Needs Driven Design Solutions in Railroad Projects

Purdue Road School
March 8, 2016

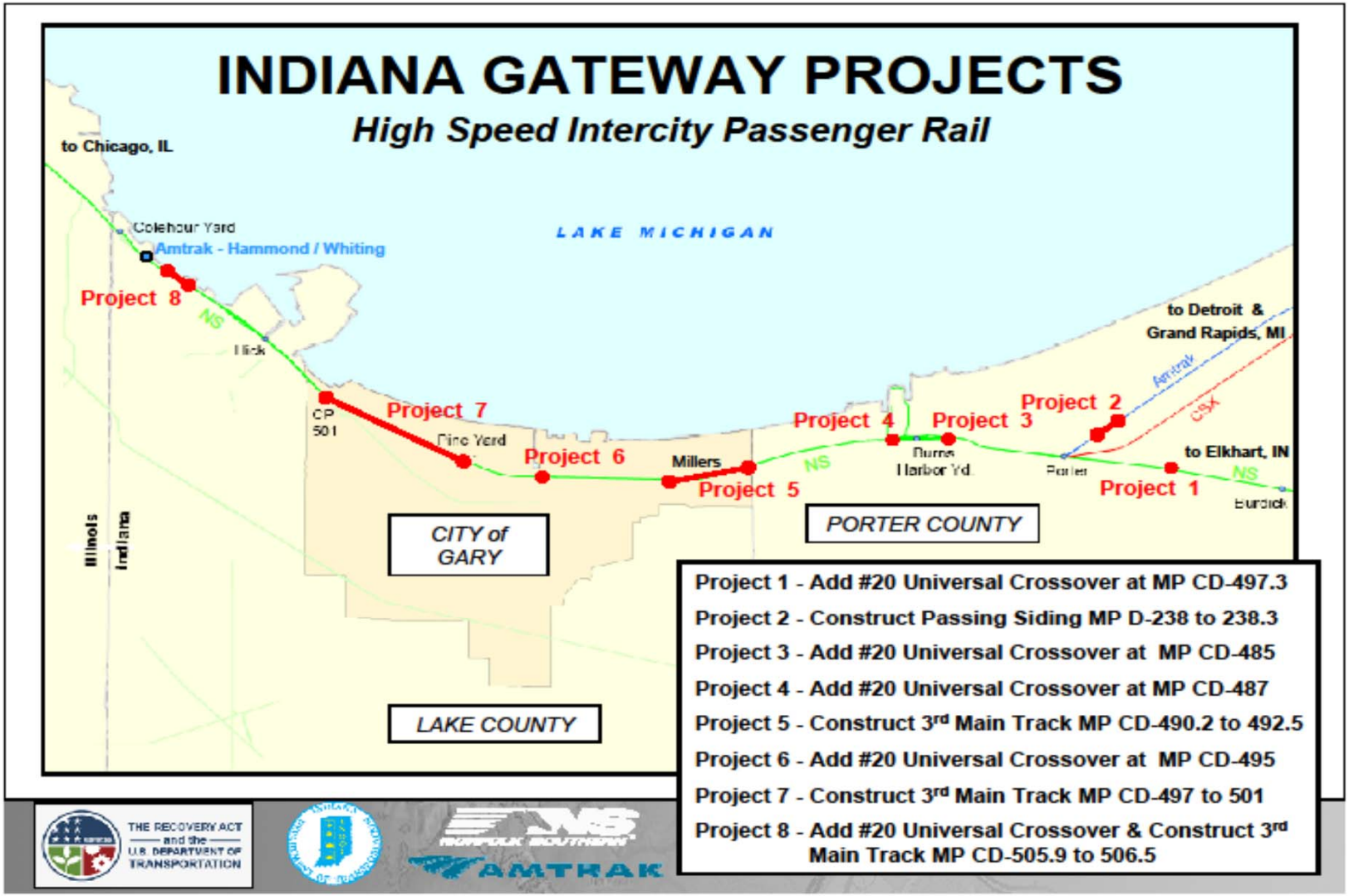
Indiana Gateway & White River Bridge Projects

Tom Rueschhoff
Project Manager, Rail Office - INDOT

American Recovery & Reinvestment Act of 2009

- ARRA had a portion of Funds focused on High Speed Rail Projects
- INDOT with the assistance of NS and Amtrak applied for a Grant for the Indiana Gateway Project and was selected in 2010
- INDOT was awarded a $71.4M Grant that included 100% federal funds
- Agreements were finally reached in September 2012 between FRA, NS, Amtrak and INDOT

Project Site



Indiana Gateway Project

- The Indiana Gateway consists of eight subprojects.
- Seven of the subprojects are on the Norfolk Southern Chicago Line and consist of five locations where universal crossovers will be added and three locations where a third mainline track will be constructed. The seven subprojects have an estimated cost of $66.9 million.
- One subproject is on the Amtrak Michigan line, located just north of the Porter Interlocking, will construct a new passing siding to enable meeting trains to pass each other. This subproject has an estimated cost of $ 4.5 million.

White River Bridge (1899-2015)

Grant and Funding Sources

Total Project Cost $13,845,220

- Federal Railroad Administration TIGER Grant
  - **$8,245,220**
- Industrial Rail Service Grants (2013 & 2014)
  - **$600,000**
- The Indiana Rail Road Responsibility
  - **$5,000,000**

