BRIDGE PROBLEMS AND DESIGN SOLUTIONS

Session 6, Bridge Design

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Presentation Objective

• Present Various Bridge Problems
  ➢ Problem details
  ➢ Design challenges

• Design Solutions
Bridge Abutment Details

Problem:

- Not maintenance friendly
EXISTING APPROACH SLAB AND RISER WALL

(REMOVE CONCRETE TO EXPOSE REINFORCEMENT IN HATCHED AREA OF THE RISER WALL.)

(REMOVE APPROACH SLAB CONCRETE AND REINFORCEMENT)
STRIP SEAL ASSEMBLY

NO. 6 BARS (SEE END BENT DETAILS)

DETAIL "B"
(NTS)
Abutment Details

Solution:

- New detail allows rotation without damage to the abutment wall
- A neoprene bearing pad is used to distribute bearing pressure and seal the wall.
- Integral abutments another option
1/2" JOINT FILLER

1/2" X 8" ELASTOMERIC BEARING PAD

NO. 6 DOWELS

3/4" DIAMETER THREADED ROD FOR JOINT ANCHORAGE

NO. 6 DOWELS
Span Continuity Details

Problem:

- Spans made continuous to eliminate joints result in difficult construction and poor performance details.
1" x 9" Neoprene Pad at Girder

6" 6" 3"

1" Styrofoam Pad at Girder
1/2" THICK CARDBOARD CAP

NO. 10 BAR 3'-8" LONG W/ 1 1/2" I.D. SHEATH (SEE NOTE "A")

1/2" STYROFOAM PAD (OR EQUAL) IS TO BE PLACED BETWEEN DIAPHRAGM CONCRETE AND RISER FOR FULL EXTENT OF RISER AND DIAPHRAGM

NEOPRENE BEARING PADS

WP

TOP OF CAP
Span Continuity Details

Solution:

- Continuous deck eliminates deck joints
- Provides a hinge
- Bent reactions can be simple span, therefore reducing loads
ATION A-A (ALONG C.) / TYPICAL ALL UNITS
CONTROL JOINT NOTES:

1. CONTROL JOINT LENGTH TO BE ENTIRE DECK WIDTH.
2. JOINT NOTCH DEPTH AT TOP OF DECK SHALL NOT EXCEED 19 mm (¾").
3. JOINT CHAMFER DEPTH AT BOTTOM OF DECK SHALL NOT EXCEED 13.5 mm.
4. SILICONE SEAL TO BE NO CLOSER THAN 6 mm (¼") FROM ROADWAY SURFACE.
5. UNDERSIDE DECK FORMWORK TO BE REMOVED.

DETAIL "B" - CONTINUOUS DECK CONTROL JOINT
TO BE PAID FOR UNDER ITEM S-103 CONTINUOUS DECK CONTROL JOINT
Bridge Deck Treatments
Bridge Deck Treatments

Skid Abrader

- Loss of friction
- Structurally sound deck
Skid Abrader increases Micro and Macro texture to improve friction
Bridge Deck Treatments

Epoxy Overlay System

- Moderate deterioration of the deck surface
- Structurally sound deck
- NBI deck condition ratings of 6 or 7
Bridge Deck Treatments

Hydro blast / High Density Concrete Overlay

- Loss of structural integrity of the deck with delamination
- Sound concrete below the top mat of deck reinforcement
Bridge Deck Treatments

Deck Replacement

- Full depth failure and no structural integrity remaining
Bridge Joint Details

Problem:

- Live load cyclic loading and fatigue
- Anchorage failure
Solution:

- Repair joint support with structural polymer concrete.
- Replace the joint gland with either a poured joint sealer (small joints) or preformed joint seal (large joints).
Bridge Settlement

Problem:

- US 190 Morganza Floodway Bridge
- Differential substructure settlement
- Pile driving by truck impact loading
Bridge Settlement

Solution:

- Jack and level the spans.
- Bearing leveling system
Problem:

- I-20 Mississippi River Bridge at Vicksburg
- Pier movement
- Existing rocker bearing and pier width could not accommodate any future movement.
Bridge Bearing

Solution:

- Widened pier top
- Installed sliding disc bearings to accommodate both thermal movement and additional future pier movement.
BELLE RIVER PONTOON REHABILITATION
Problem:

- Loads have increased
- Overloads cross regardless of load posting, resulting in damage to the structure.
Barge Stability

Solution:

- Design a more stable pontoon for truck loads
- A dog bone configuration
Cable Operating System

Problem:

➢ Earlier designs had efficient cable configuration
➢ Not maintenance friendly
➢ Cable across channel - safety issues
Cable Operating System

Solution:

- Modified cable operating system
- Mechanical advantage resulting in more cable travel
- Cables out of the water and don’t cross the navigational channel.
- Cable replacement cycle (1 year to 5 - 10 year)
Special Multi-directional Sheaves Required
Apron Spans

Problems:

- Counterweight supports are often damaged by overweight vehicles.
- Damage to the counterweights results in bridge closure.
Apron Spans

Solution:

- Hydraulic operating and support system
- Slotted attachment for vertical span movement
Riding Surface

Problem:

- Low friction steel deck riding surface
Riding Surface

Solution:

- Epoxy overlay system
- High friction course riding surface