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
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
INDIANA GATEWAY PROJECTS
High Speed Intercity Passenger Rail

Project Site

Project 1 - Add #20 Universal Crossover at MP CD-497.3
Project 2 - Construct Passing Siding MP D-238 to 238.3
Project 3 - Add #20 Universal Crossover at MP CD-485
Project 4 - Add #20 Universal Crossover at MP CD-487
Project 5 - Construct 3rd Main Track MP CD-490.2 to 492.5
Project 6 - Add #20 Universal Crossover at MP CD-495
Project 7 - Construct 3rd Main Track MP CD-497 to 501
Project 8 - Add #20 Universal Crossover & Construct 3rd Main Track MP CD-505.9 to 506.5
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.
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
Derek Tichy, P.E.
Norfolk Southern Corp.
Engineering – Design & Construction

March 2016
Trains Per Day on Major Corridors

Chicago
Amtrak Trains Per Day

Indiana Gateway

Chicago
Hammond/Whiting
Porter
Elkhart
Cleveland
Pittsburgh
New York
Albany
Washington, D.C.
Boston
Grand Rapids
Port Huron
Battle Creek
Detroit
Pontiac
Lake Shore Limited
Capitol Limited

Norfolk Southern
One line, infinite possibilities.
Chicago Line Traffic – West of Porter

14 Amtrak Trains per Day

90 Freight Trains per Day
Turnouts and Crossovers

- Turnout
- Crossover
- Universal Crossover
Turnouts and Crossovers

Track Work, Holding Train, etc.
Turnouts and Crossovers

Track Work, Holding Train, etc.
New Main Line Track and Turnouts to be Installed

- 26 Turnouts Installed in 2015
- 4 Turnouts Installed in 2014
- 15 Turnouts to Install in 2016
- 6 ½ Miles Main Line Track
- 12 ½ Mile
- 5 Turnouts
- 4 Turnouts
- 2 Miles
- 4 Miles
No. 20 Universal Crossovers

Existing | 506 | 501 | 497 | 491
No. 20 Universal Crossovers

<table>
<thead>
<tr>
<th>Existing</th>
<th>506</th>
<th>501</th>
<th>497</th>
<th>491</th>
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<tr>
<td>Proposed</td>
<td>507</td>
<td>506</td>
<td>501</td>
<td>497</td>
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Project #1 - Burdick

CP 479

No. 20

No. 29

NS 1

NS 2

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 #2
Porter
3,000 ft Amtrak Siding
Construction

Amtrak Michigan Line
Project #3 – Burns Harbor East

CP 485

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
Fill Section – 4” Minus Stone

Cut Section – Natural Sand
Millers

Delivering Subballast Stone

Compacting and Shaping Subballast
Millers

Third Track Construction
Project #6 – Gary

CP 494

(MP CD 494,3)

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
New Roadbed

Dune and Swale Topography on Railroad Right-of-way

Pine
Project #8 – Hammond

CP 507
AMTRAK STATION
CP 506

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 #1: Burdick CP 479 In Service
- Project #2: Porter 3,000 ft Amtrak Siding Construction
- Project #3: Burns Harbor E CP 485 In Service
- Project #4: Burns Harbor W CP 487 In Service
- Project #5: Millers Siding CP 490/492 Construction
- Project #6: Gary CP 494 Construction
- Project #7: Pine Siding CP 497/498/500/501 Construction
- Project #8: Hammond CP 506/507 In Service
Project Challenges

- Time-sensitive freight and passenger traffic
- Traffic Density
- Winter Weather Conditions
- Fiber Optic and other utility conflicts
- Scope of Work
- Domestic Material Required
Keys to Success
Keys to Success

Define Projects

Talk Between Departments

Plan/Schedule
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 BRIDGECONDITION

- 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.
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 EFFICIENCY.
  • 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 INTEGRITY 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 EFFICIENCY 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
Drill 10" dia. micro-piles around perimeter between masonry & sheet-pile

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

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

Plate H

Cars may be constructed to an extreme width of 10' 1" and to the other limits of this diagram when truck centers do not exceed 63' 9" and when, with truck centers of 63' 9", the swing-out at ends of car does not exceed the swing-out at center of car on a 13" curve. A car to these dimensions is defined as the base car.

When truck centers exceed 63' 9", car width for the entire clearance outline shall be reduced to compensate for the increased swing-out at center and/or ends of car on a 13" curve so that the width of car shall not project beyond the center of track more than the base car.

Maximum car widths for various truck centers, at center of car, are shown in Plate H-1. Maximum car widths at locations other than center of car are shown on Plate D.

Where permitted by Plates H-1 and D, the width of the profile below 15'-4" may be increased, not to exceed 10'-6".

Fig 1.1 Maximum clearance requirements for double-stack container cars

Note: Restricted to routes for which specific clearance has been obtained from the handling lines.

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 15\textsuperscript{th} to May 19\textsuperscript{th}, 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 19\textsuperscript{th}, 2015
BEFORE AND AFTER
SOUTH APPROACH
APPROACH SPANS
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 INFRASTRUCTURE
  • 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 POTENTIAL 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
THANK YOU!

STAY TUNED FOR EXCITING TIME LAPSE VIDEO OF SPAN CHANGE OUT
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

- INDOT
  - Document Management
  - Critical Path Scheduling
  - Field Inspection
  - Stakeholder Coordination
  - Design Review

- Railroad
  - Federal Compliance

- Federal Railroad Administration
  - Federal Reporting
Keys to Success

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