Project Schedule

Contactor : OCCI, Fulton, MO. May 30, 2014

Construction Began: June 2014

Bridge Change Out: May 2015

Main Project Completion: August 2015

FRA Contractual Completion: February 2016

Indiana GATEWAY PROJECT

NORFOLK SOUTHERN

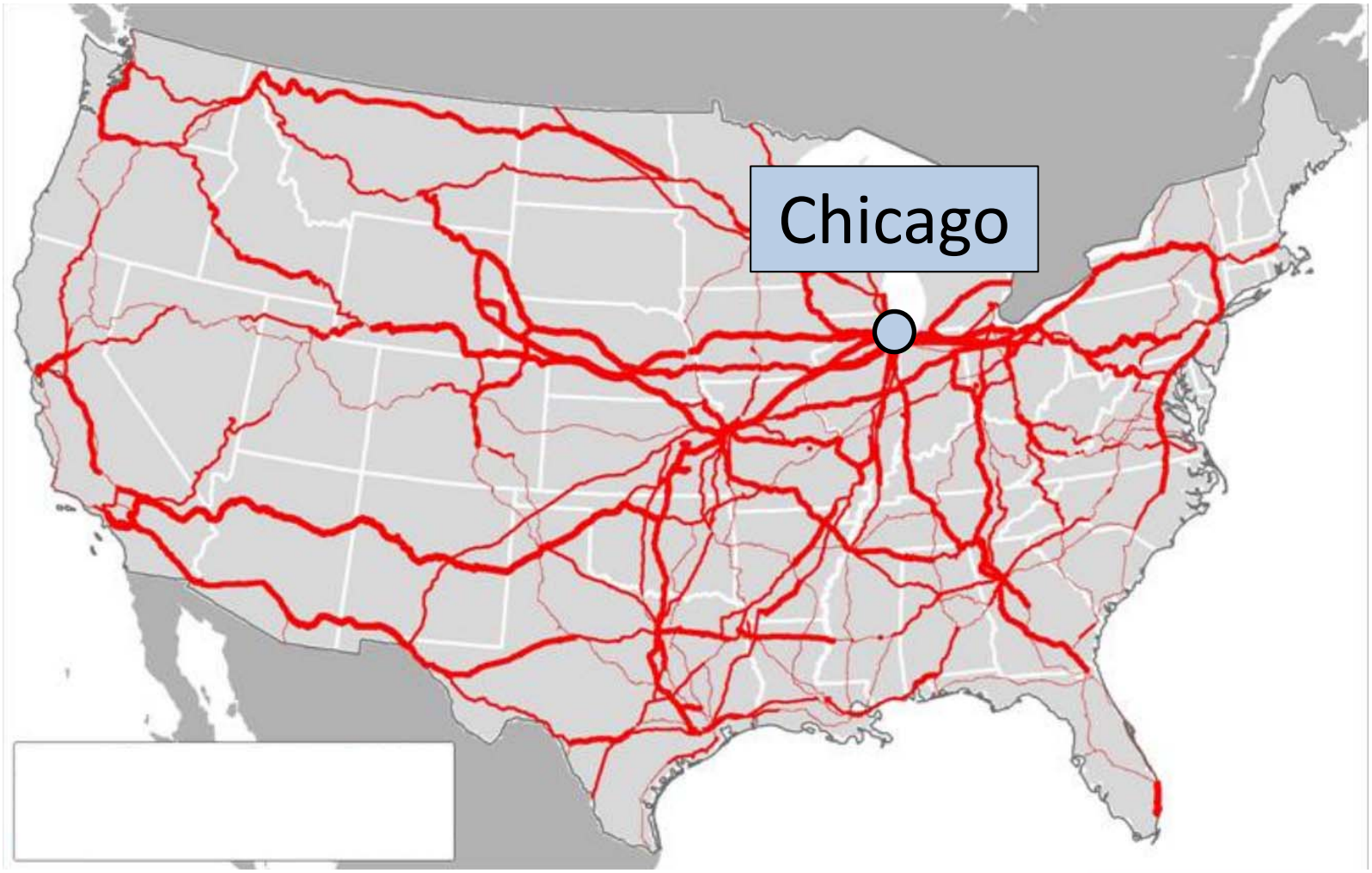
AMTRAK

U.S. Department of Transportation
Federal Railroad Administration

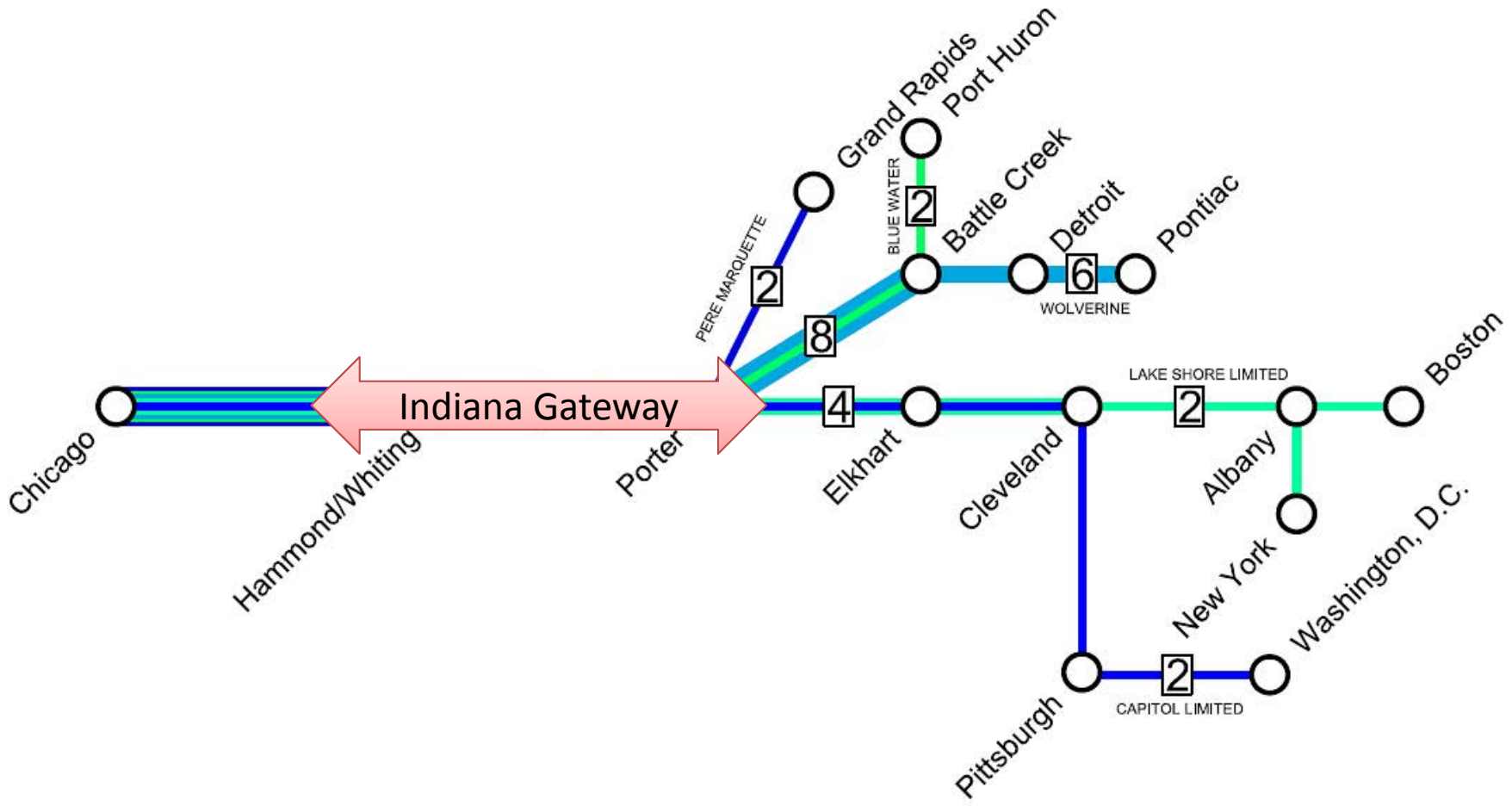
March 2016

Derek Tichy, P.E.
Norfolk Southern Corp.
Engineering – Design & Construction

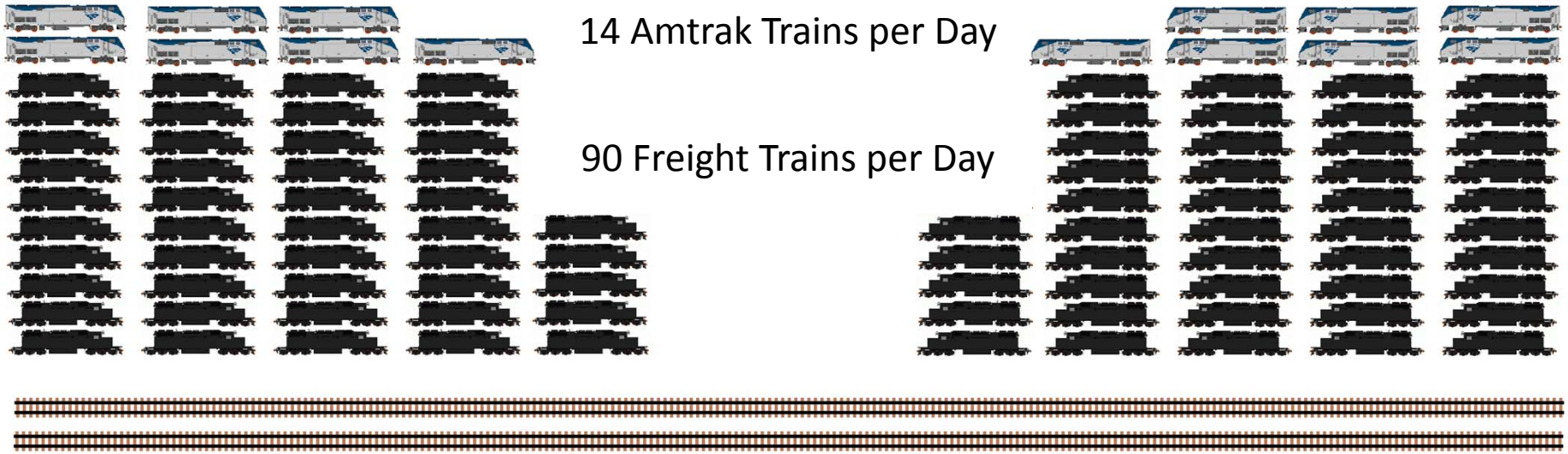
Trains Per Day on Major Corridors



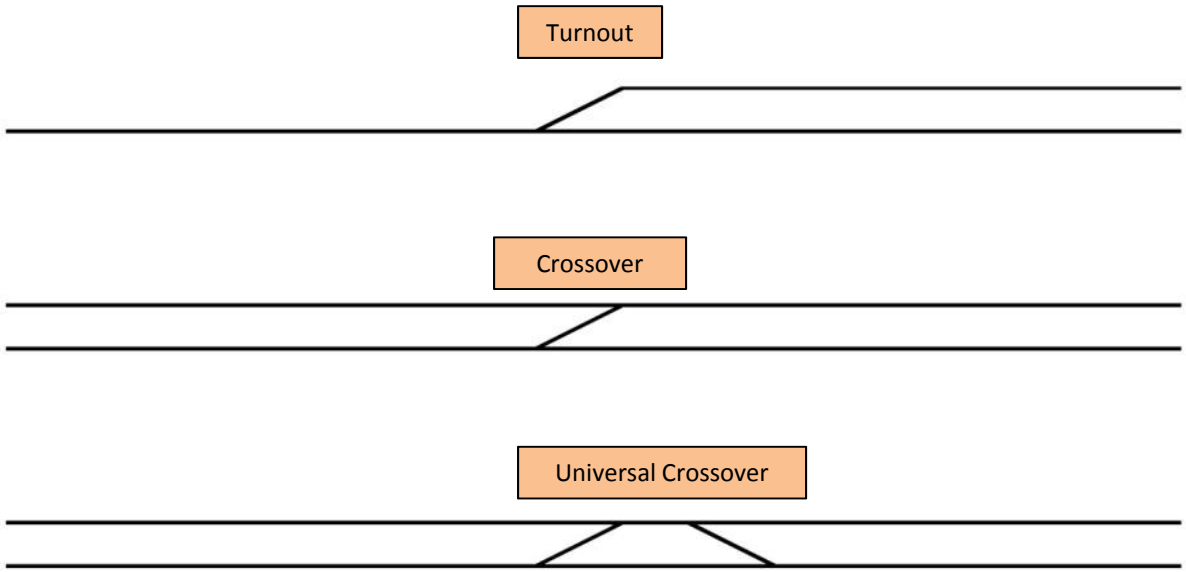
