LATERAL BRIDGE SLIDE: I-75 OVER US 6

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Agenda

• Design
  • Bob Beasley, PE, Ohio Bridge Manager, *Arcadis U.S., Inc.*

• Construction
  • Todd Lezon, Regional Manager, *Kokosing Construction Company, Inc.*
Project Location
Existing Bridges

Twin Structures

- 4-Span Rolled Steel Beam and Concrete Deck
- Spill-through Stub Abutments on H-piles
- Cap and Column Piers on Spread Footings
Existing Bridges
Existing Bridges
New Bridges

Twin Structures

- 2-Span Precast, Prestressed Concrete I-Beam and Concrete Deck
- Stub Abutments on H-piles behind Mechanically Stabilized Earth (MSE) Wall
- Cap and Column Pier on H-piles
Lateral Bridge Slide

Why did ODOT choose Accelerated Bridge Construction?

- Looking for different construction methods
- Concerned with driver delay and inconvenience
- Work-zone safety for drivers and workers
- Improved construction quality
Why this location?

- For pilot project, plenty of room to construct within an interchange
- ODOT District 2 not afraid to try something new and innovative
- Bridge needed replaced and widened for 3rd lane project
Design

ABC using Lateral Bridge Slide

Research
• How are other states doing ABC

How to slide
• Push, Pull
• Teflon, rollers, etc.

Resources
• FWHA
• Webinars
• Workshops
Design

Research

Similar projects in other states:

- Iowa DOT SR 92 over stream
  - 120’ single span precast I-beams
  - Slid on PTFE (Teflon) coated bearings

- Utah DOT I-80 over Echo Dam Road
  - 78’ single span precast I-beams
  - Slid on Teflon bearings
  - Superstructure supported on temporary steel bents
  - Approach slab moved with superstructure
Design

How to slide
Push or Pull?

- Both have been completed successfully
- Affects plan details
- Design assumed contractor would push
- Slide on Teflon coated elastomeric bearings
Design

Resources

Webinars

- FHWA
- Florida International University
- Colorado DOT

FHWA

- Accelerated Bridge Construction website
- On-site Workshops
Design

Workshops
Utah DOT: I-84 over Echo Frontage Road

- Single span precast box beams & no approach slab
- Pulled using 2 cranes simultaneously
- Slid on PTFE coated elastomeric bearings

New York DOT: I-84 over Dingle Ridge Road

- Single span precast double tee beams & approach slab
- Pushed with hydraulic ram with steel guide rail
- Slid on PTFE coated elastomeric bearings
Design

Workshop: Utah DOT I-84 over Echo Frontage Road
Design

Workshop: Utah DOT I-84 over Echo Frontage Road

Lessons Learned:

• Sliding on PTFE coated bearings was effective
  • Bearings are very “slippery”
  • Kinetic friction much less than static friction

• Pulling with cranes was not effective
  • Tension in cables difficult to control
  • Bridge tended to “rack” and was difficult to control
Design

Workshop: NY DOT I-84 over Dingle Ridge Road
Design

Workshop: NY DOT I-84 over Dingle Ridge Road

Lessons Learned:

• Sliding on PTFE coated bearings was effective
  • Rain during move increased coefficient of friction
  • Measure movements during slide to control racking
• Pushing with hydraulic ram was effective
• Construction of temporary supports was most time consuming portion of construction
Design Details

• Abutment
• Pier
• Superstructure
• Temporary Support
• Slide
Design Details

Abutment

Location

• Under existing bridge
• Placed between existing pier and abutment

Seismic Pedestal

• Usually placed between beams on abutment seat
• Since bridge slides over abutment, use wingwall to resist
• Precast wingwall installed after slide
Design Details

Abutment
Design Details

Pier

Pier Location

- Temporary support of existing required to build new pier
- Existing bridge now has new span arrangement – required load rating
- Bridge OK for short term

Seismic Pedestal

- Usually placed between beams on pier
- Since bridge slides over pier, pedestal on outside of pier
- Precast pedestal installed after slide
Design Details

Pier

PIER 2 ELEVATION
Design Details

Pier
Design Details

Pier

BEAM SEAT

1" P.E.J.F.

1'-3"

1'-0\(1/2\)"

* CONST. JOINT

MECHANICAL SPLICE (TYP.)

P802

P803

P805

P806

2-P801

2-P804

E SECTION
Design Details

Superstructure

• End diaphragms modified to allow for sliding
  • Stainless steel detailed at bottom of end diaphragms for sliding
  • Details modified at side of diaphragm to allow for pushing
  • Approach slabs modified to move with superstructure
Design Details

Superstructure

DIAPHRAGM ELEVATION
Design Details

Superstructure

PRESTRESSED CONCRETE I-BEAM

5/8" DIA. x 5" END WELDED STUD (TYP.)

