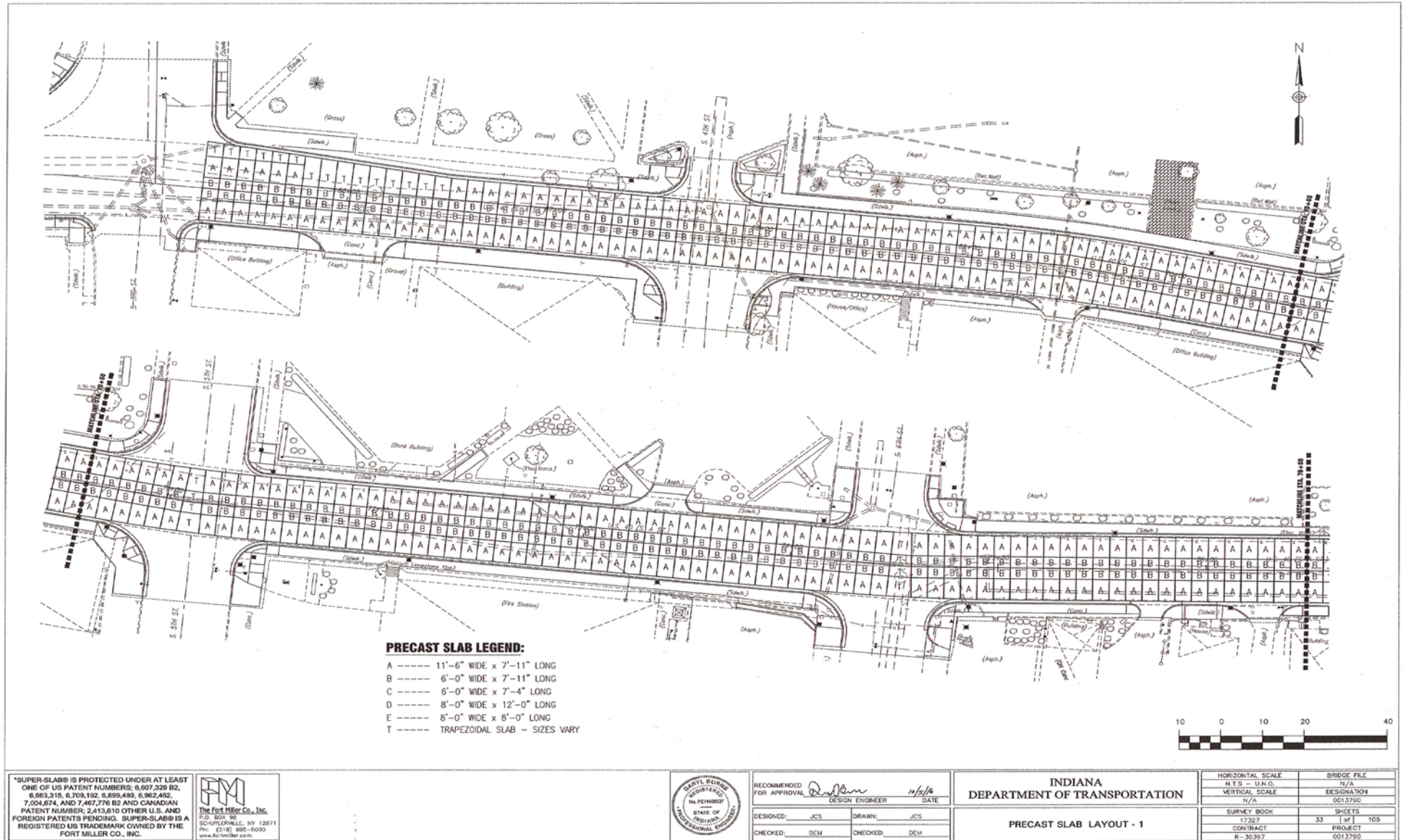
Maintenance of Traffic Considerations:

- Joints between panels need 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