Amtrak Trains Per Day



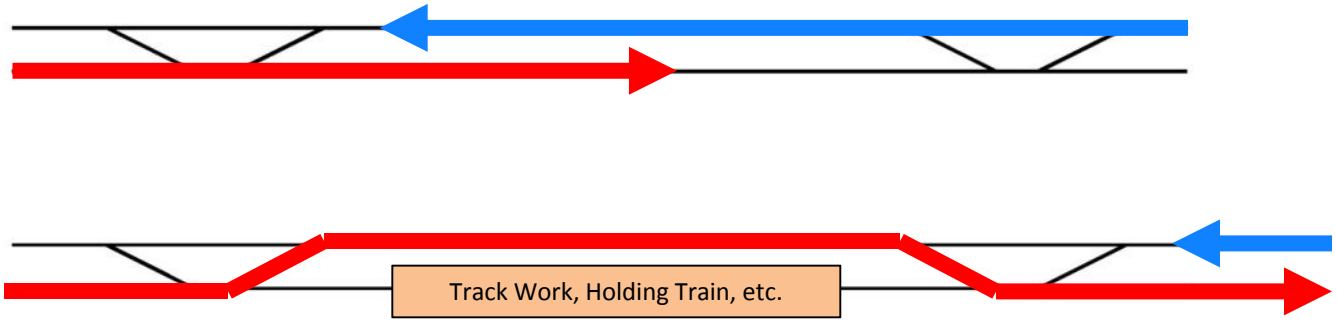
Chicago Line Traffic – West of Porter



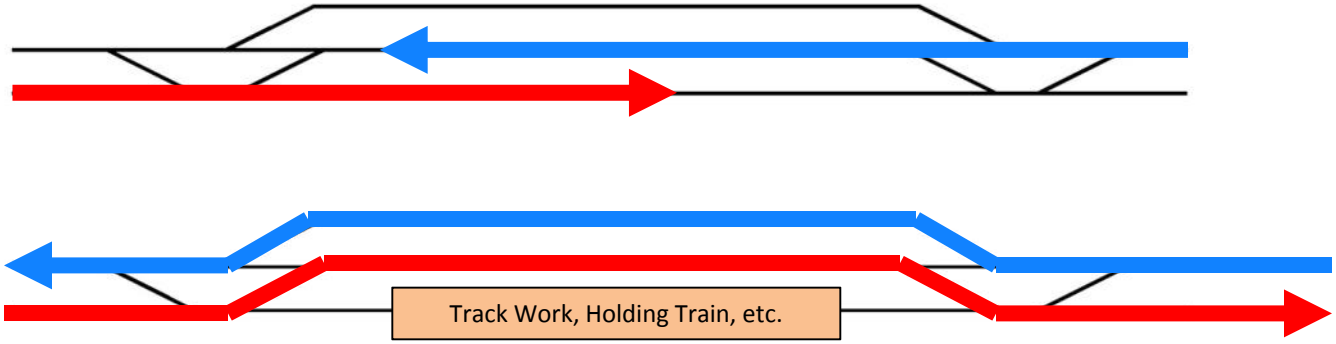
Turnouts and Crossovers



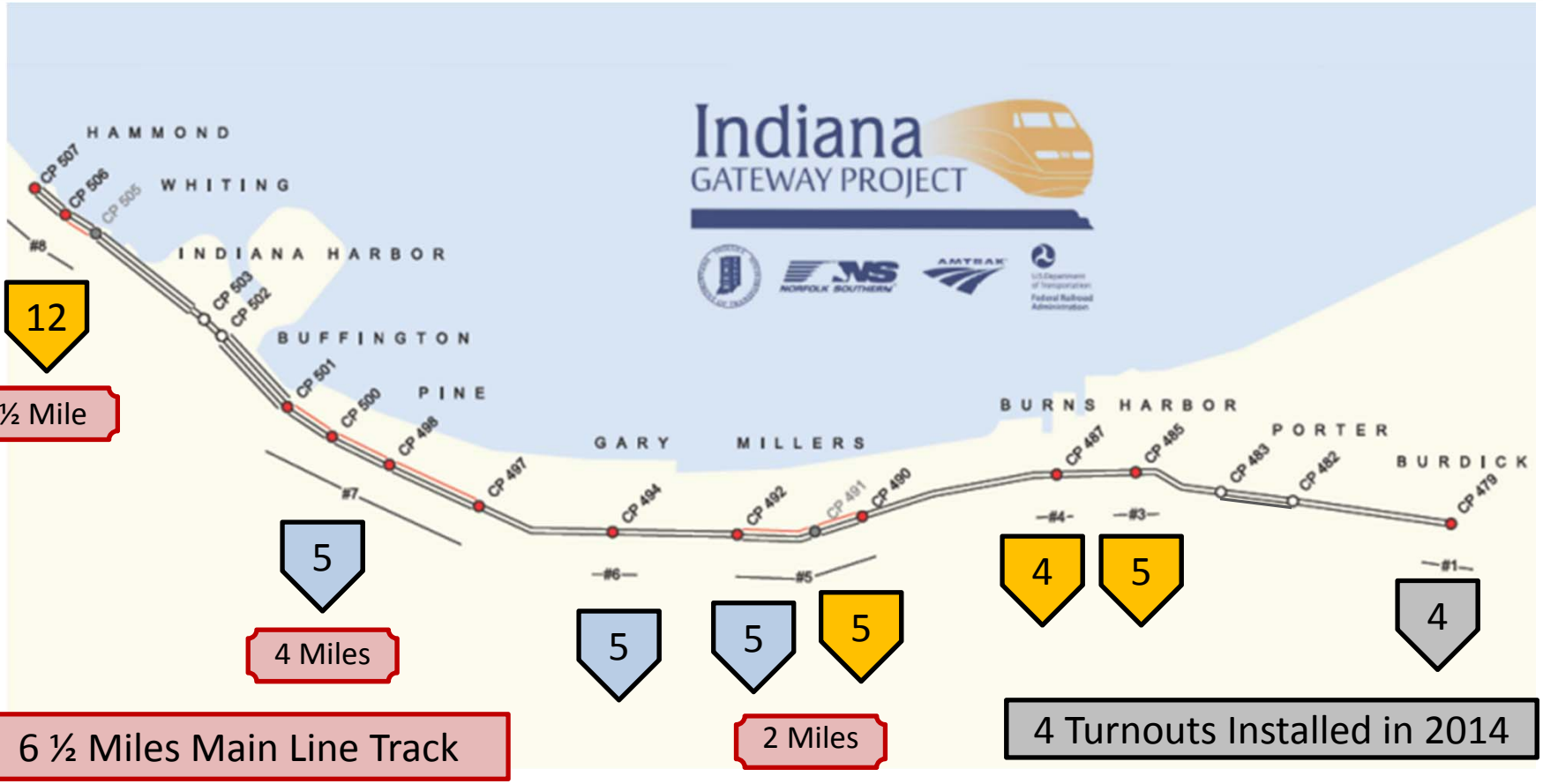
Turnouts and Crossovers



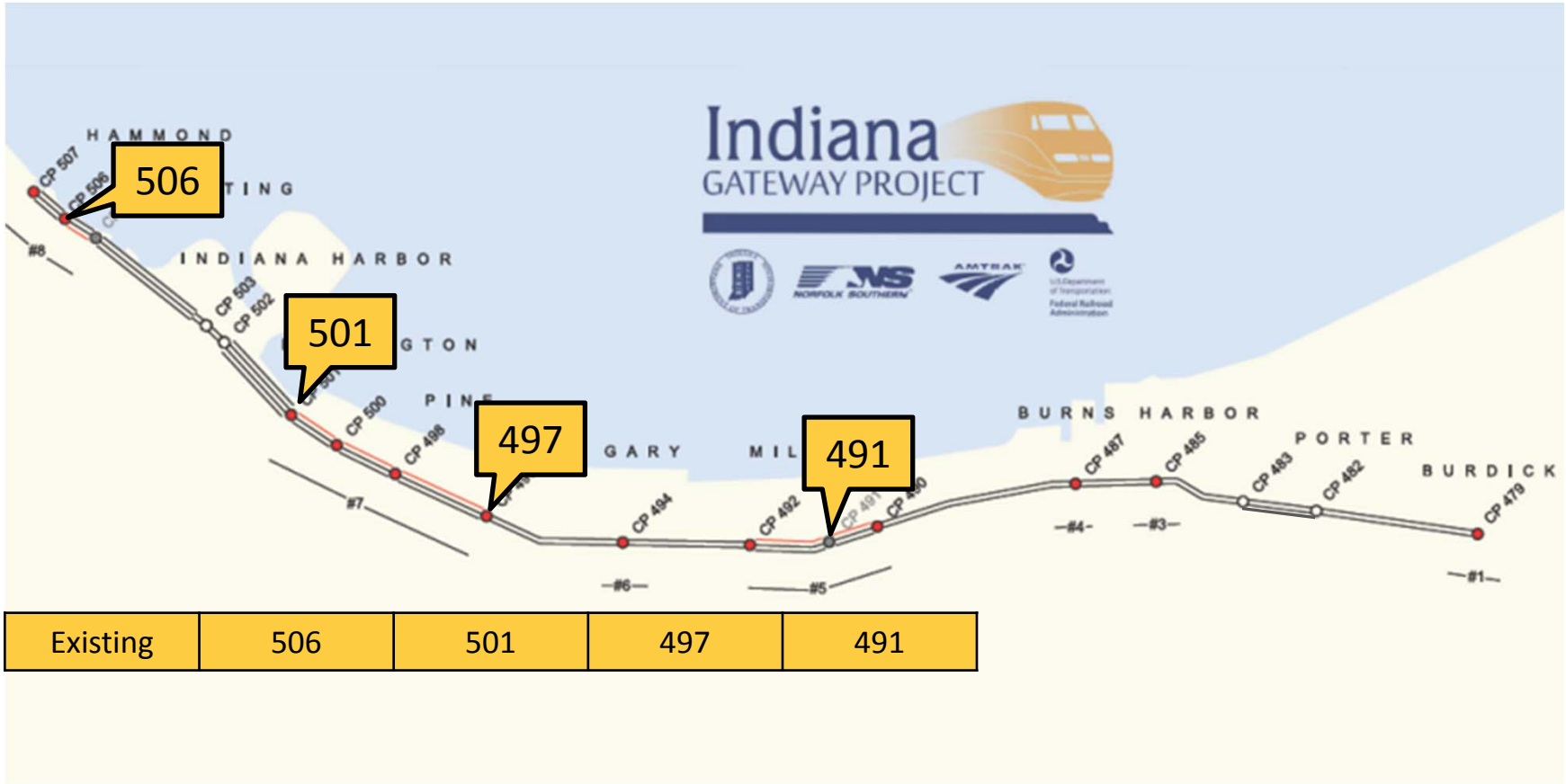
Turnouts and Crossovers



New Main Line Track and Turnouts to be Installed

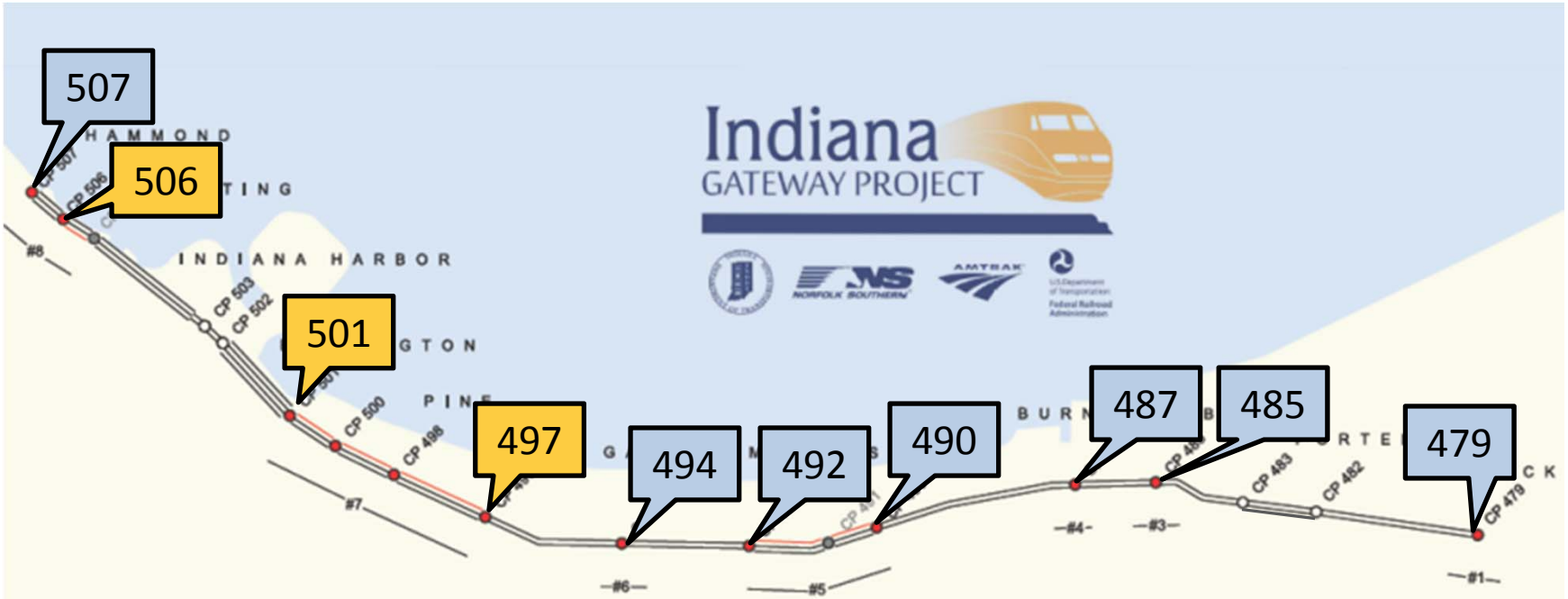


No. 20 Universal Crossovers



Existing	506	501	497	491

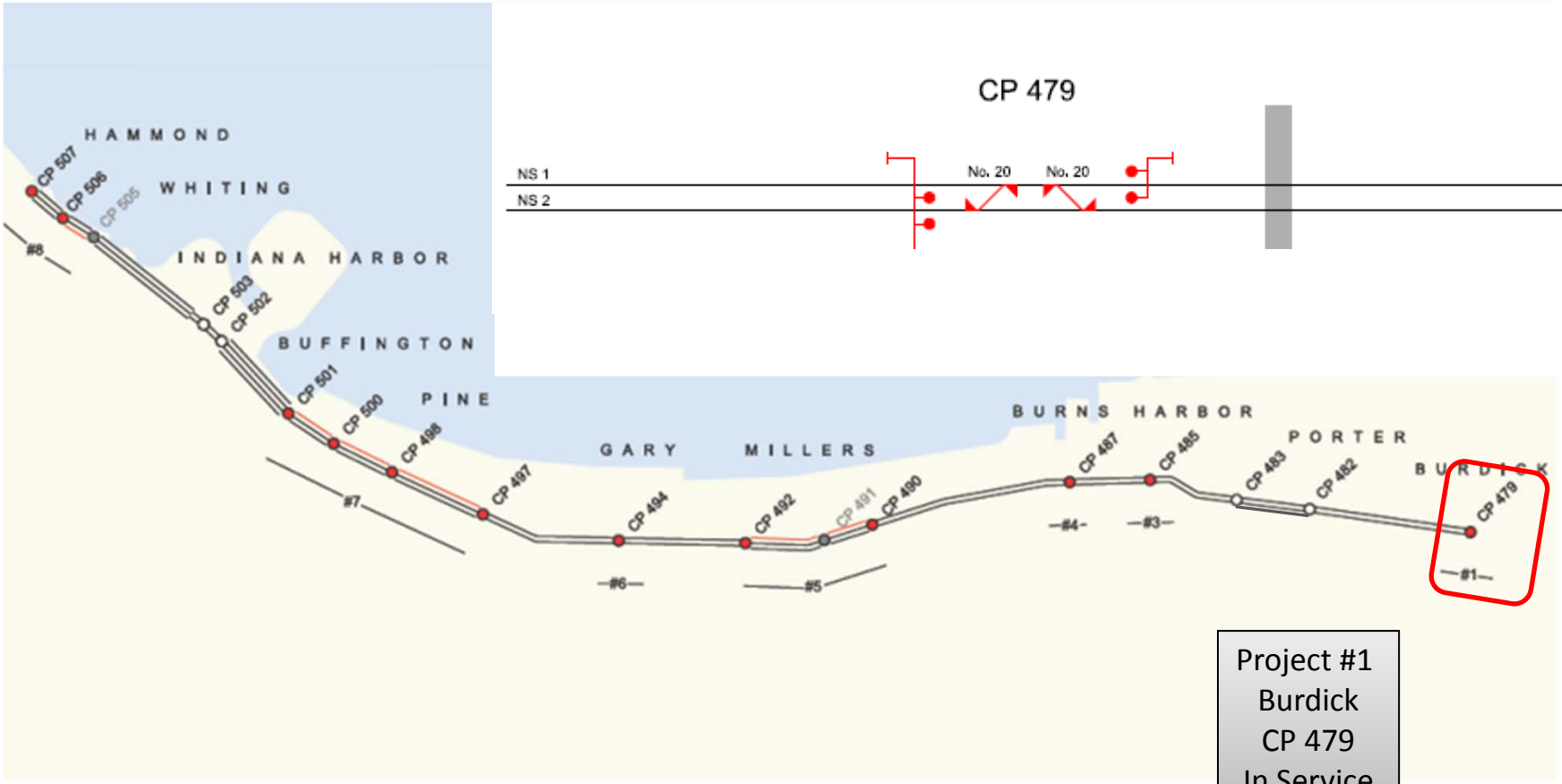
No. 20 Universal Crossovers



Existing	506	501	497	491