3'-2 1/2" x 1'-8" x 3/4" THICK EMBEDDED STEEL SOLE PLATE

W24x94 SUPPORT BEAM

1/4" STAINLESS STEEL SLIDING PLATE

LAMINATED ELASTOMERIC BEARING PAD 12" x 30" x 3.07"

SECTION

(ABUTMENTS SHOWN, PIER SIMILAR)
Design Details

Superstructure

C504, SER. C506, SER. C507 OR SER. C508
C501, C502 OR C503
B501 (TYP.)
A1001, A1002 OR SER. A1003
HAUNCH (6” MIN.)
C505
WT7x185 (TYP.)
1” P.E.J.F.
2’-0” 2’-0” 4’-0”
8’-0”
(CONCRETE SLEEPER SLAB)

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Design Details

Slide

• How to move – contractor restricted to slide method

• Arcadis assumed pushing on temporary elastomeric bearings

• Temporary supports were designed and could be used by contractor

• Contractor allowed to modify slide details in plan
Design Details

Slide

ABUTMENT / APPROACH SLAB ELEVATION
Design Details

Slide
Design Details

Slide
Construction

- Schedule
- Maintenance of Traffic (Weekend)
- Contractor Changes
- Bridge Construction
- Cost
Construction

Schedule – Bridge Slide

• 59 Hours
  • Set up MOT
  • Demolish existing structure
  • Slide new bridge into position
  • Place 304 & asphalt up to new bridge
  • Install guardrail and pavement markings
  • Open new bridge to traffic

36 November 2016
Construction

Maintenance of Traffic (Weekend)

I-75 at US 6 Slide In Place Bridge
Traffic pattern for Friday, October 16 at 7pm, through Monday, October 19 at 6am

Key:
- Southbound I-75 traffic
- Northbound I-75 traffic
- Closed
Construction

Contractor Changes

- Temporary supports modified
- Pulled not pushed
- Bridge slide used rollers in lieu of Teflon bearings
Construction Contractor Changes

Hillman Rollers

ATTACH TO UNDERSIDE OF DIAPHRAGM
Construction

Abutment

EXISTING PIER

ABUTMENT PILES
Construction

Abutment

EXISTING SUPERSTRUCTURE

MSE WALL BACKFILL

~8'
Construction

Abutment

EXISTING SUPERSTRUCTURE

EXISTING PIER

ABUTMENT FOOTING

~2’
Construction

Abutment

EXISTING BRIDGE

~1.5'

ABUTMENT SEAT

FLOWABLE FILL
Construction

Pier

EXISTING BRIDGE TEMPORARY SUPPORT

PIER COLUMN REINFORCING AND FOOTING
Construction

Pier

TEMPORARY SUPPORT

EXISTING BRIDGE

PIER
Construction

Superstructure

TEMPORARY SUPPORT

PRECAST BEAMS
Construction
Superstructure

PRECAST BEAMS & DECK FORMS
TEMPORARY SUPPORT
Construction

Superstructure

DECK REINFORCING STEEL
Construction
Temporary Support

APPROACH SLAB SUPPORT

BEAM SUPPORT @ ABUTMENT
Construction

Temporary Support

MSE WALL TEMPORARY FACE

CONNECTION BETWEEN TEMP SUPPORT AND ABUTMENT

APPROACH SLAB SUPPORT

BEAM SUPPORT @ ABUTMENT
Construction

Temporary Support
Construction

Divert Traffic & Begin Demolition
Construction

Demolition

TRAFFIC MOVED TO EXISTING BRIDGE

EXISTING PIER

MSE WALL
Construction

Slide Details

ROLLERS

BEAM SUPPORT @ ABUTMENT

CONNECTION BETWEEN TEMP SUPPORT AND ABUTMENT

MSE WALL
Construction

Slide Details

STEEL PLATE ON ABUTMENT SEAT FOR ROLLING SUPERSTRUCTURE
Construction

Slide Details

ROLLER UNDER DIAPHRAGM
Construction

Slide Details

JACKS TO PULL SUPERSTRUCTURE
Construction Slide Details

- Squared Off Abutment Seat
- Steel Bracket
- Jack to Pull Superstructure
Construction

Slide Details

DONE!
Construction

Slide Details

READY FOR TRAFFIC
Construction

Slide Video
Construction

Cost

• Total cost for twin I-75 Bridges: $7,790,879
• Cost for sliding both bridges: $2,000,000 (25.7%)
Lessons Learned

• Benefits of ABC
  • Enhanced safety for motorist and workers
  • Improved construction quality
    – No phased joints
    – Workers not distracted by traffic
  • Minimal disruption to public (weekend only)
Lessons Learned

• Meeting with Arcadis, ODOT Office of Structural Engineering, ODOT District 2, FHWA & Kokosing

  • Biggest cost driver: building on temporary falsework
  • Size limit for slide: mostly dependent on size of bridge being removed
    – Demolition time is critical during closure
  • Weekend timeframe is appropriate for work to be completed
  • Large crane required to move precast elements
    – Keep weights under 20,000 lbs
  • Consider fast set concrete in lieu of precast elements
Questions