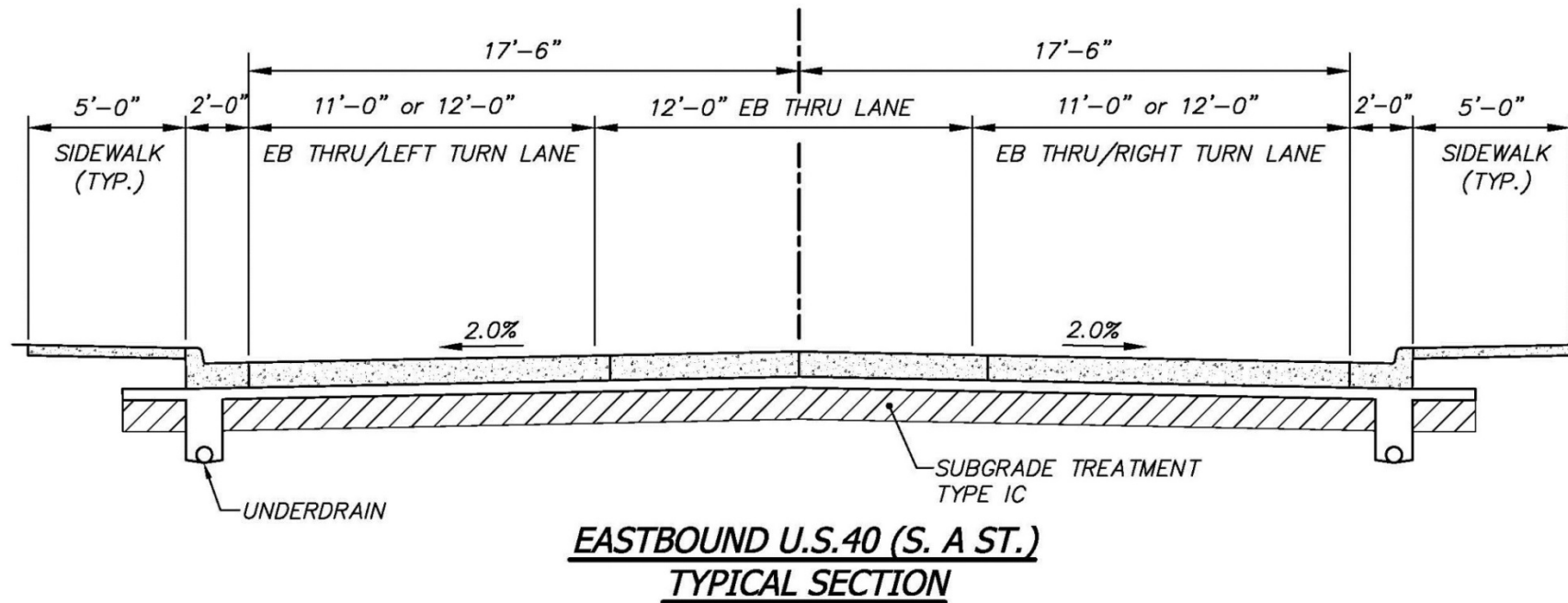
Public Outreach – Contractor Presentation before bidding:

- Assisted INDOT in preparing and delivering a presentation for Contractors
- Local Contractors were unfamiliar with using Precast Concrete Pavement