Proposed	507	506	501	497	494	492	490	487	485	479

Project #1 - Burdick



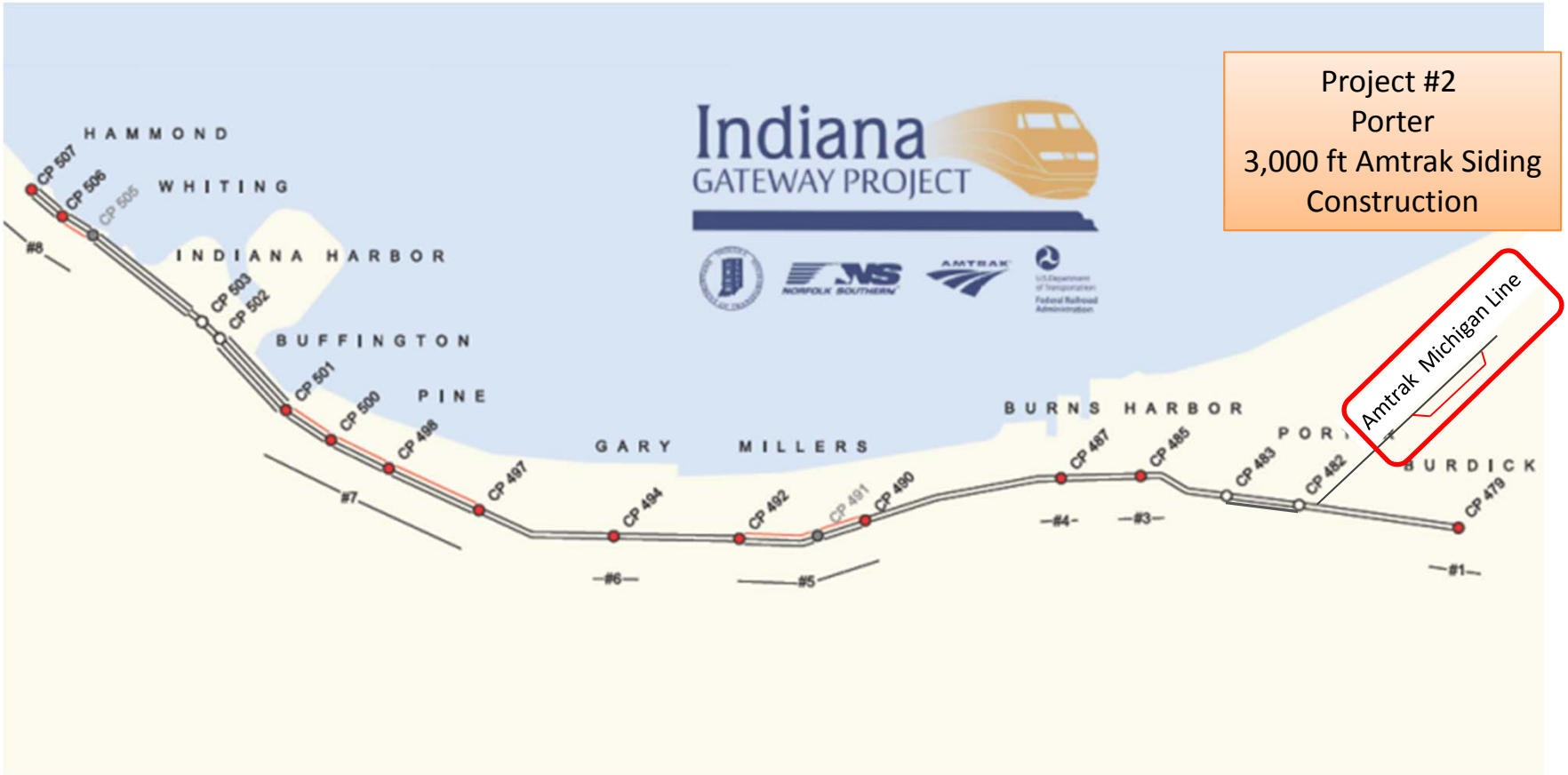
Project #1
Burdick
CP 479
In Service

CP 479 Turnout Installation

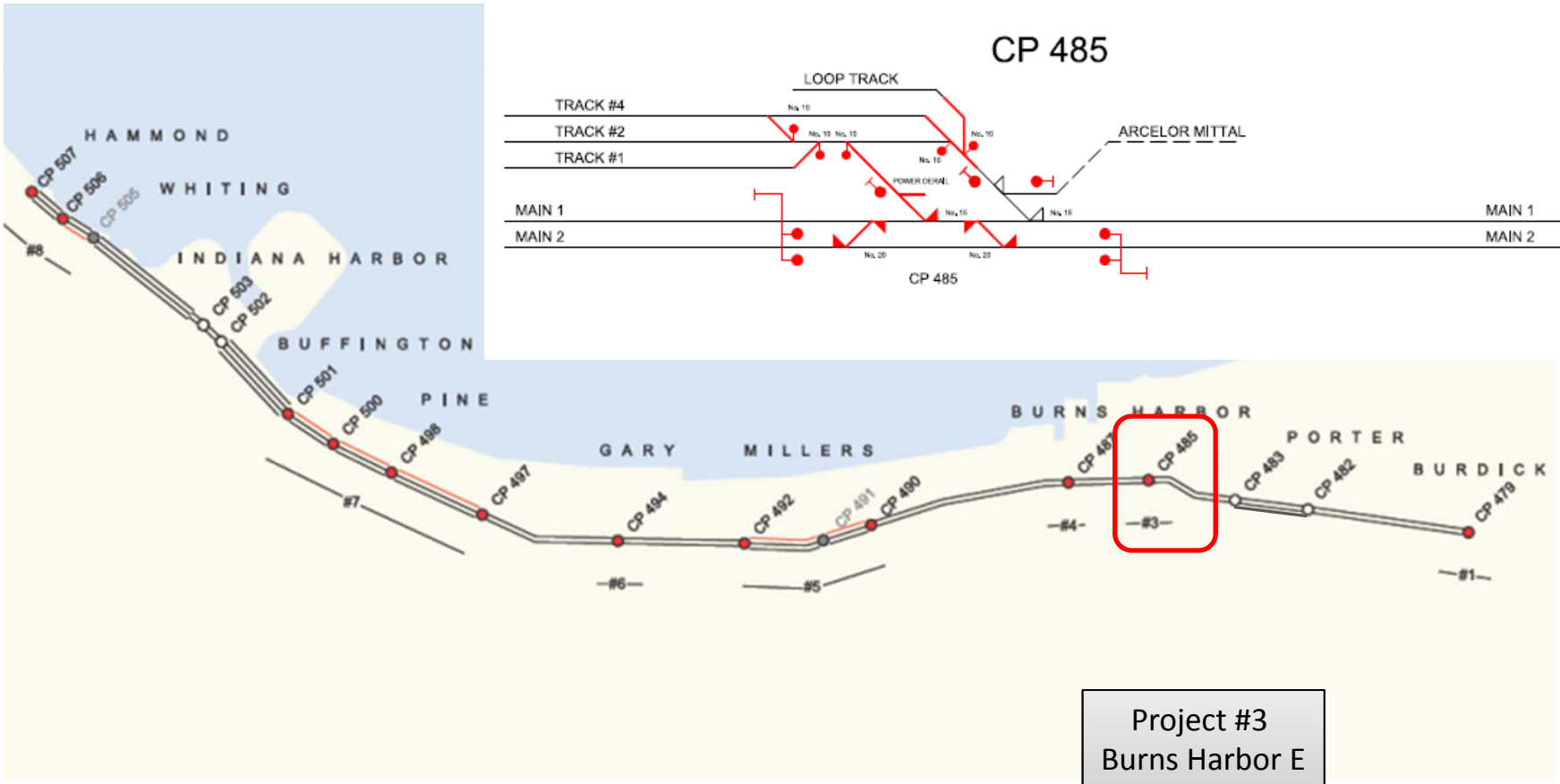
September 1 and 15, 2014

Two work windows on Mondays.

Project #2 – Porter - Amtrak Siding



Project #3 – Burns Harbor East



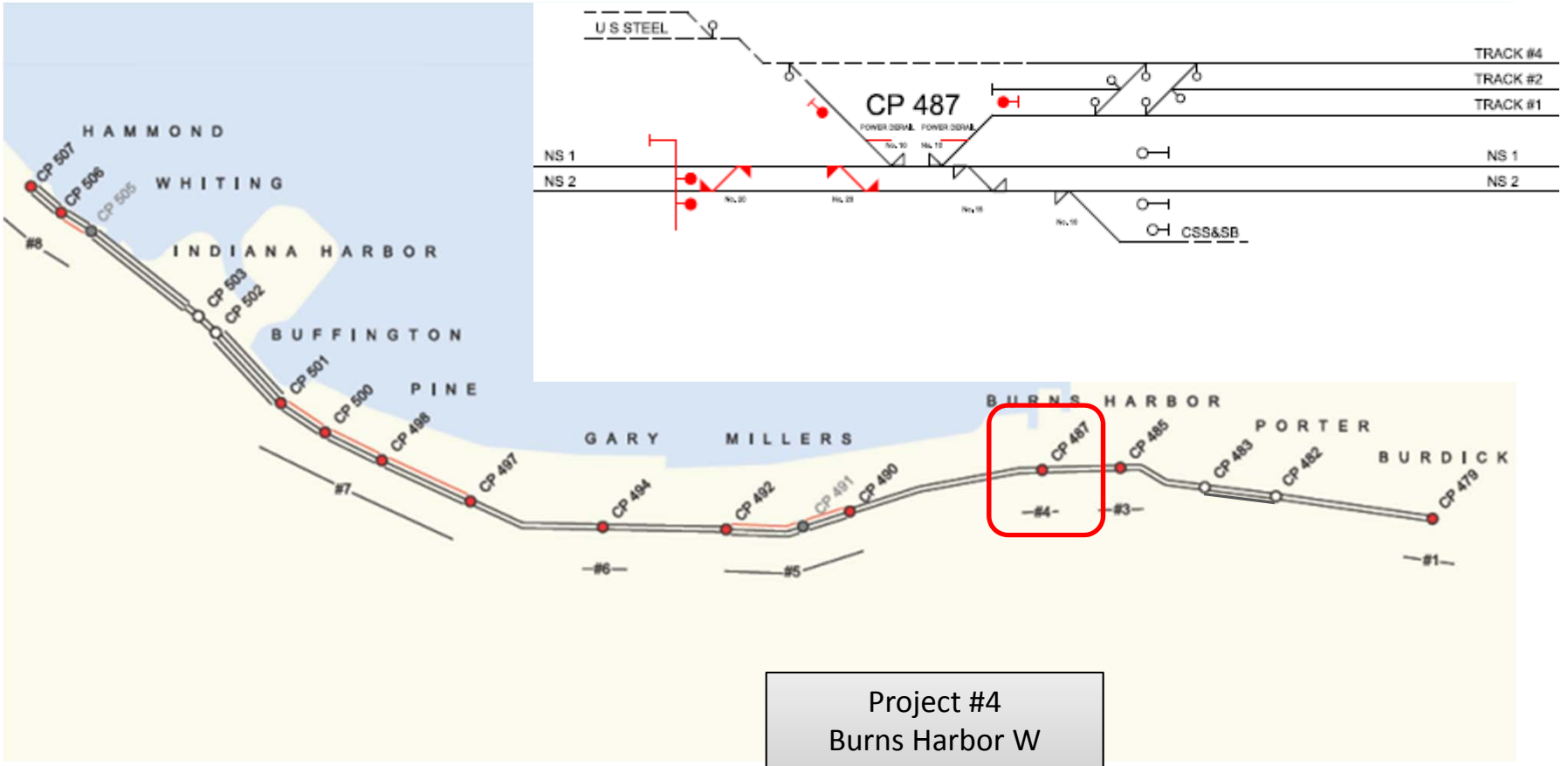
Project #3
Burns Harbor E
CP 485
In Service

Burns Harbor - East

Amtrak

Installing a No. 20 Turnout

Project #4 – Burns Harbor West



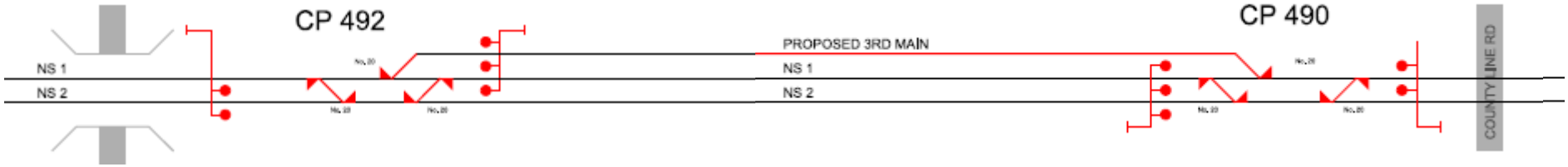
Project #4
Burns Harbor W
CP 487
In Service

