Creativity & Innovation
Bring a Distinctive Solution to the Eldean Road Widening & Railroad Bridge Replacement Project

MIA-CR33-1.81
PID 84154
Brooks Vogel, PE
Partner – Korda/Nemeth Engineering

Purpose, Need & Roadway Design

- Structure Design Issues/Challenges
- Railroad Coordination/Track Design
- Construction
Project Team/Stakeholders

- Miami County Engineer (Owner)
- Korda/Nemeth Engineering (Prime)
- TranSystems (Bridge/Rail Subconsultant)
- Eagle Bridge (Contractor)
- CSXT (Track owner)
- HDR (CSX consultant reviewer)
- ODOT (ODOT Let LPA)
- Mennel Milling Co. (Troy Grain Elevator)
- MVRPC (Funding)
- CEAO (Funding)
Project Location & Context

- Northern bypass
- GMR crossing
- IR75 crossing
- CR25A interchange
- Superfund Site
- Quarry (ponds)
- Troy-Piqua convergence
- Future land use
- Design ADT
  - 7,000
- 3-lane section
Existing CSX Bridge

- Through girder on stone abutments
- Built in 1905
- Vertical clearance 9’-8”
- ~4 strikes per year reported
- Likely 15-20 per year
At-grade Crossing
- Safety concerns
- Roadway delays
- Constraints on Troy Elevator operations
- Drive impacts
- Mitigation – 3 off-site, at-grade closures

Grade Separation
- More trackwork
- Flooding
- Groundwater infiltration
Design Constraints

Groundwater & Flooding
Design Approach

- Maximize vertical clearance (N.D.C. = 14’-6”)
  - Future overlays
- Minimize track rise
- Minimize profile lowering (groundwater/flooding)
Final Design Benefits

- Roadway profile – 45 mph vs. 55 mph
- Shallow bridge was key

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>PE Study</th>
<th>Delta</th>
<th>Final</th>
<th>Delta</th>
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<tbody>
<tr>
<td>Top of Track</td>
<td>850.53</td>
<td>853.47</td>
<td>2.94</td>
<td>851.53</td>
<td>1.00</td>
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<td>Bottom of Structure</td>
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<td>1.94</td>
<td>849.20</td>
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<td>Roadway Low point</td>
<td>837.48</td>
<td>834.59</td>
<td>-2.89</td>
<td>834.90</td>
<td>-2.58</td>
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- Reduce flooding frequency
- Maintain gravity stormwater outlet
- Significant roadway and track cost savings
Cost Savings

<table>
<thead>
<tr>
<th>Approximate Costs Comparison (Corrected)</th>
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<tbody>
<tr>
<td>PE Study At-Grade</td>
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<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Roadway</td>
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<tr>
<td>Bridge</td>
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<tr>
<td>Track</td>
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<tr>
<td>ROW</td>
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<tr>
<td>Utilities</td>
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<tr>
<td>TOTAL</td>
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</table>

*Constructed project was a grade separation
*Additional track work for reconfiguring the yard was above and beyond these costs
Nabil Farah, PE
Ohio Bridge Team Leader - TranSystems

Purpose & Need

Structure Design Issues/Challenges

Railroad Coordination/Track Design

Construction
Proposed Structure

- Track can be closed during offseason
  - January to September
- Bridge need to be built in one season
- Bridge need to provide for 14’-0” Vertical Clearance
- Innovation need to be approved by CSX
- All Track Turnouts located outside bridge limits
  - will affect the bridge width and overall cost
- Bridge need to be designed for E80 loading
**Proposed Structure - Geometrics**

- **Span:** 51.5 feet
- **Alignment:** Tangent
- **Track** is low speed with 0.27% grade
- **Vertical Clearance:**
  - 14’-2 5/8”; 14’-0” required
- **Substructure:**
  - CIP Full Height Concrete Abutments
  - Supported on 14” CIP Reinforced Concrete Piles
Replacement Methods Alternates Studied – Superstructure – RR Preferred

Ballasted Deck Bridge:

Through Girders:

- Two Thru Steel Plate Girders placed 24 ft. apart with 2 ft. center to center of transverse floor beams, and a steel floor plate
- Structure Depth from Top of Track = 4.25 feet
Replacement Methods Alternates Studied – Superstructure – RR Preferred

- Ballasted Deck Bridge:
  - **Multiple Girders:**
    - Multiple Plate Girders spaced 3.5’ ft. apart with 4 girders under the track.
    - Structure Depth from Top of Track = 6 to 7 feet

STRUCTURE DEPTH
6'-0” to 7'-0”
Innovation: With the limitation on lowering CR33, we needed a design that truly minimize structure depth

Direct Fixation:

- AREMA Definition: **Rail Fastening Systems** that are attached to the structure using either cast-in-place or post-installed fasteners or anchors.
- Direct fixation is used in tunnel inverts, bridge decks, concrete crossings, and slab on grade track sections.
- The primary purpose of Direct Fixation track is to:
  - Minimize the track envelope in tunnels
  - Reduce the dead weight on aerial structures
Proposed Structure: Direct Fixation Alternate - Stage 1 Plans

TRANVERSE SECTION
(LOOKING UPSTATION)

DIRECT FIXATION DETAIL

STRUCTURE DEPTH
2'-6"

ELEVATION
STRUCTURE
DEPTH
2’-6”
Proposed Structure: Direct Fixation Alternate - Comparison

**Direct Fixation**

**Ballasted Deck**

Structure Depth Savings = 21” (1’-9”)

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OTEC 2016
Proposed Structure: Direct Fixation Alternate - Stage 1 Plans