Precast Concrete Pavement (PCP) Precast Panel Plans

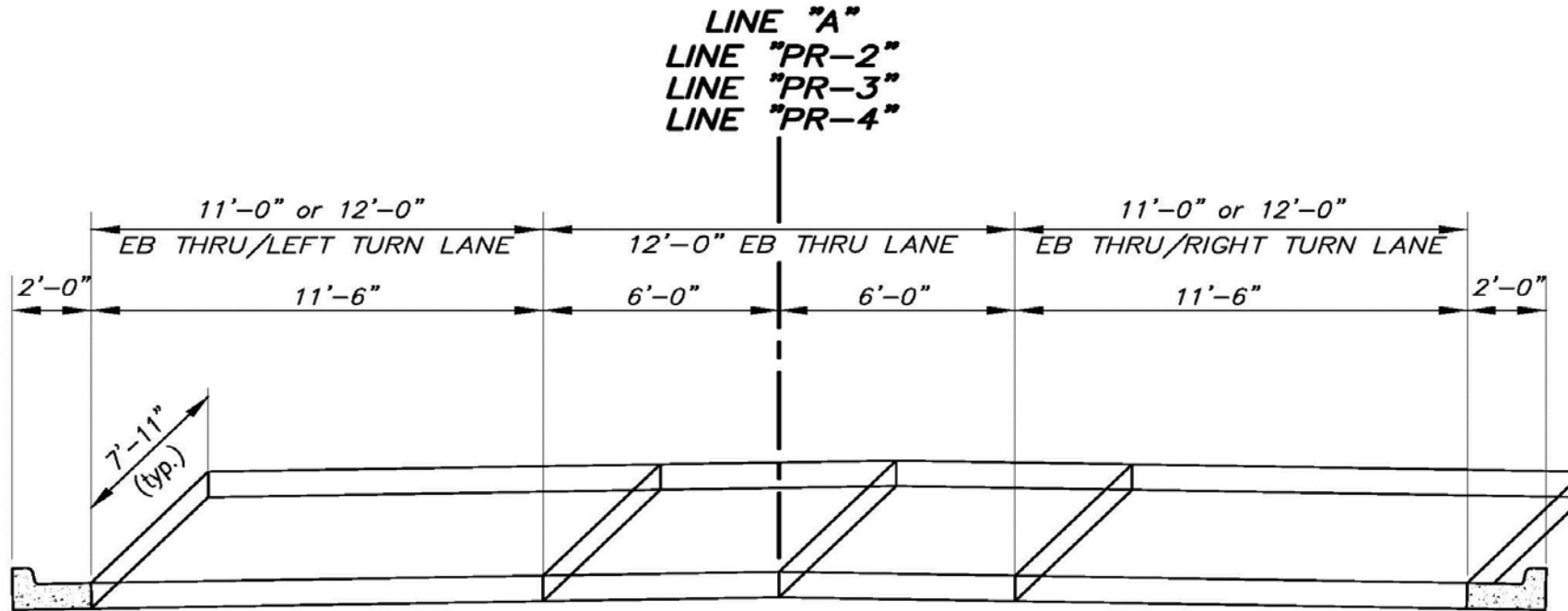


Precast Concrete Pavement (PCP) Typical Cross Section



- Three Lane Roadway Section
- 9.5" Precast Concrete Pavement, Removable
 - Proprietary Product specified: Super-Slab[®] Removable and Reusable Urban Pavement System[®] RUP, Fort Miller Co., Inc.
- Precision Grading Fine Aggregate on 4" Comp. Agg. Drainable Subbase
- 12,165 SYS of Precast Concrete Pavement (approximately 1,100 panels)
- 0.60 miles total length along US 40 - (S. A St.) from 3rd St. to 11th St.

Precast Concrete Pavement (PCP) Typical Panel Sizes



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

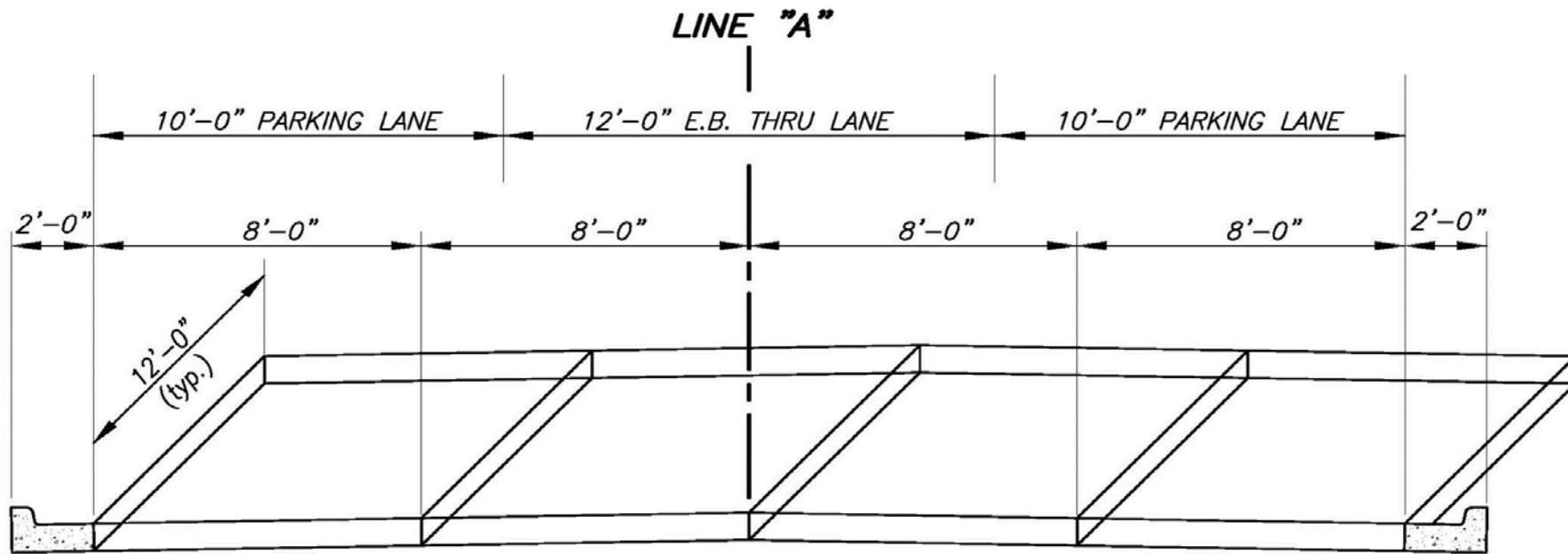
U.S. 40 (S. A St.)

