Construction of Laboratory and Field Demonstration Modified Beam-in-Slab Bridges

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Iowa’s Deficient Off System Bridges

- Approximately 30% of Off System Structures are Deficient
- Limited Replacement Funding
- Develop Alternative Designs
Alternative Replacement Designs

- Design Requirements
  - Lower Cost
  - Constructible by County Forces
  - Accommodate Recycled Materials
  - Require Minimal Maintenance
Alternative Replacement Designs

- Beam-in-Slab Bridge (BISB) System
  - Conservatively Designed
  - In Service For 25 Years +
  - Exists only in Iowa?
Beam-in-Slab Bridge System

- Concrete
- W 12 Girders, 24 in. on Center, Typ.
- Steel Confining Straps
- Plywood
Beam-in-Slab Bridge System

- Conclusions to BISB Testing
  - Structurally Adequate System

- Advantages
  - Easy to Construct
  - Cost Competitive

- Limitations
  - Lack of Efficiency
  - Limited Span Length
Increasing Applicability

- Increase the Efficiency of the System
  - Develop Composite Action
  - Reduce Self Weight of the Section
Composite Action

- Use of Alternative Shear Connector (ASC)
Reduce Self Weight With Arched Section

- Advantages
  - Wider Girder Spacing
  - Deeper Girder Sections
  - Longer Spans
  - Reduced Reinforcement

- Complication
  - Forming the Section
Formwork Investigation

- Various Materials and Configuration
  - Polyethylene Pipe
  - Arched Plywood
  - Corrugated Metal Pipe (CMP)
  - Custom Rolled Corrugated Section
Custom Rolled Corrugated Sections
Laboratory Testing

- Specimen #1 (Preliminary Section)
  - Investigate Feasibility

- 21" Radius, 42" Dia. Poly Pipe
- 2" x 1/4" Strap
- W 21 x 62 Girders
- Concrete
- #4 ASC Reinforcement
Laboratory Testing

- Specimen # 2 & # 3
  - Investigate Punching Shear
Laboratory Testing

- Specimen # 4
  - Investigate Load Distribution
  - Investigate Flexural Failure Mode
Demonstration Bridge

- Design Based on:
  - AASHTO LRFD Bridge Design Specification
  - Laboratory Testing Results
- 6 – W27 x 129 Girders Outfitted with ASC
- Custom Rolled Corrugated Sections
Demonstration Bridge
Demonstration Bridge
Demonstration Bridge
Conclusions

- **BISB System**
  - Alternative Replacement
  - Span Limited to 50 ft due to Structural Inefficiencies

- **Modifications to Improve Efficiency of Design**
  - ASC and Transverse Arched Section
  - Increase Span Length to 75 ft
  - Improved Use of Materials
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