Burns Harbor - West

Assembling a new No. 20 Turnout

Preparing New Signals

Project #5 – Millers



Project #5
Millers Siding
CP 490/492
Construction

Millers

Fill Section – 4” Minus Stone

Cut Section – Natural Sand

Millers

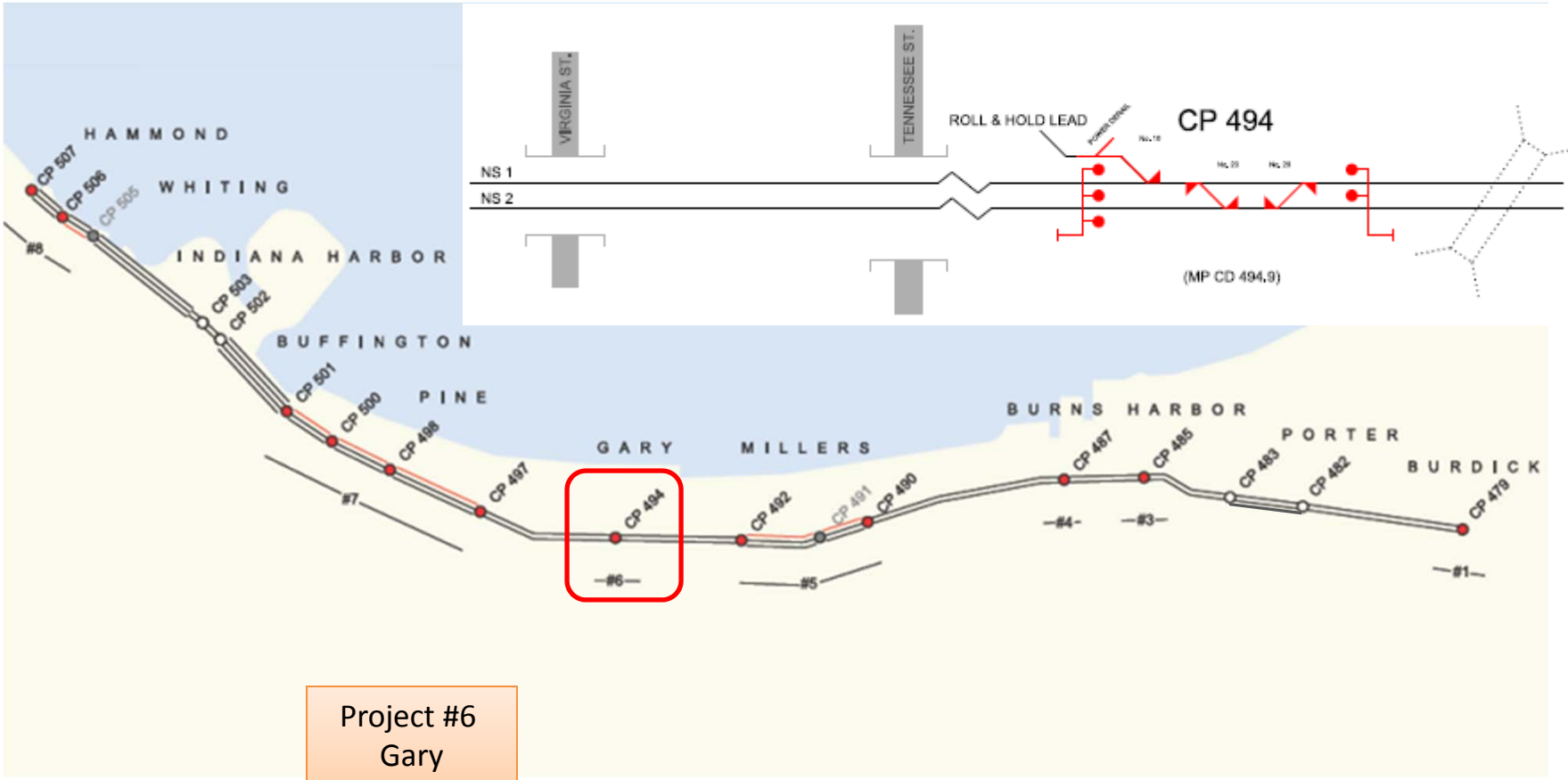
Delivering Subballast Stone

Compacting and Shaping Subballast

Millers

Third Track Construction

Project #6 – Gary

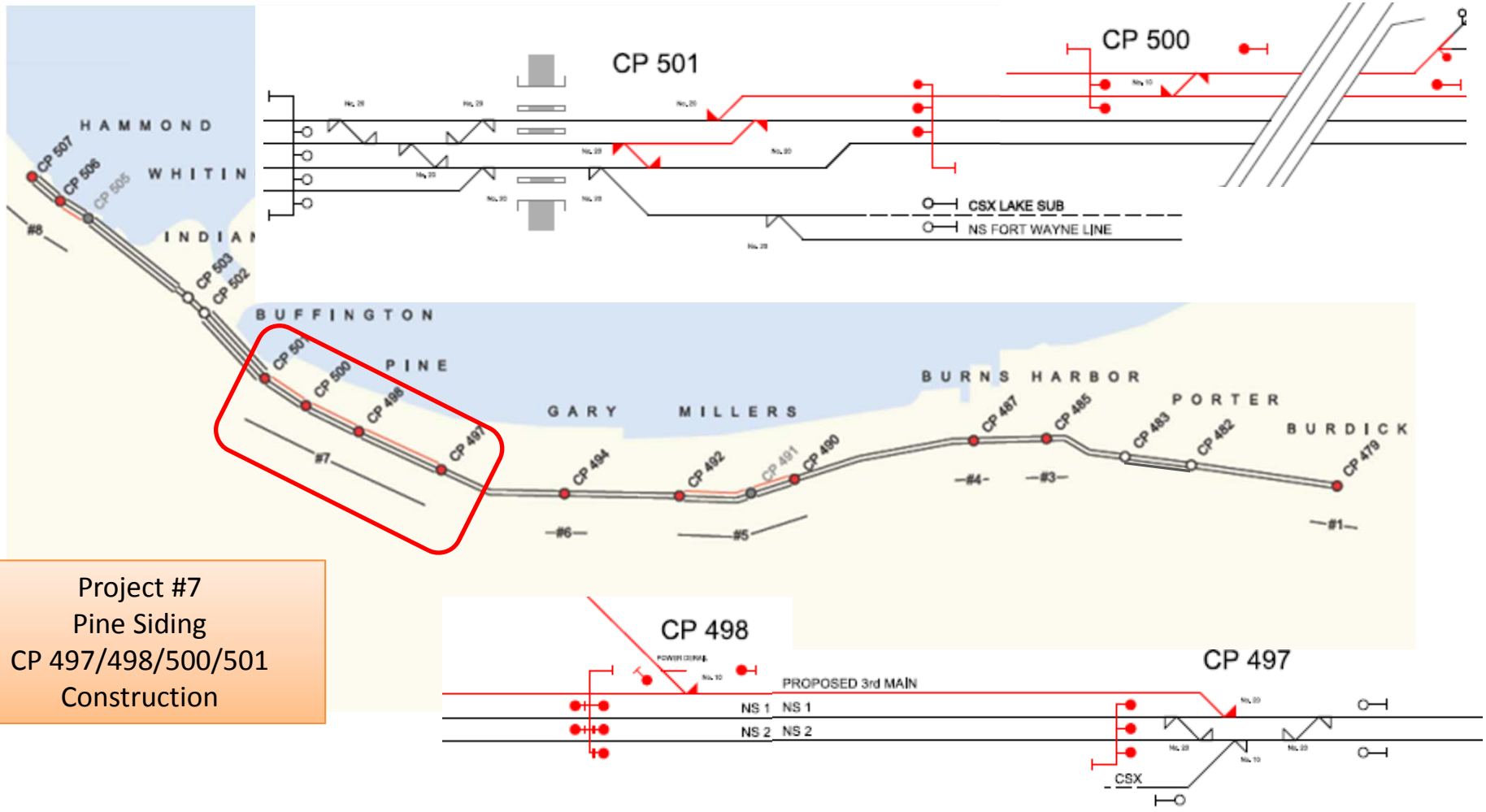


Project #6
Gary
CP 494
Construction

Project #6 – Bridge Demolition

Project #6 – Bridge Demolition

Project #7 – Pine



Project #7
Pine Siding
CP 497/498/500/501
Construction

Pine

Before

After

Pine

Distributing Stone Fill

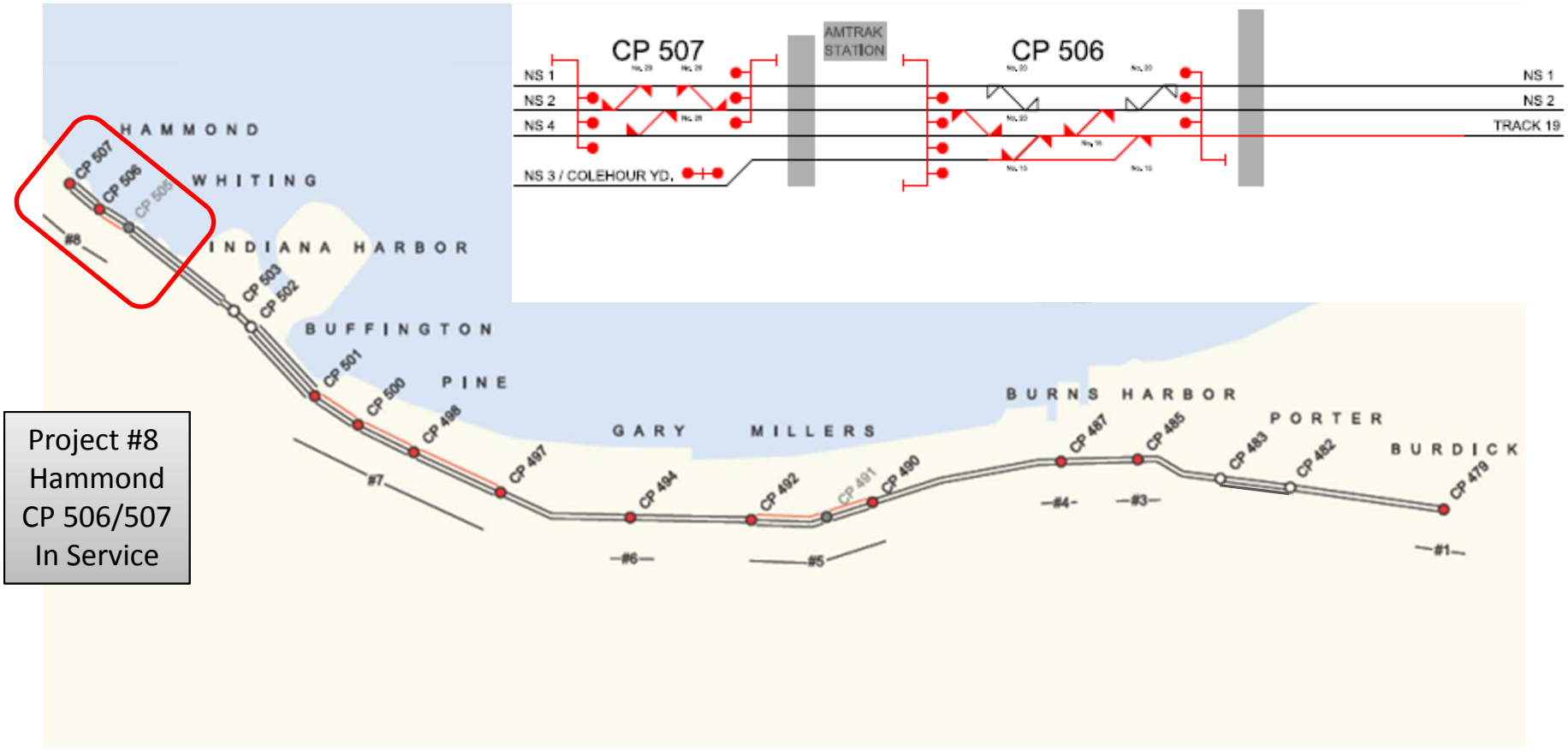
New Roadbed

Pine

New Roadbed

Dune and Swale Topography
on Railroad Right-of-way

Project #8 – Hammond



Project #8
Hammond
CP 506/507
In Service

Hammond

Track Construction

Temp. Position Light Signal

Hammond

Hammond

CP 507 Turnout Installations

Hammond

Setting the 4-track Signal Bridge

Track Construction on a Very Active Railroad

Hammond

Completed CP 506 and CP 507

Target Completion: End of 2016

Project #2
Porter
3,000 ft Amtrak Siding
Construction

Project #8
Hammond
CP 506/507
In Service

Project #7
Pine Siding
CP 497/498/500/501
Construction

Project #6
Gary
CP 494
Construction

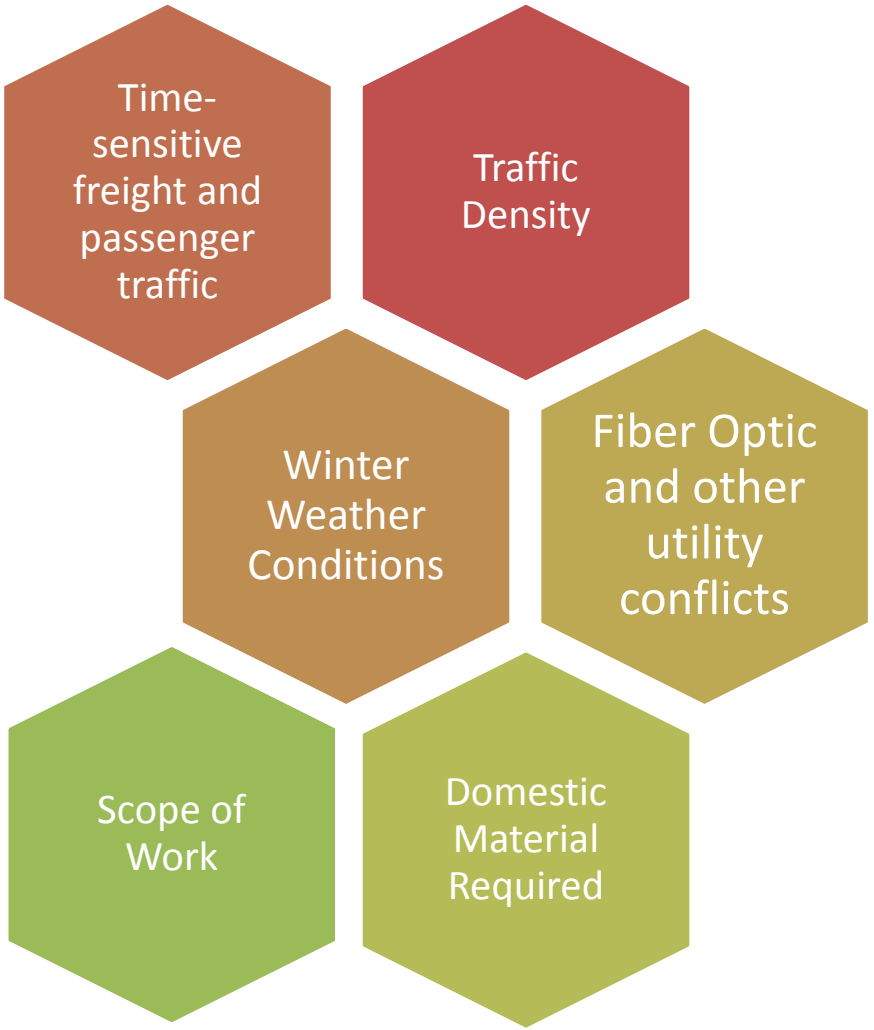
Project #5
Millers Siding
CP 490/492
Construction

Project #4
Burns Harbor W
CP 487
In Service

Project #3
Burns Harbor E
CP 485
In Service

Project #1
Burdick
CP 479
In Service

Project Challenges



Keys to Success

Keys to Success

THE INDIANA RAIL ROAD

Entrepreneurial Railroading

The White River Bridge

Justin Cronin, P.E.