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)

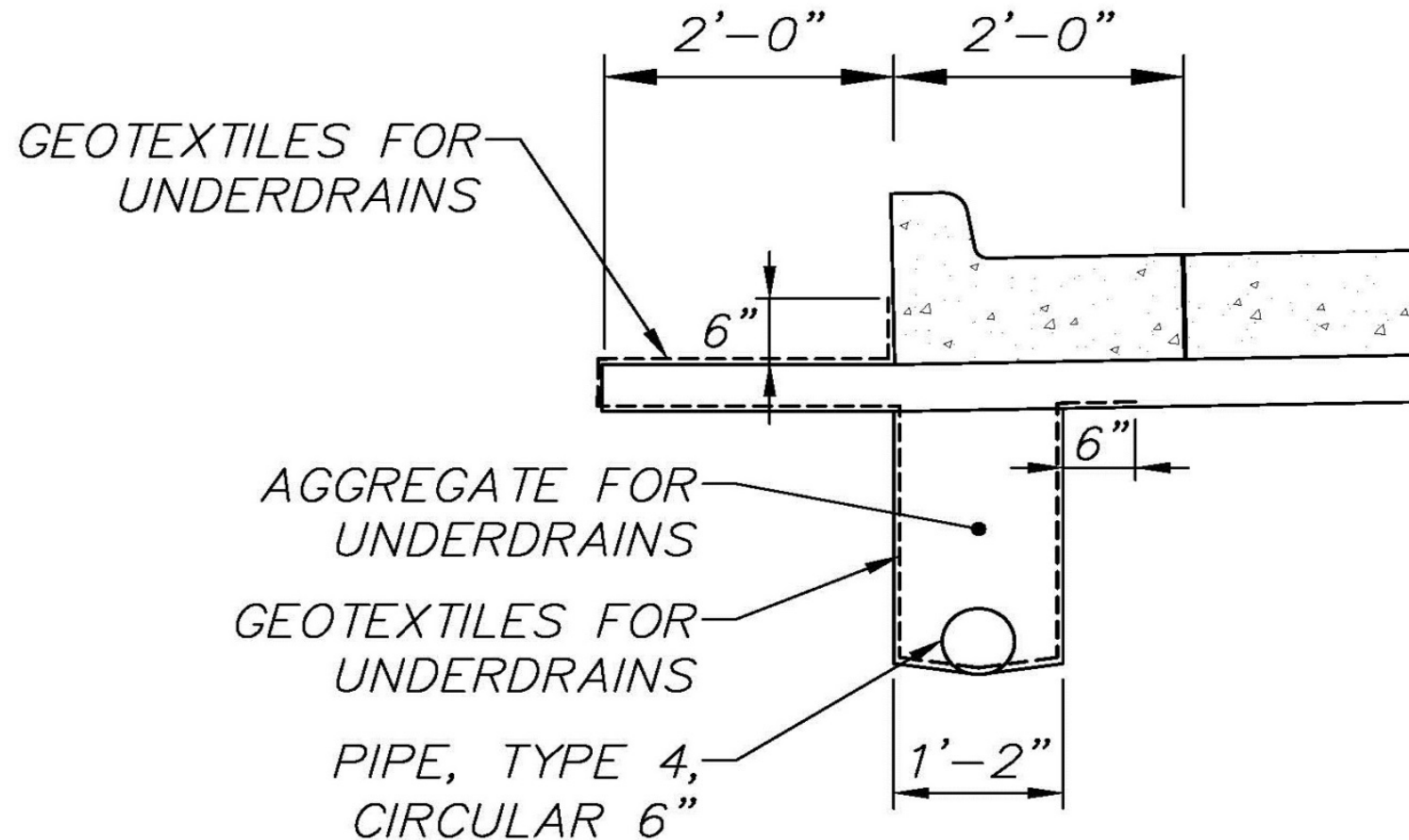
Precast Concrete Pavement (PCP) Typical Panel Sizes