DIRECT FIXATION FASTENERS

L.B. Foster has been manufacturing rail trackwork fasteners for over 35 years. We design and manufacture fasteners to the customer’s toughest requirements. Our field-proven fastening systems reduce noise, vibration, and maintenance. L.B. Foster’s trackwork fasteners are compatible with all types of track and tie, and are available in various sizes and materials. The Direct Fixation Alternate is designed to be easy to install, inexpensive to purchase, and effective to use. These cost-effective systems are used in rail transit systems, mainline passenger rail systems, and throughout North America. Our field-proven fastening systems are designed to provide superior performance and durability in all types of weather conditions.
Proposed Structure: Direct Fixation Alternate - Stage 1 Plans
Replacement Methods Alternates Studied - Superstructure

Innovation: Initiated **Pre-Stage 1 Meeting** with CSX/HDR & Team to discuss Project, Funding and Design Approach

**Direct Fixation:**

- Feedback:
  - Was a good application of this type of bridge given that there was a low number of train traffic traveling at a low speed to serve the current grain facility.
  - There will be a profile raise of 1 FOOT above the existing track on the north side of the bridge.

- More discussions about the direct fixation bridge will be needed with HDR and CSX as this type of bridge **not generally approved** for replacement since future maintenance is a concern, different equipment is needed to maintain, different fasteners, surfacing, etc.
Proceed with the Direct Fixation Preliminary Design

Stage 1 Submittal Review Comment

Direct Fixation Comment:
- The plan shows the direct fixation of the track to the deck. We understand there is still a question if the direct fixation will be approved. Other track standards would apply if it is determined that the direct fixation is not approved. An alternate “hybrid” timber open deck direct fixation type is preferred and is recommended for development.

CSX hesitated on the use of Direct Fixation on their Tracks
- Time to explore the Alternate “Hybrid” Timber Open Deck Alternative
OPTION 1: DIRECT FIXATION STEEL DECK

OPTION 2: TIMBER OPEN DECK
Worked with HDR/RR/Korda/County to use the following Alternative

**Open Deck Alternative:**
- Allowed by AREMA.
- CSX does not have a design criteria for open deck bridges
- Design and Details will need to follow AREMA specification
- Drainage on the structure will need to be collected on the road below

- One advantage of ballasted decks is that they make it easier to keep the track across the bridge in surface (vertical alignment) with the tracks to either side when the MOW forces clean or add ballast.
Final Plans - Superstructure

STRUCTURE DEPTH 2'-4"
Purpose & Need

Structure Design Issues/Challenges

Railroad Coordination/Track Design

Construction
Suggested Raising the Rail Elevation approx. 3.25 ft.

Four Alternatives Presented

- Reconfigure tracks at the North end of the existing yard
- Build Additional Tracks accessed from North end of existing yard
- Build Additional Tracks on the South side of the bridge
- Relocate the rail yard to the south side of the bridge
  - Add a Conveyor from the new yard to the existing elevator
Track Design
Preliminary Engineering Design
Reconfigure tracks at the North end of the existing yard
Build Additional Tracks accessed from North end of existing

**Track Design**

**Preliminary Engineering Design**

MIA-CR33-1.81 Eldean Road

OTEC 2016
Build Additional Tracks on the South side of the bridge
Track Design
Preliminary Engineering Design

- Relocate the rail yard to the south side of the bridge
- Add a Conveyor from the new yard to the existing elevator
Track Design
Preliminary Engineering Design

- Suggested Raising the Rail Elevation approx. 3.25 ft.

- Four Alternatives Presented Required
  - Significant reconfiguration to the Rail Yard and Operations
  - Extreme Lengths of New Trackwork
  - Property Acquisition of a known Superfund Site
    - 32,000 CY of Crushed Battery Cases had been discovered
  - Increased Rail Traffic Blocking Hospital Emergency Access Roadway
  - Extreme Costs to maintain existing Capacity and Function
Track Design

- Preliminary Engineering Study Alternatives were Unacceptable
- Change in Top of Rail Elevation must be Minimized
- Bridge Group Investigated Structure Types to Decrease Structure Depth
- Roadway Group Investigated Lowering the Roadway Profile

Final Track Raise = 1 Foot
TranSystems Rail Team gets to Work!
Track Design
Design Constraints

- Any Single Rail Car curving in Two Separate Directions Simultaneously will result in Two Separate Trains moving Independently from Each Other.
  - Minimum Vertical Curve Length = 100 ft. (2 Cars)
  - Minimum Tangent Between Curves = 100 ft. (2 Cars)

- Car Loading and Storage Track Must be Flat < 0.1% grade Maximum

- No Vertical Curves within Track Turnouts
Track Design
Profiles
Track Design
Stacked Turnouts
Track Design
Physical Constraints
Track Design Solutions
Purpose & Need
Structure Design Issues/Challenges
Railroad Coordination/Track Design
Construction
Construction
Construction
Construction
Construction
Completed Corridor
ODOT Conway Partnership Award

- Concurrent project - Bridge replacement over Great Miami River (other side of CR25A)
- MOT impacts for only 1 season
- Expedited schedule by 1 year
- MVRPC loan CEAO $4 MM, repay following fiscal year
- Communication and Trust
- Everyone Communicated, Everyone Benefitted

Miami County Eldean Road Projects Win Ohio Conaway Award

The Eldean Road project won ODOT's Conaway Partnering Award. This is an outstanding example of the innovation and flexibility required in today's limited funding environment. It takes cooperative and invested funding partners to complete projects because of the numerous project commitments, backlog, and limited funding compared to needs. Congratulations to Miami County, ODOT and MVRPC on completing a quality construction project.