The Indiana Rail Road Co.

OWNER:
THE INDIANA RAIL ROAD COMPANY
INDIANAPOLIS, IN

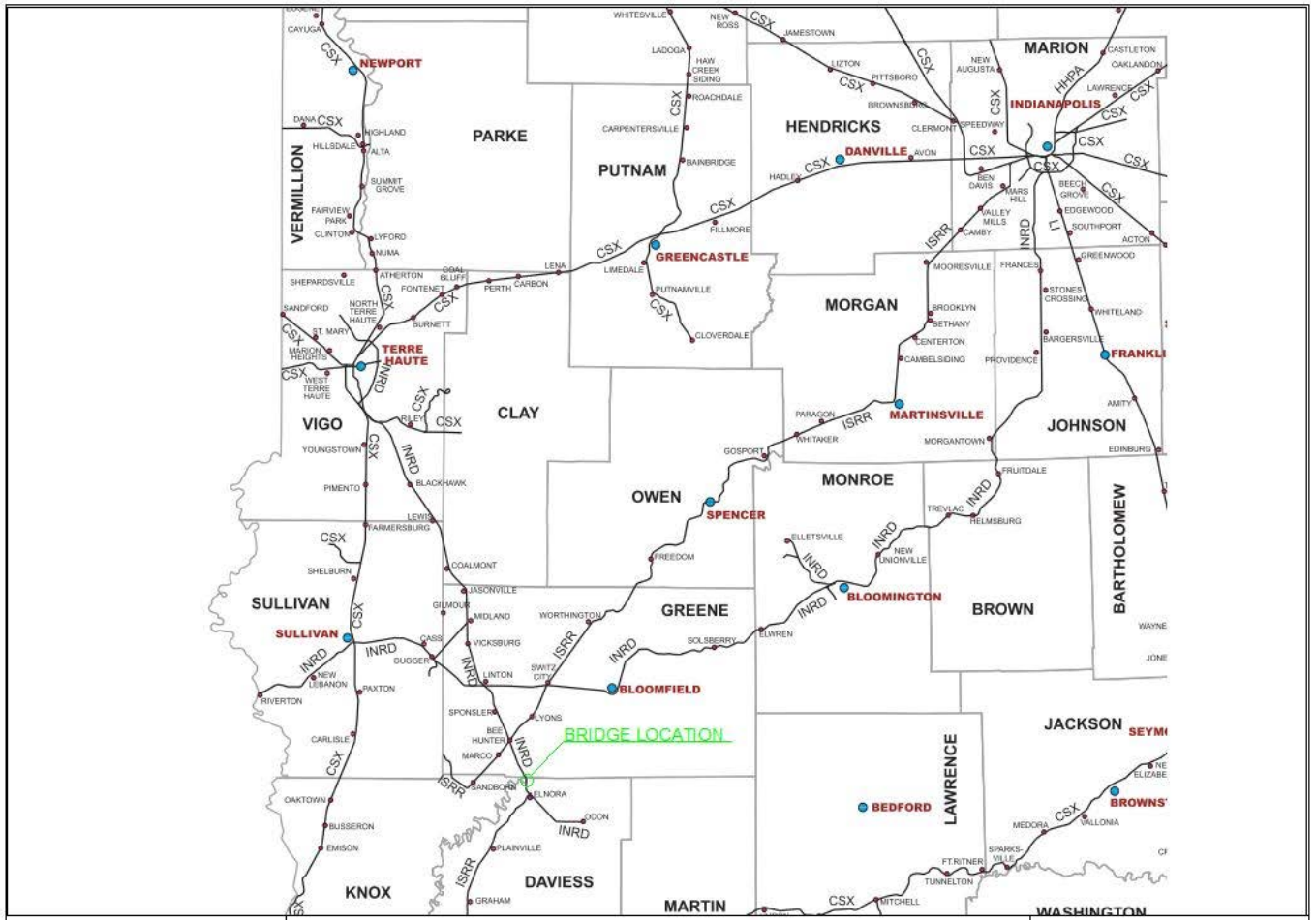
TIGER FUND GRANTEE:
STATE OF INDIANA
INDIANA DEPT. OF TRANSPORTATION

DESIGN CONSULTANT:
DESIGN NINE INC.
ST. LOUIS, MO

CONTRACTOR:
OCCI ENGINEERING CONTRACTORS, INC.
FULTON, MO

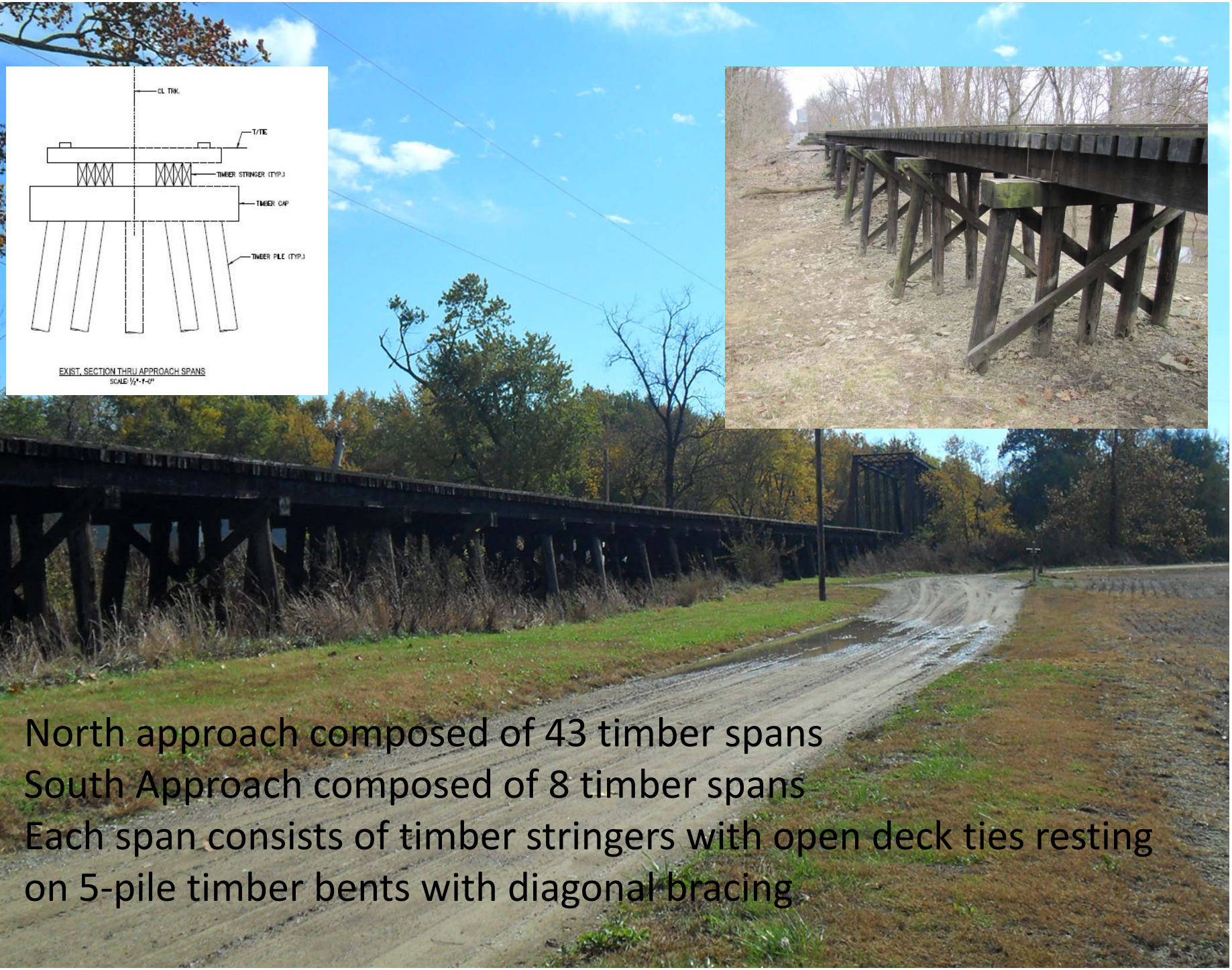
BRIDGE LOCATION

AT MP 221.79 ON INRD'S CHICAGO SUBDIVISION
NORTH WEST OF ELNORA IN GREENE/DAVIESS COUNTY



EXISTING BRIDGE CONDITION

- Open-deck rail bridge constructed in 1899 (115 year service life)
- Composed of three 150-foot Pratt medium steel truss spans supported by stone pilings
- Speed restrictions to 10 MPH
- Maximum gross railcar weight limit restricted to 131.5 tons
- Clearance height limit to equipment meeting AAR Plate F (17’-0”)



- North approach composed of 43 timber spans
- South Approach composed of 8 timber spans
- Each span consists of timber stringers with open deck ties resting on 5-pile timber bents with diagonal bracing

HISTORICAL SIGNIFICANCE

Pratt style pin-connected truss was popular because of ease of design (no moment force), ease of construction (parts fabricated off site), economical (light weight/high capacity), and was ideal for the long spans over Indiana's Rivers

EXISTING ON-GOING BRIDGE REPAIRS

Steel shims installed below bearings – Pier Settlement

Replaced steel rivets with H.S. bolts - Deterioration

Installed steel channel walers – Erosion and Undermining

Replaced expansion bearing & pedestal

Replaced displaced masonry units with concrete facing

Maintain track alignment Settlement & Deterioration

PROJECT NEEDS

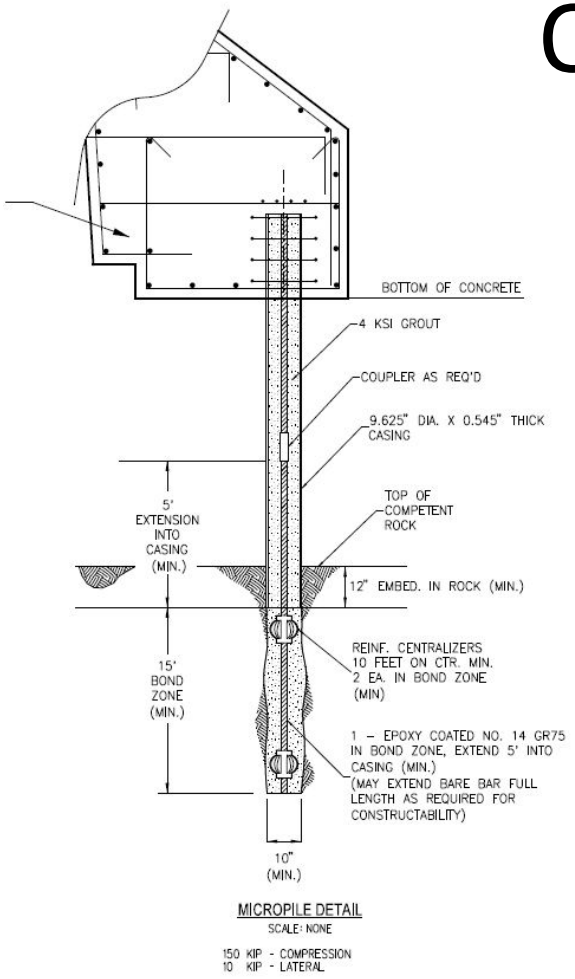
- TO UPGRADE THE OBSOLETE, DETERIORATED STRUCTURE TO IMPROVE SAFETY AND EFFICIENCEY.