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

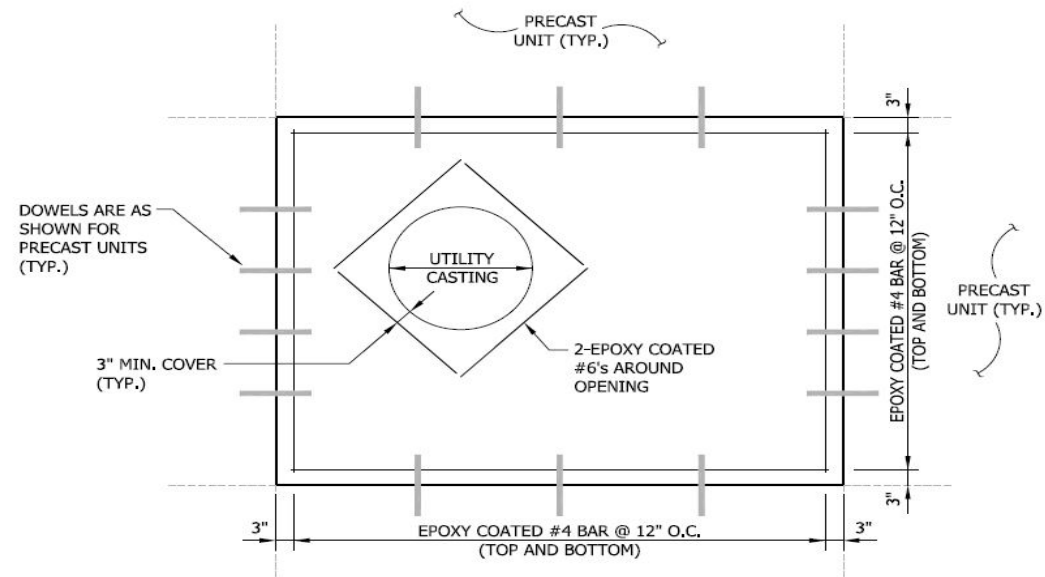
U.S. 40 (S. 11th St.)
Typical Size and Layout of
Precast Concrete Panels
Panel wt. +/-11,400 lbs (5.7 Tons)

Precast Concrete Pavement (PCP) Details



- 2' Concrete Curb & Gutter – not attached to Precast Concrete Panels
- Placed after Precast Concrete Panels are in place
- Bituminous Mastic placed between precast panels and gutter to seal the joint

Precast Concrete Pavement (PCP) 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 required

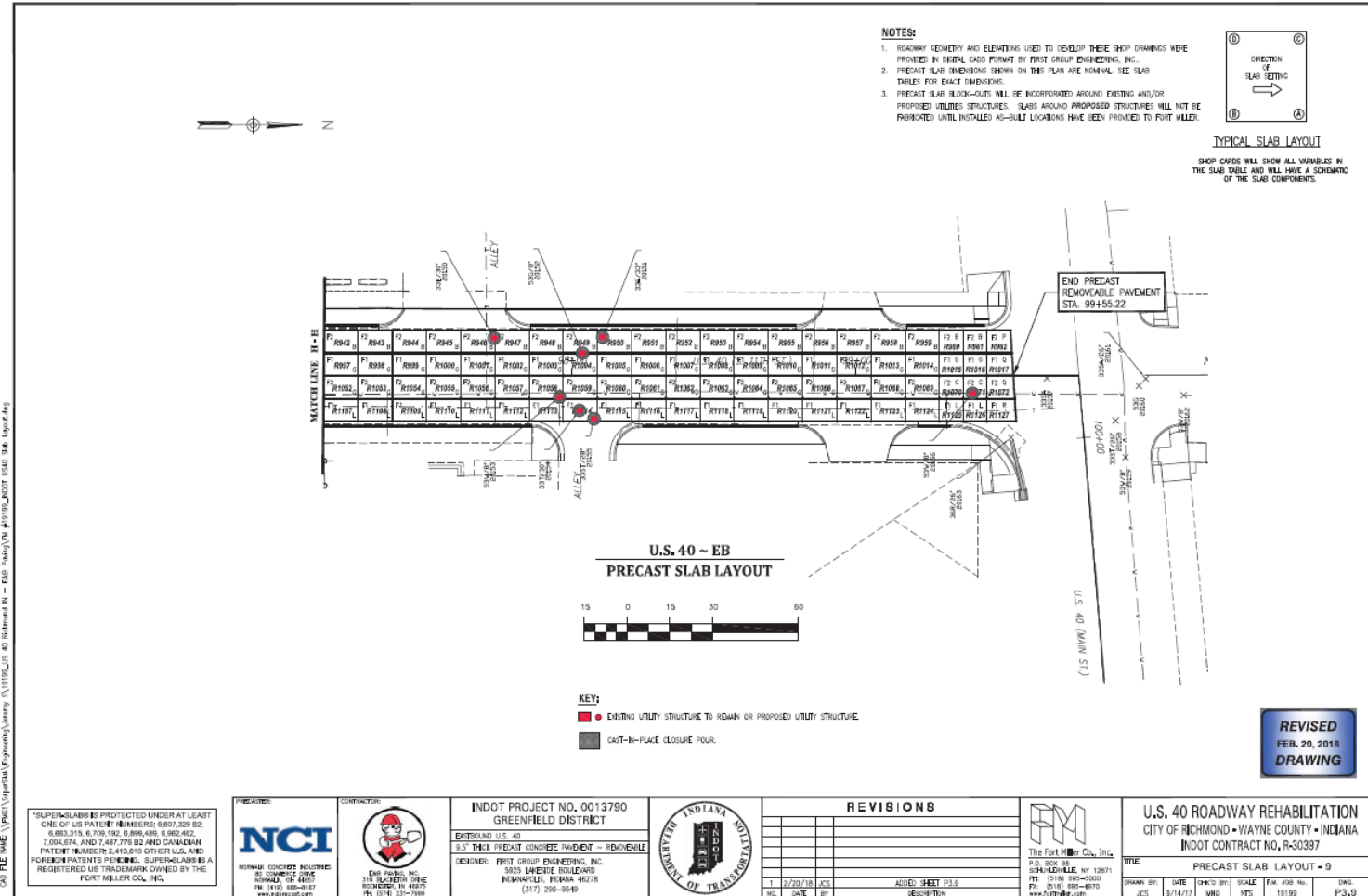
Precast Concrete Pavement (PCP) Construction Overview

