A Stronger Span:
Perspectives on Ohio’s Longest County Route Semi-Integral Bridge

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A Stronger Span: Perspectives on Ohio’s Longest County Route Semi-Integral Bridge

Smothers Road over Hoover Reservoir

Ed Herrick, PE
Mike Killian, PE
Kevin Gothberg
Owner’s Perspective

Ed Herrick, PE
Franklin County Engineer’s Office
The Existing Bridge

- Built in 1953 (redecked in 1980)
- 6-spans (72.8, 99.7, 100.1, 100.1, 99.7, 72.8)
- Bridge Limits: 546’-2”
- Reinforced concrete slab on 3-haunched steel girders
- 30’-0” f/f guardrail
- Stub abutments on piles
- 80’+ tall cap-and-column piers on piles and spread footings
- Strip seal expansion joints and rocker type bearings.
Existing Bridge Issues

- Approach causeway and abutment settlement and slope failure
- Fracture critical – 3 girder system
- Fatigue-prone steel detailing
- Limited right shoulder width
- Deteriorated abutment bearing seats
- Deteriorated concrete deck
Coordination

- ODOT
- CEAO
- COC Division of Water
- COC Dept. of Public Service
- Columbus Recreation & Parks
- Delaware County
- Westerville
- Blendon Twp. (Franklin)
- Genoa Twp. (Delaware)
Project Design Schedule

- April 2013 – Consultant Authorization
- October 2013 – Preliminary Engineering Study
- January 2014 – Stage 1
- March 2014 – Contractor Constructability Review
- July 2014 – Stage 2
- **Project selected for Federal Exchange Process Funding**
- February 2015 – Stage 3
- March 2016 – Tracings
- August 2016 – Project Sold
Design Perspective

Mike Killian, PE
Burgess & Niple, Inc.
Project Design Scope / Goals

- Replace existing bridge deck (detour MOT)
- Replace existing bridge girders (redundant system, no fatigue-prone details)
- Convert abutments to semi-integral and salvage the existing piers (if possible)
- Minimize the approach causeway work
- Minimize disruption to traffic and the surrounding community
- Incorporate provisions for a shared-bike shoulder
- Maintain or improve vertical boating clearance
Preliminary Bridge Design –

Structure Types Considered

- Haunched steel plate girders
- Rolled steel beams
- Prestressed concrete I-girders
- Prestressed concrete box beams
- Constant depth steel plate girders (selected)
EXISTING TYPICAL SECTION AND REMOVALS

PROPOSED TYPICAL SECTION
Contractor Constructability Review

- Coordinated with Ohio Contractors Association and two different local contractors

- Obtained input on:
  - Constructability
  - Site access
  - Methods for accelerating construction and minimizing impact to surrounding community.

- Notable outcome:
  - Minimum closure time = 120-days
  - No to precast elements
  - SIP forms would be the best solution for reducing construction time.
  - Barges would be used for both demo and construction – but that dock location and design should be left up to contractor.
Detail Design – Semi-Integral Conversion Design
Semi-Integral Conversion Design (continued)
Semi-Integral Conversion Design (continued)

ROADWAY APPROACH PAVEMENT

20'-0" ROADWAY PAVEMENT BASE

ASPHALT PAVEMENT (SEE ROADWAY PLANS)

AGGREGATE BASE (SEE NOTE 3) (TYP.)

INCREASE THICKNESS OF AGGREGATE BASE TO FULL DEPTH OF SLEEPER SLAB

SECTION A-A

SEE STRIP SEAL DETAIL ON SHEET

33 / 35

STEEL TROWEL FINISH, SEE NOTE 2

SEE SLEEPER SLAB DETAIL ON THIS SHEET 6" PERFORATED UNDERDRAIN (SEE NOTE 3)

BURIED 6" DIA. PVC AEP UTILITY CONDUITS DETAILED ON SHEET

20 / 35

APPROACH SLAB
Bearing and Seismic design

AASHTO – LRFD
Bridge Design Specs
- 2012

3.10—EARTHQUAKE EFFECTS: EQ

3.10.9.2—Seismic Zone 1

The horizontal design connection force shall be addressed from the point of application through the substructure and into the foundation elements.
Bearing and Seismic design (continued) (fuse concept)

**BEARING DETAIL - PIER 3**
(FIXED)

- 1 1/2" DIA. HOLE IN STEEL LOAD PLATE FOR 1 1/2" DIA. X 1'-6" ANCHOR ROD (TYP.)
- 2 EXTERNAL ELASTOMER LAYERS THICKNESS = 0.288"
- 6 INTERNAL ELASTOMER LAYERS THICKNESS = 0.411"
- 7 INTERNAL STEEL LAMINATES THICKNESS = 0.0747"

**VIEW D-D**
Bearing and Seismic design (continued)

It should be noted that after the design was completed...


3.10.9.2—Seismic Zone 1

Delete paragraph 3 of this Article.
Abutments and Approach Design

PROPOSED ABUTMENT PLAN
(REAR ABUTMENT SHOWN, FORWARD ABUTMENT SIMILAR)
(DIAPHRAGM NOT SHOWN IN PLAN VIEW FOR CLARITY)
Modified TST Railing
Aesthetic Pier Caps

AESTHETIC PIER ALTERNATIVES
SMOTHERS ROAD OVER HOOVER RESERVOIR
Environmental

- Federal Exchange Process –
  - No NEPA documents required (i.e. 4F, Cultural, Ecological)

- Wetland Delineation Report completed
  - 3 small wetland areas were identified

- 404 permit was not prepared. Existing boat facility to the north available for use. But, each contractor will likely want to do something different.

- Structural Steel
  - Weathering and galvanized steel options were considered
  - Pre-painted with 3-coats (prime, intermediate, finish) (similar to Sunbury Road Bridge)
Construction Perspective

Kevin Gothberg

Kokosing Construction Company
Challenges

- Tight Schedule
- Weather – Winter Start
- Access – Causeway not feasible, limited roadway width
- Obtain 404 permit
- Overhead utilities at south edge of bridge
Schedule

- 120 day closure with an early road closure date of 2/13. Incentive was $5,000 per day and disincentive was $7,000 per day.

- Weather delays were allowed to move the completion date, but did not move the incentive date.

- Internally decided incentive was not realistic. Schedule too linear and weather too uncertain to financially rationalize pursuing incentive.

- Still accelerated by using winter concrete protection, overtime, and 6 day work weeks as needed.

- 3 sets of prefabricated pier forms used.

- Specification allowed for metal deck.
Weather

- Concrete saw, asphalt mill, water freezing, etc.
- Winter Concrete
- Wind impacts on barges and cranes
- Wind on picked members
Access

- Access from closed Smothers to avoid traffic and turns in and out of busy road.
- Had to thread drive through 2 wetlands.
- Access road and dock fill required 404 Permit
Overhead Utilities

- Electrical and Communications
- Required removal for piling, demo, and erection
Electrical was removed with services back fed from a temporary substation. AEP was fantastic.

We were able to work around communications lines.
Deck Demolition
Steel Demolition
Cap Demo and New Column Extensions
New Pier Caps
Steel Erection
Steel Erection (continued)
Splices and Decking
Deck Pour
Bridge Mounted Utility Ducts
Pre Painted Steel Splices/Touch Up
Build it, and he will come!
Thank-you!