

# UHPC

## A Solution for Today and Tomorrow

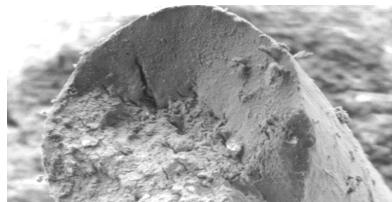


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Transportation Asset and Infrastructure Management Conference

October 28, 2019 – PSU



U.S. Department of Transportation  
**Federal Highway Administration**



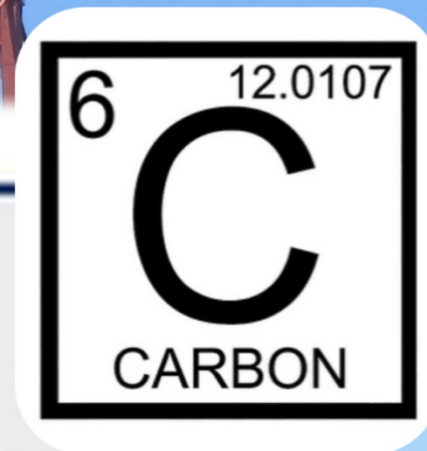
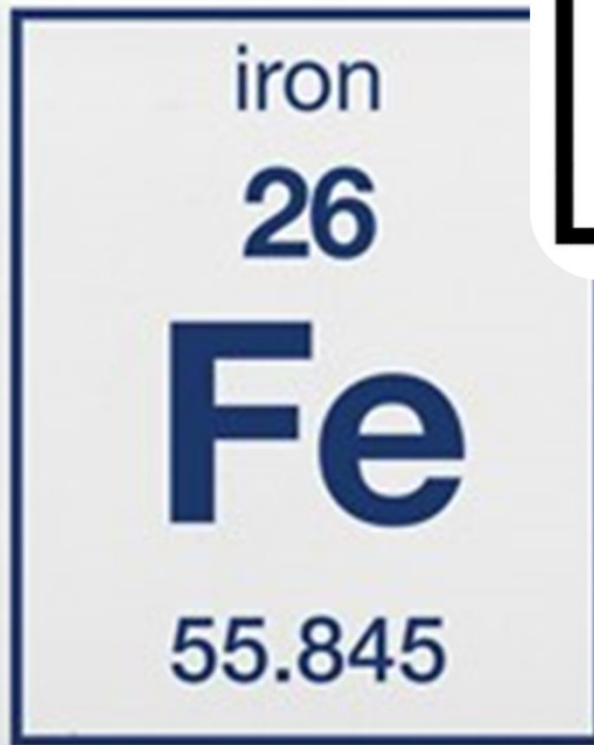


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26

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# Old Ninth Street Bridge, Boise