Production:

- Fort Miller chosen as proprietary source, had primary responsibility for choice of precast source
- Source had to be on Indiana's pre-approved precast lists
- First looked at source in Dayton, had issues with getting AP aggregate source
- Finally chose Norwalk Concrete of Norwalk, Ohio. Their aggregate source already had approved AP aggregate

Precast Concrete Pavement (PCP) Construction Overview

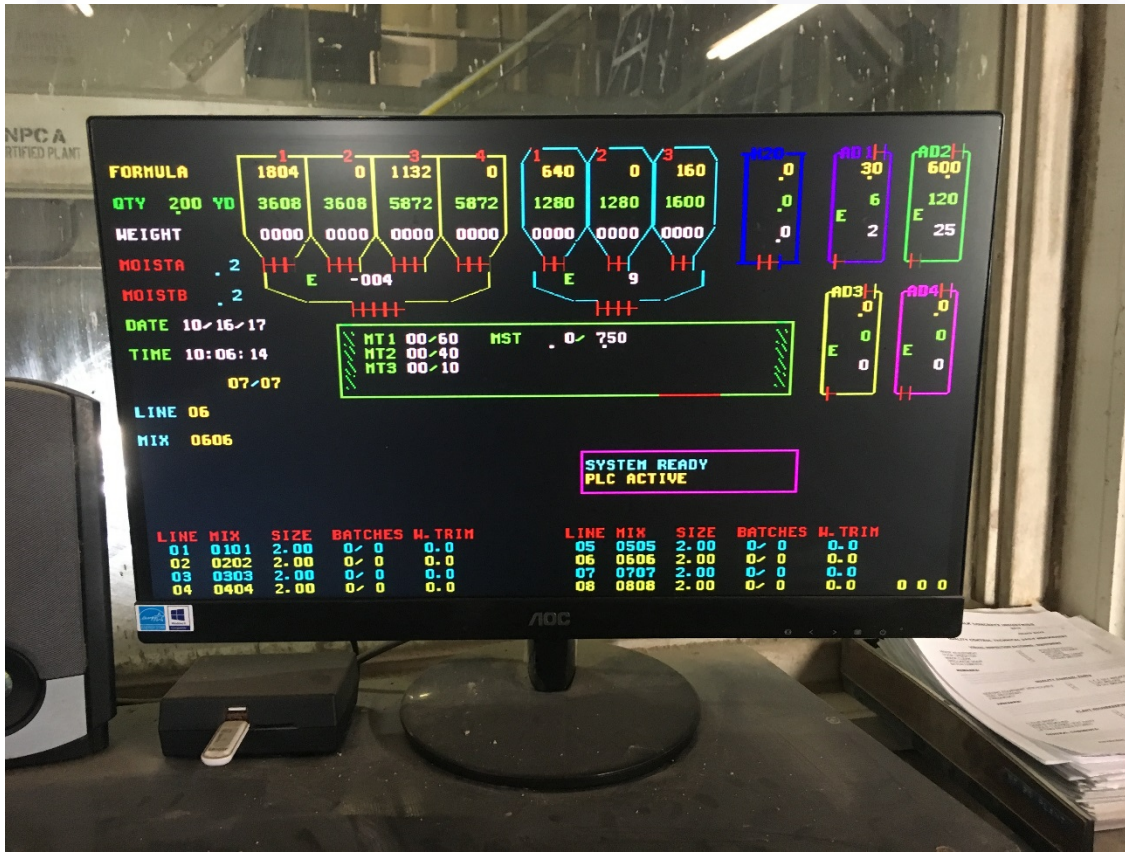
Shop Drawings:



Precast Concrete Pavement (PCP) Construction Overview

Production:

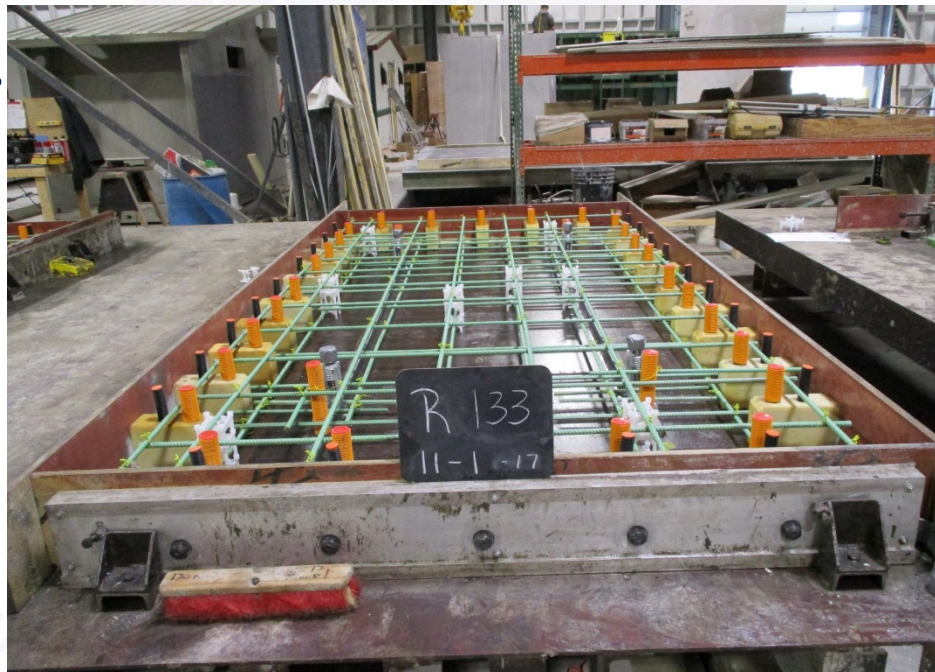
- First trial batch on October 7th 2017. Some issues with the theory behind our trial batch methodology, couldn't complete. Did inspect production process/sample panels.



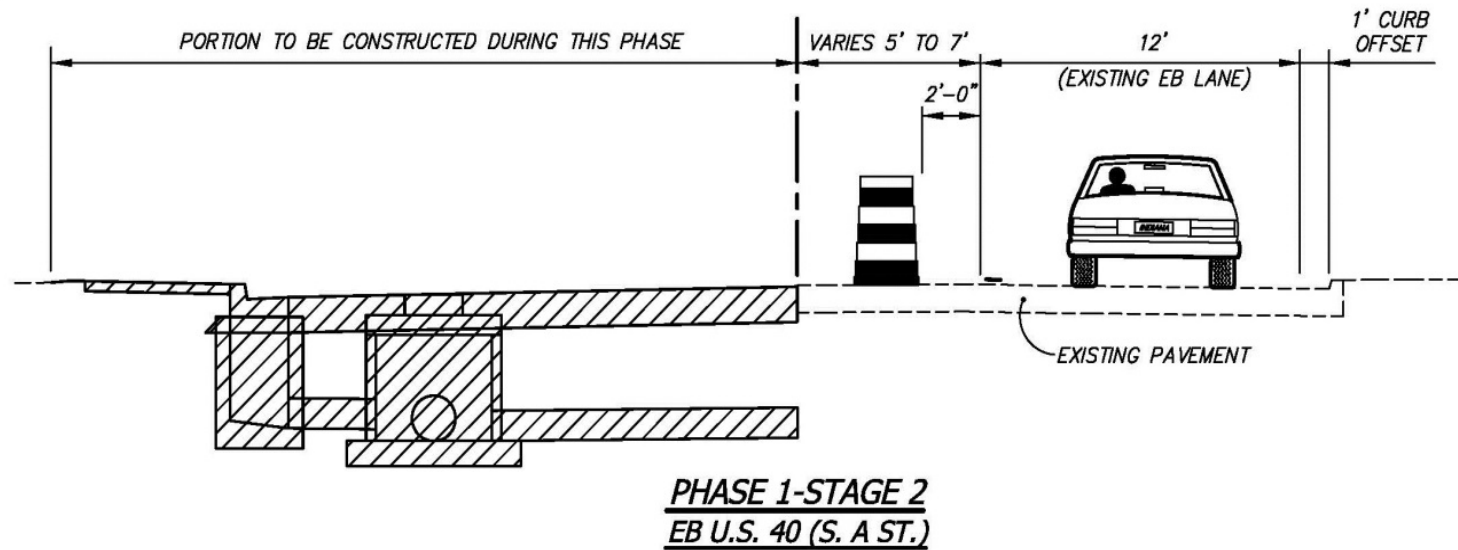
Precast Concrete Pavement (PCP) Construction Overview

