Ultra-High Performance Concrete in Ohio
Presentation Overview

Student • Background & Research

Contractor • Experience

ODOT • Perspective
UHPC Background & Student Research

Elné Barnard
Stantec – Structural Designer
Ohio University – Ms Graduate Student
UHPC Composition

- Binders
- Superplasticizer
- Fine Aggregates
- Steel Fibers
Microscopic Scale (Lafarge)

Typical Concrete  UHPC
Ultra High Performance Concrete

- Strain Hardening Concrete
- Self Consolidating
- Almost Zero Permeability
- Excellent Bonding Strength
Properties

Compressive Strength:
- UHPC 25–30 ksi
- Normal Concrete 4-8 ksi

Tensile Strength
- UHPC 4–6 ksi
- Normal Concrete 0.4-0.8 ksi
UHPC Simplifies

Detail

Fabrication

Construction
FHWA Interactive Map

North American Deployments of UHPC in Highway Bridge Construction

State or Province: OH
City or County: Etna
Owner: Ohio Department of Transportation
UHPC Application: Longitudinal closure pour between staged CIP concrete deck
Year Constructed: 2017
GPS Latitude: 39.95
GPS Longitude: -82.68
Bridge Image 1

Zoom to
Ultra-High Performance Concrete in Ohio

Licking County

- Widening of 4 span bridge
- UHPC Closure pour

Licking County: Bridge LIC310/70
Licking County Bridge LIC310/70

Closure Pour Detail
Sequence of Construction
Instrumentation

• L1 at Pier 1
• L2 at Midspan between Pier 1 and Pier 2

(Partial Plan View)
Conduits
Conduits
Strain Gauge Wires

Blue – Thermocouples
Red – Vibrating Wire Gauges
Black – KM-100B Strain Gauges

Wires through conduits at midspan
Gauges Installed at L2
Data Collection

Data Collector at South Abutment

Ambient temperature
Results

Processed Data

![Graph of UHPC at Pier, KM100-B Gauges]

- Transverse - Top
- Transverse - Bottom
- Longitudinal - Top
- Longitudinal - Bottom

Date, Time

Corrected Strain, με
Thank YOU

Ohio University:
Dr. Eric Steinberg, Dr. Issam Khoury,
Ali Semendary, Caleb Slyh, Josh Jordan, Waleed Hamid

ODOT:
Tim Keller, Cindy Wang, Dan Miller, Matt Blythe
Andrea Salyer, Elli Alexander, Justin Reed

Complete General Construction:
Ashley Hoskins, Nathan McCune, Darryl King

Lafarge: Gregory Nault, Andrew Ross, Joseph Rebrovich
Contractor’s Experience

Ashley Hoskins
Complete General Construction
Ashley Hoskins

Project Overview

[Image of the bridge with the word "ETNA" on it]
Closure Pour Forming
Concrete Deck Pour
Concrete Deck Pour
Mock Panels

3 Test Slabs (12hr, 18hr, 48 hr)

- Joint created with Styrofoam
- Stripping of 8 ft mock panels
- Estimate $8000/cy
Retarder Effect

Pre power wash
Retarder effect comparison

Post power wash

No retarder applied

Post power wash
Materials & Equipment
UHPC Mixers
ICE

Control UHPC Temperature

• Total 1,650 pounds of ice

• Chest Rental

• Need generator on site to run chest
UHPC Closure Pour

Adding steel fibers

Initial pour (August 3, 2017)
UHPC Closure Pour
UHPC Closure Pour

August 3, 2017

August 8, 2017
Surface Grinding
Surface Grinding

• PC 1500

• Utilized standard concrete head

• Reduced production by 50%
60-hr Early Break

3 Cylinders Tested (ODOT)

Cylinder 2

- Length: 5.42 in
- Diameter: 3 in
- Load: 102 kips
60-hr Early Break

ODOT

Compressive Strength

14.5 ksi
28-Day Compressive Strength

Advance Testing (New York)

- Area: 7 in\(^2\)
- Diameter: 3 in
- Load: 162 kips

Compressive Strength

22.5 ksi
Lessons Learned
ODOT’s Perspective

Tim Keller, PE
Administrator – Office of Structural Engineering
Tim Keller, PE

Project Oversight
Why UHPC?

9.25 in.

UHPC Closure Pour
Accelerated Bridge Construction
Future of UHPC in Ohio
Thank YOU

OTEC 2018
Elné Barnard
Ashley Hoskins
Tim Keller