- THE STRUCTURE IS OBSOLETE BECAUSE CURRENT TRAFFIC LOADS ARE MUCH HIGHER THAN ORIGINAL DESIGN
- RUST AND SECTION LOSS OF THE STEEL GREATLY REDUCES THE STRUCTURAL INTEGRETY OF THE BRIDGE.
- GREATER TRAFFIC LOADS AND FAST MOVING FLOOD EVENTS ARE CAUSE OF PIER SETTLEMENT AND UNDERMINING
- LOWER TRAIN SPEEDS AND LOWER CAR LOADS EFFECT THE EFFICENCY IN TRAIN CREW HOURS AND COST OF TRANSPORTATION
- PROJECT ALSO NEEDED TO BE COST EFFECTIVE

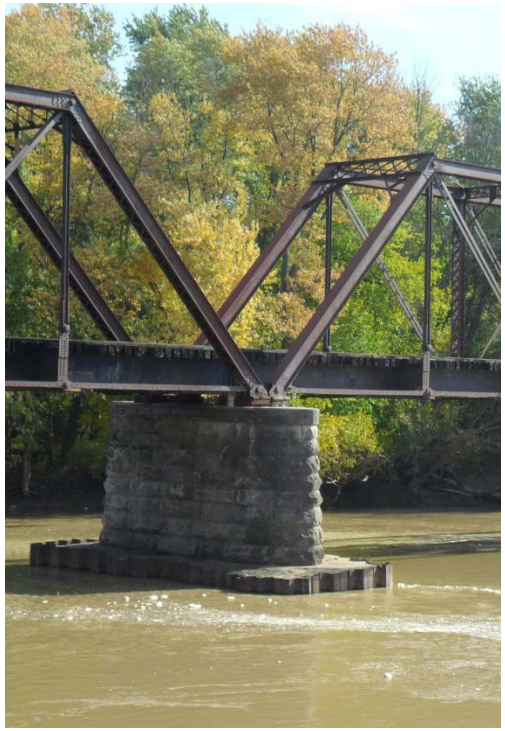
SCOPE OF WORK

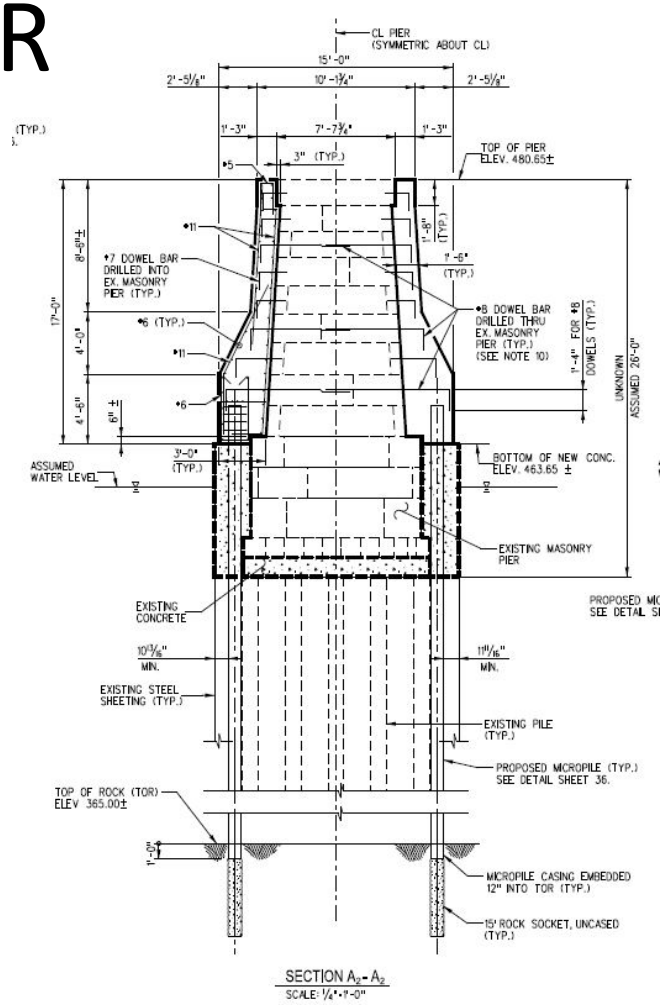
- PIER RETROFIT
- CONSTRUCTION OF TEMPORARY BRIDGE
- INSTALLATION OF H-PILES AND PIER CAPS
- FABRICATION AND DELIVERY OF CONCRETE GIRDERS
- FABRICATION AND DELIVERY OF STEEL GIRDERS AND COMPONENTS
- 6 DAY OUTAGE TO COMPLETE CHANGE-OUT

ORIGINAL PIER RETROFIT



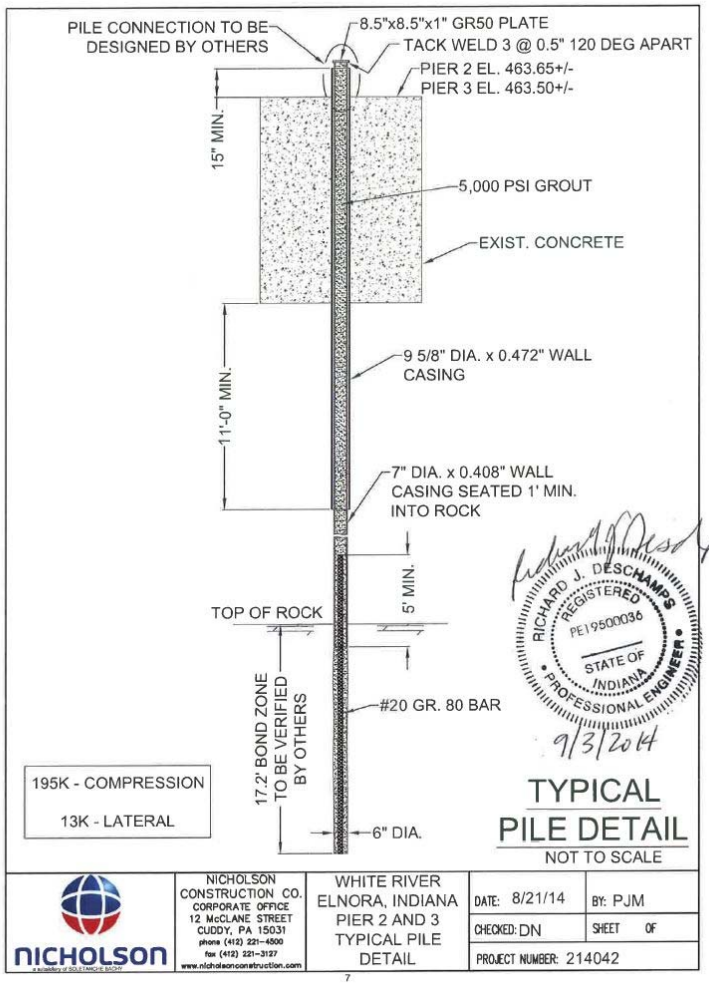
Drill 10” dia. micro-piles around perimeter between masonry & sheet-pile

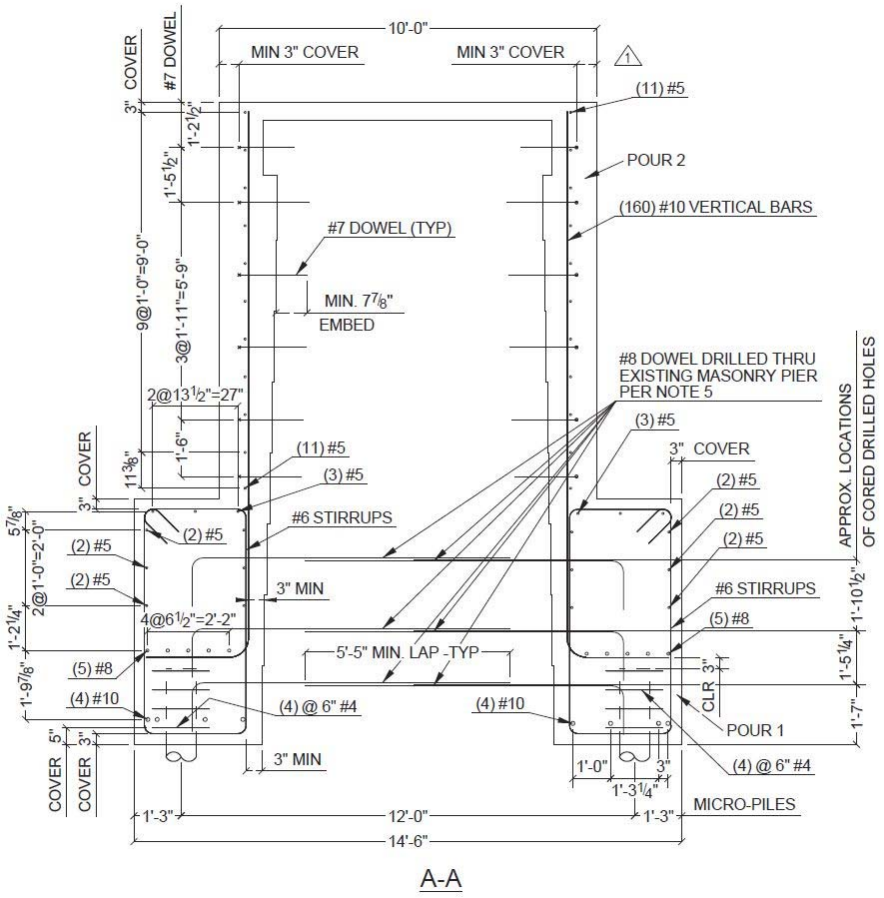




Assemble rebar mat, anchors & thru-bolts around masonry & encase in concrete

RETROFIT REDESIGN





A-A

DESIGN BASED CONTRACTOR EXPERIENCE

CONSTRUCTABILITY BASED DESIGN USING STANDARD FORMS SAVES TIME & LABOR

PIER 1 COMPLETED MICRO-PILE

PIER 4 COMPLETED REBAR

FIRST POUR AT PIER 1

SECOND POUR AT PIER 1

NOTE: REUSABLE FORMS FOR COST SAVINGS

COMPLETED PIER RETRO-FIT

CONSTRUCT TEMPORARY BRIDGE

PIPE PILE DRIVEN WITH VIBRATORY HAMMER
REUSABLE PIER CAP ATTACHED TO PILE

STRUCTURE COMPONENTS ARE RECOVERED FOR COST SAVINGS

DRIVE BRIDGE PILING & INSTALL CAPS

New piers installed under existing bridge keeps track in service

BRIDGE DESIGN

AREMA COOPER E-80 FIGURE

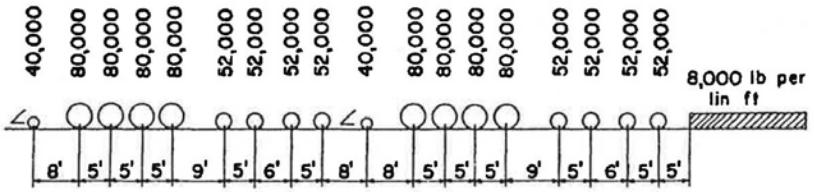
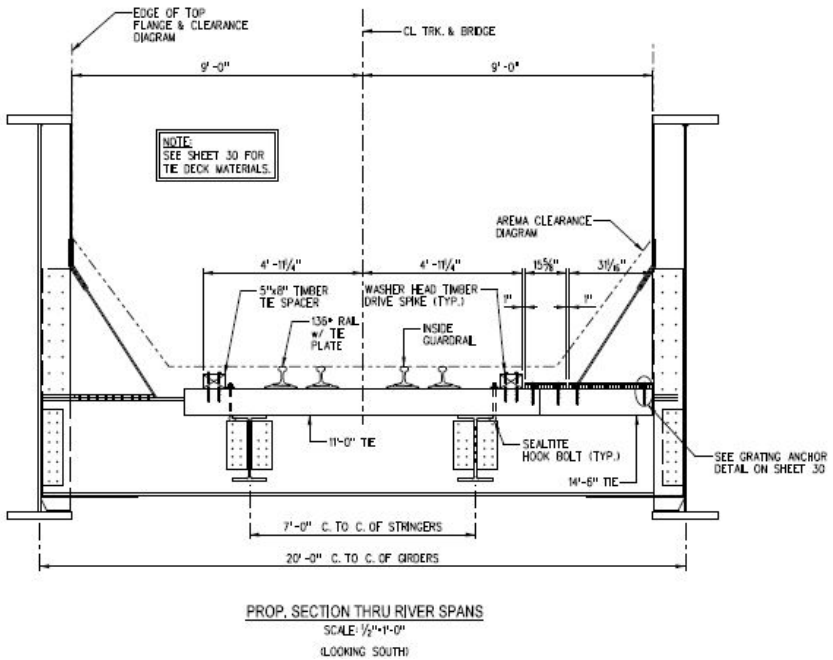


Figure 15-1-2. Cooper E 80 Load



PROP. SECTION THRU RIVER SPANS
SCALE: ½"=1'-0"
(LOOKING SOUTH)