Production:

- Second trial batch on October 16th and 17th 2017. Ran test on 16th, Brian Walker (Greenfield IA technician) stayed for 17th to do follow up, 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.



Precast Concrete Pavement (PCP) Typical MOT



- Typical Maintenance of Traffic (Phase):
 - Maintain access to all adjacent businesses and residences
 - Do not close two adjacent streets simultaneously
 - Final MOT phasing and details vary from illustrations
 - Subgrade preparation completed prior to panel installation
 - The first Phase of Panel delivery, unloading and placement was completed during daytime hours with brief 20 minute closures

Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Planned to place panels on typical #53 subgrade + #43 drainage layer. 1/8th inch tolerance instead of usual 1/2 inch. Also thin sand layer for placement of panels.



Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Gradex prepped #53 layer, E&B handled #43 layer + panels.



Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Used GPS on small bobcat for fine grading. Grade was able to be very precise. Surveys earlier in contract had to locate all structures to allow panels to be built with proper space, *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).



Precast Concrete Pavement (PCP) Construction Overview

Installation:

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



Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Some unforeseen issues with traffic control. Couldn't place at night due to above noted shipping issues, had to create temporary closures on US 40 for placement, which impacted Stellar LPA project schedule due to inability to close a section of Main street.
- Placement rate, number of panels placed in a day started in the mid 30's but ended up in 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 some issues with late trucks.
- Grout placed generally without issues. Curb placed generally without issue. 2nd set of panels had some issues with grade along centerline, able to field adjust to within grade tolerances.

Precast Concrete Pavement (PCP) Construction Overview



Precast Concrete Pavement (PCP) Construction Overview



Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Fine milling completed after placement, no significant issues with this. May have been unnecessary for some applications (rest area parking repairs or the like) but decided on doing in field for both smoothness and to apply texturing to surface for skid resistance.
- Pucks substituted for loops for all panels, puck installation currently ongoing with no issues.

Precast Concrete Pavement (PCP) Construction Overview

Installation:

- Completed section of roadway with final diamond grind surface completed.



For More Information; Visit Contract R-30397 Website:

<http://www.in.gov/dot/div/contracts/slab/30397.htm>

MENU **IN.gov** BUSINESS & AGRICULTURE RESIDENTS GOVERNMENT EDUCATION TAXES & FINANCE VISITING & PLAYING FAMILY & HEALTH
Governor Mike Pence

Indiana Department of Transportation A State that Works INDOT

INDOT HOME

DOING BUSINESS WITH INDOT

- Request for Information
- Request for Qualifications
- Request for Proposals
- Consultants/Pre-Construction
- Contractors/Construction
- Standards & Specifications
- Contract Letting Information
- Indiana Design Manual
- Open Roads (Practical Design)
- Permits
- INDOT University
- Economic Opportunity
- Local Public Agency Programs
- Utility Coordination
- Procurement
- Other Business



Contract R-30397 Super Slab Construction



Project Description

US 40 (South A Street) from South 3rd Street to South 11th Street, and US 40 (South 11th Street) from South A Street to East Main Street.
US 27 (8th Street) from South O Street to North D Street, and US 27 (Chester Blvd.) from North F Street to Whitewater River bridge.
City of Richmond, Wayne County

Des. No.: 0013790 and 0100701
Contract No.: R-30397

INDOT is testing implementation of a new pavement treatment approach for PCCP Pavement Rehab, Precast Concrete Pavement (PCP). Several experimental projects are, or will be coordinated; as each set of projects will involve testing a different PCP system. US 40 in Richmond is the first of these test projects. A Precast Concrete Pavement Forum was hosted by the Joint Transportation Research Project (JTRP) on Thursday, August 11, 2016 addressing the general use of PCP, see website in "Helpful Links" below.