Summary of Ultra-High Performance Concrete Laboratory Testing
UHPC Testing Objectives

- Confirm adequacy of the Wapello County bridge design
- Investigate flexural behavior
- Investigate shear behavior
Flexural Test Setup
Flexural Test Results

- Estimated prestress force, 1420 kips
- Flexural cracking
  - 3727 ft-k, 2.8 in., 1.10 ksi (T)
  - Anticipated service stress = 0.70 ksi (T), design allowable = 1.00 ksi (T)
- Final load, 265 kips
  - 4159 ft-k, 3.2 in., 1.13 ksi (T)
- Ultimate capacity was not tested
  - Predicted = 8968 ft-k, Required = 7356 ft-k
- Analytical & experimental results correlated well
Deflection

Midspan Deflection

Deflection (inches)

Total Load (kips)

Experimental

Analytical
Strain Profile

Midspan Stain Profile at 237k Total Load

Midspan Stain Profile at 265k Total Load

Experimental

Analytical
Flexural Cracking
Shear Test Setup
Shear Test Results

- Shear cracking, 370 kips
  - Shear of 315 kips, 189 kips required

- Flexural cracking, 398 kips
  - 3576 ft-k, 2.01 in., 1.10 ksi (T)

- Failure, 594 kips
  - Shear of 501 kips, 301 kips required
  - Did the lifting loop add extra strength?

- Analytical & experimental results correlated well
Deflection at Transducer #3

- **Deflection (in)**
- **Total Load (kips)**

Graph with two lines:
- **Experimental**
- **Analytical**
Principal Stresses

**Principal Stresses at Gage #6**

- Stress (ksi)
- Total Load (kips)

**Principal Stresses at Gage #15**

- Stress (ksi)
- Total Load (kips)

---

- Blue line: Experimental
- Pink line: Analytical
Shear Cracking
Flexure-Shear Test Setup
Flexure-Shear Test Results

- Still Under Investigation
- Flexural and Shear Cracking Occurred
- Failure did not occur by breaking, rather the load vs. deflection curve became flat.
Deflection

Average Deflection at Transducers #5

Total Load (kips) vs. Deflection (in)
Principal Stresses

Principal Stresses at Gage #17

Principal Stresses at Gage #R1

- Experimental
- Analytical
Beam at Maximum Load
Future Testing

- Small scale shear tests
- Live load testing
Small Scale Shear Tests
Live Load Testing

- Tandem axle dump truck
- Static loading
Concluding Remarks

- Wapello County bridge design appears to be adequate
- Constitutive material properties still under investigation
- Shear design approach still under investigation
Questions?