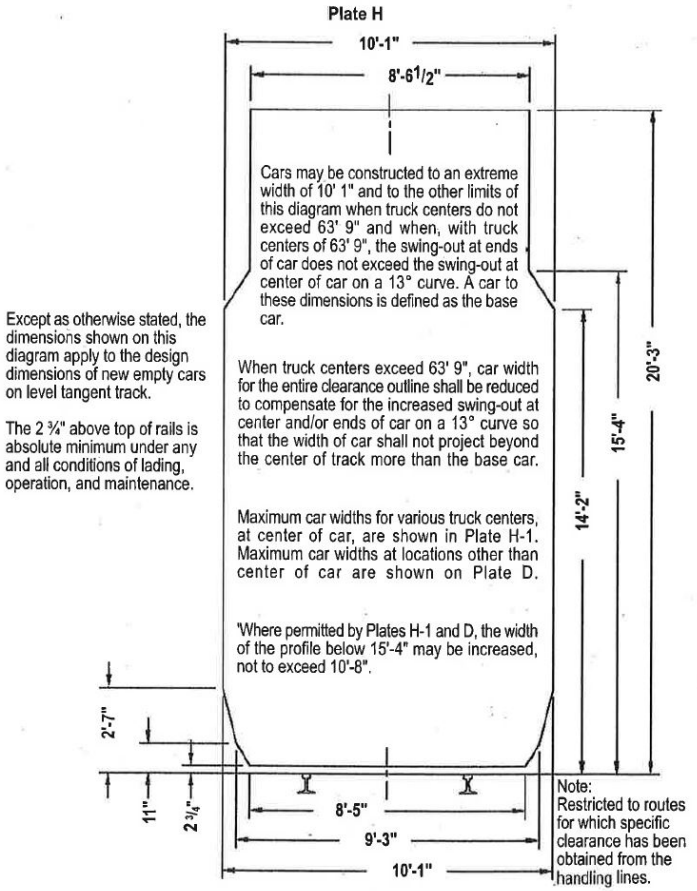


Fig 1.1 Maximum clearance requirements for double-stack container cars

PLATE H DIAGRAM

FROM "THE OFFICIAL RAILWAY EQUIPMENT REGISTER"

DELIVERY AND FABRICATION OF STEEL GIRDERS

CRANE PERFORMS A PICK OF 250 KIPS THEN DOES A 180 DEGREE TURN AND LOWERS ONTO ROLLERS

GIRDERS FABRICATED ON SITE UNDER RIGOROUS GUIDELINES AND SPECIFICATIONS

All is Ready for the Outage

NOTE: CONCRETE GIRDERS AND INDOT 53 STONE STAGED ON SIDE OF BRIDGE

Outage Began At 00:45 May 13th, 2015

First Night All South Approach Spans Removed, New Abutment & Wingwalls installed
North Approach Spans 13 to 22 Removed, New Abutment & Wingwalls installed
All Rail Cuts Made on North Approach Track Panel, South Panel Removed

REMOVAL OF PRATT TRUSS

ALL MAIN SPAN CRANE WORK DONE
IN DAYLIGHT HOURS FOR SAFETY

NORTH APPROACH TRACK RAISE

UP TO 4' RAISE IN SOME AREAS TO ACHIEVE
MAX GRADE OF .44%
NOTE: TRACK PANELS MOVED TO SIDE OF
EMBANKEMENT TO FACILITATE GRADING

INSTALLATION OF CONCRETE GIRDERS

Second Night: Removed Remainder of North Approach Spans; Set New North and South Approach Spans

North bridge approach was replaced with twenty-two (22) precast concrete girder spans
South bridge approach was replaced with four (4) precast concrete girder spans

May 14th, 2015 - Main Spans installed

Main Span in transit. Note: 2” Depth tread marks from 500 kip load

Remainder of the Outage - May 15th to May 19th, 2015

Finish North Approach Track Raise
Dump Ballast on Approaches and Spans
Install Rail and other Miscellaneous Work

Track Back in Service at 16:55 on May 19th, 2015

BEFORE AND AFTER

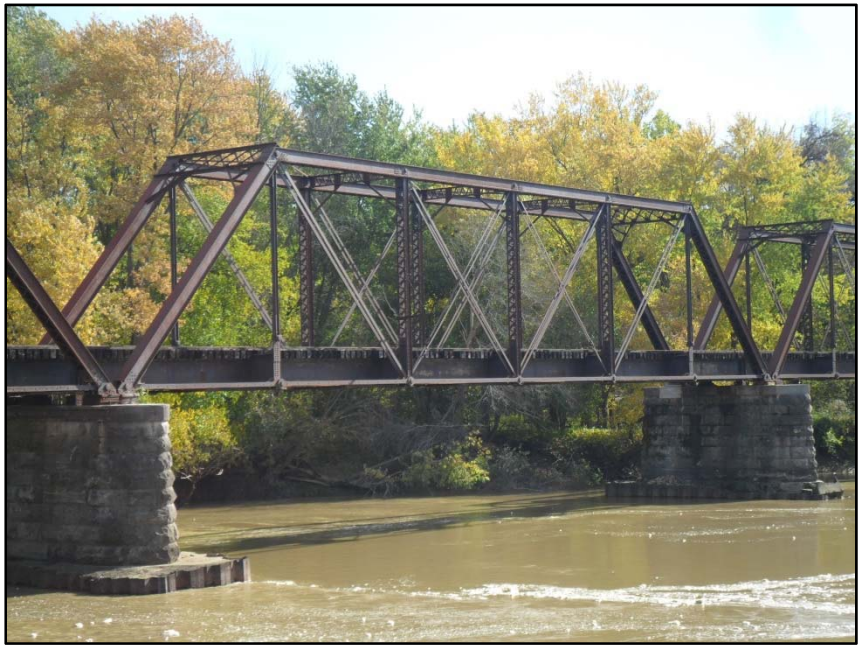
SOUTH APPROACH

APPROACH SPANS

MAIN SPAN

NOTE: HORIZONTAL AND VERTICAL RESTRICTIONS ON PREVIOUS STRUCTURE

MAIN SPAN - ELEVATION



PROJECT CHALLENGES

Wet Roads Necessitated
Delivery of Material by Rail

Supplier issues could have
Delayed the Outage

Environmental Restrictions

The Indiana Gray Bat restricted tree clearing
White River fish spawn restricted river work

WEATHER AND FLOODING

EXTREME COLD
A.K.A. POLAR VORTEX

HISTORIC FLOOD OF 2008

HAD TO CLOSELY MONITOR RIVER GAUGES TO MOVE EQUIPMENT AND MATERIAL BEFORE A FLOOD EVENT

PROJECT BENEFITS

- IMPROVED EFFICIENCY
- INCREASED TRACK SPEED FROM A PERMANENT SLOW ORDER OF 10 MPH TO 40 MPH RESULTS IN LESS CREW HOURS AND LESS ENGINE EXHAUST
- INCREASED CAR LOAD WEIGHT RESULTS IN REDUCTION OF TRANSPORTATION COSTS

- IMPROVED SAFETY
- STRUCTURE DESIGNED FOR COOPER E-80 AND CAN HANDLE INCREASED LOADS
- STRUCTURE DESIGNED FOR PLATE H AND CAN HANDLE OVERDIMENSIONED CARS AVOIDING ANY BRIDGE STRIKES

- RELIABLE INFRASTUCTURE
- ENSURING KEY CROSSING OF STRACNET RAIL FREIGHT CORRIDOR SERVING CRANE NAVAL BASE

KEYS TO SUCCESS

- RIGOROUS CONTRACTOR SELECTION PROCESS
- SENT REQUEST FOR PROPOSAL TO LIST OF QUALIFIED CONTRACTORS
- MEETING WITH 2 LOWEST BIDDERS TO DISCUSS EXPERIENCE WITH RAIL PROJECTS AND POTENTIOL COST SAVINGS

- OPEN COMMUNICATION BETWEEN ALL PARTIES
- WEEKLY MEETINGS WITH CONTRACTOR, INDOT REPRESENTATIVES, CONSULTANTS AND RAILROAD WAS ABLE TO IDENTIFY AND SOLVE PROBLEMS
- REVIEW OF CONTRACTOR'S WRITTEN WORKPLAN ENSURED QUALITY AND ADHERANCE TO SCHEDULE
- CLOSE COORDINATION AND COMMON GOALS BETWEEN RAILROAD MANAGEMENT AND CONTRACTOR LED TO GREATER PRODUCTIVITY

- PROJECT WAS ABLE TO STAY ON BUDGET AND FINISH AHEAD OF SCHEDULE AND DELIVER A SUPERIOR PRODUCT


THE
INDIANA
RAIL ROAD
Entrepreneurial Railroading℠
9010
9010
THANK YOU!
STAY TUNED FOR EXCITING TIME LAPSE VIDEO OF SPAN CHANGE OUT

HNTB

Needs Driven Design Solutions in Railroad Projects

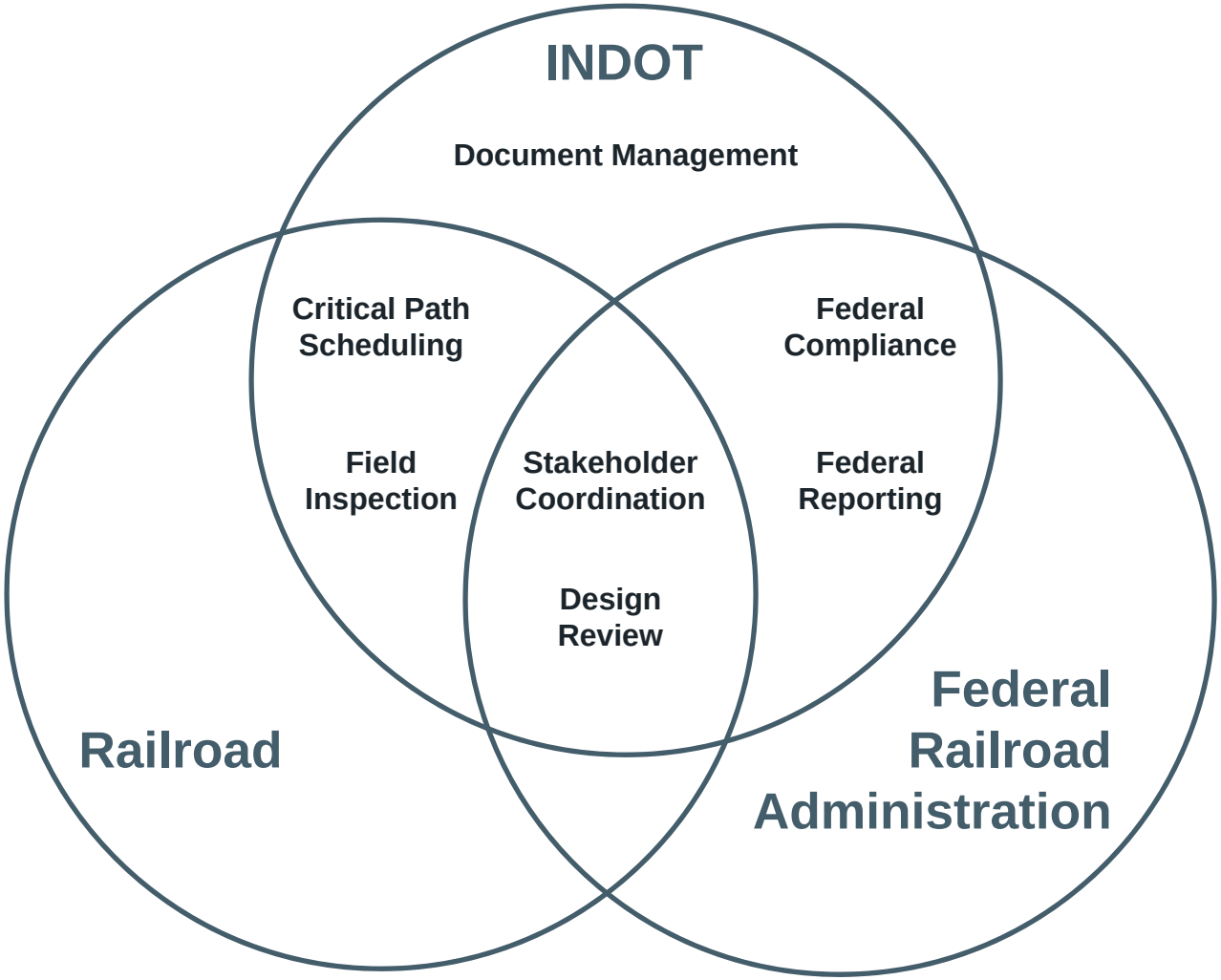
Matt Spiel, AICP

Purdue Road School
March 8, 2016

INDOT's Rationale for Subcontracting

- Limited staff
- Scope of project
- Logistics
  - Multiple ongoing multi-million dollar sub-projects
  - Location of project site
- Plan review
- Invoice review
- Maintaining project records
- Maintaining communication among all stakeholders

Key Tasks



HNTB

Keys to Success

- Dedicated professionals from all parties
  - INDOT
  - FRA
  - Railroads
  - HNTB
- Open and continuous communication