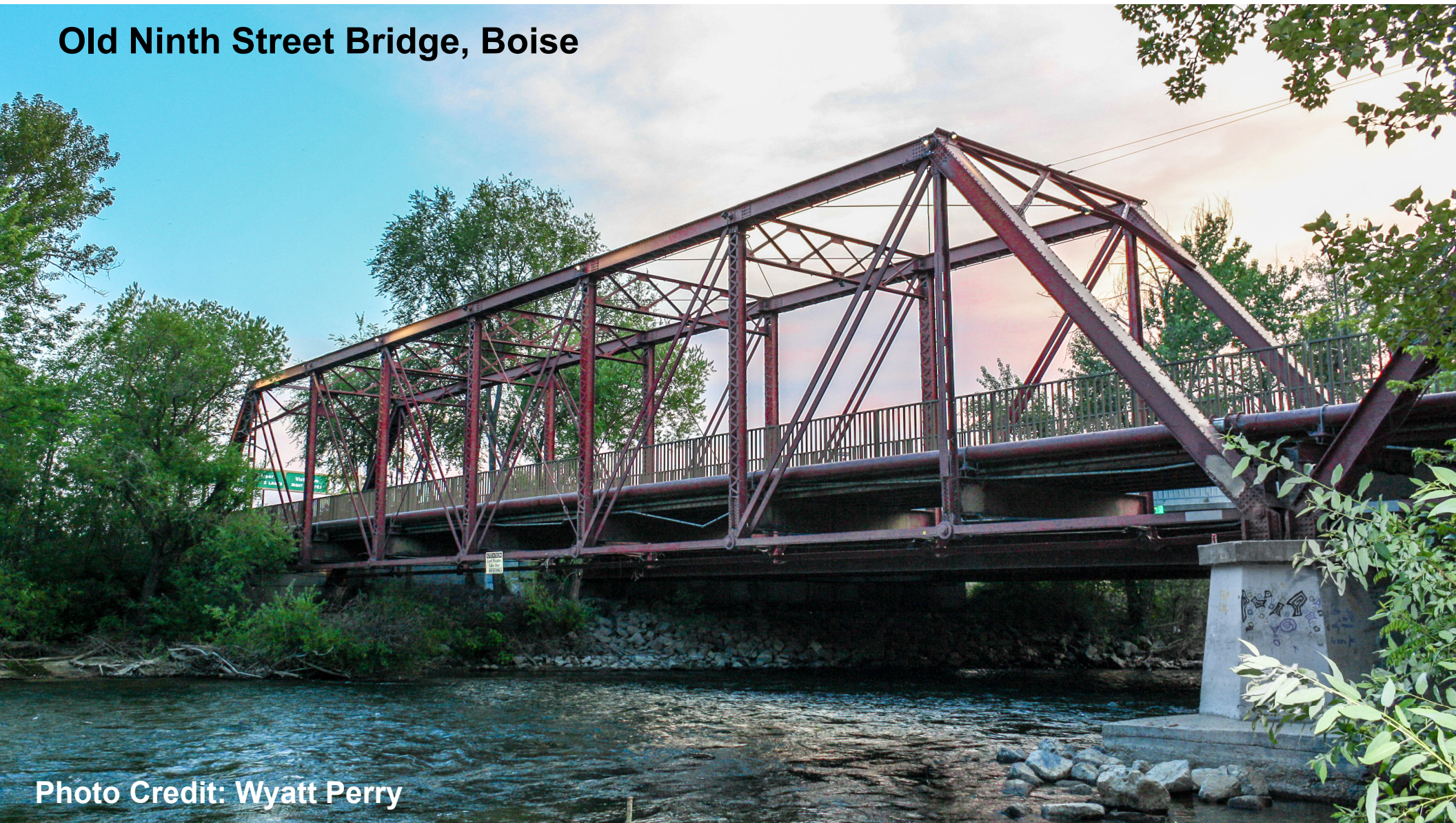


Photo Credit: Wyatt Perry





Photo Credit: Juan Sobrino



**James de Wulf Periodic Coffee Table**







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# What is Ultra-High Performance Concrete?

# What is Ultra-High Performance Concrete?

Fiber Reinforcement



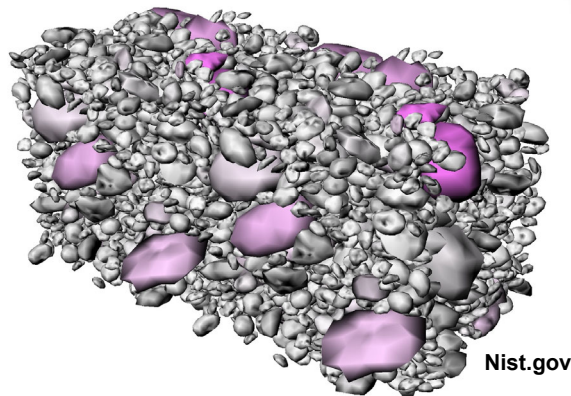
Superplasticizers



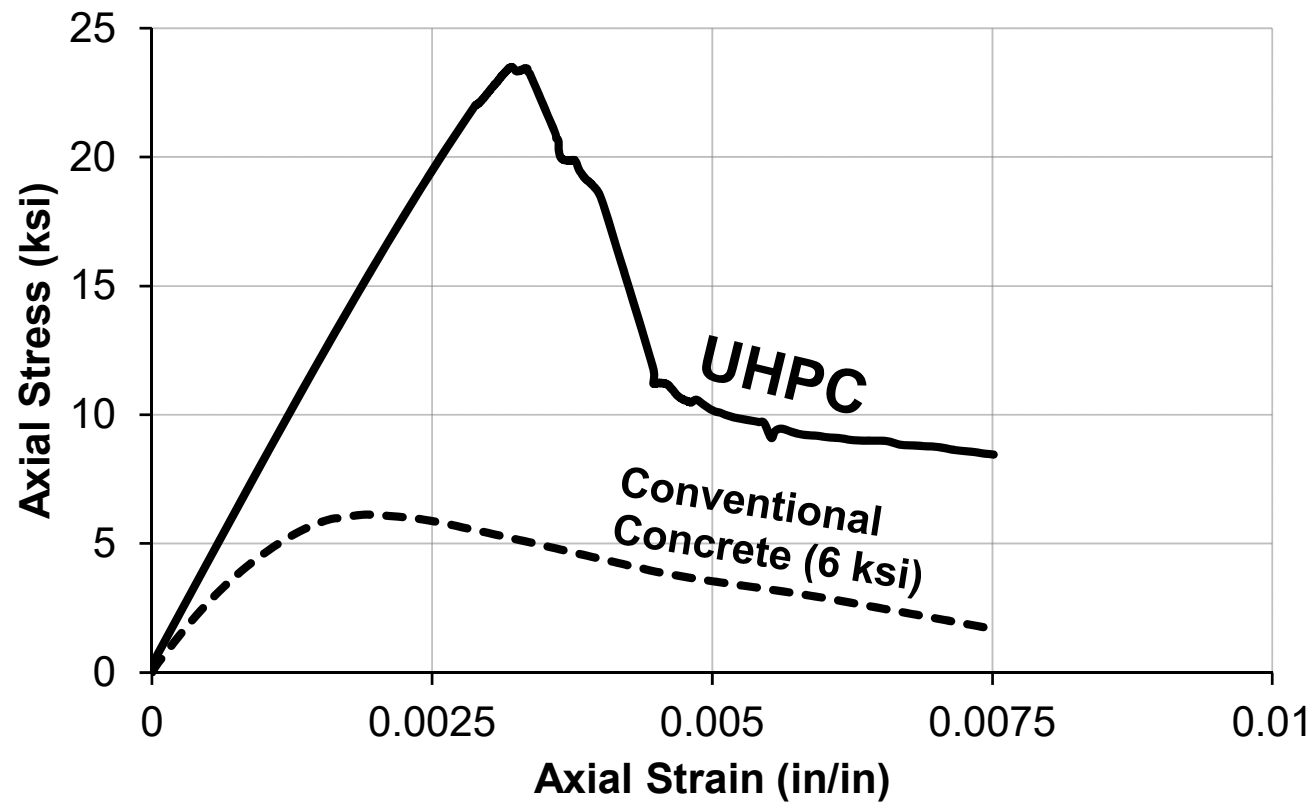
Supplementary Cementitious Materials



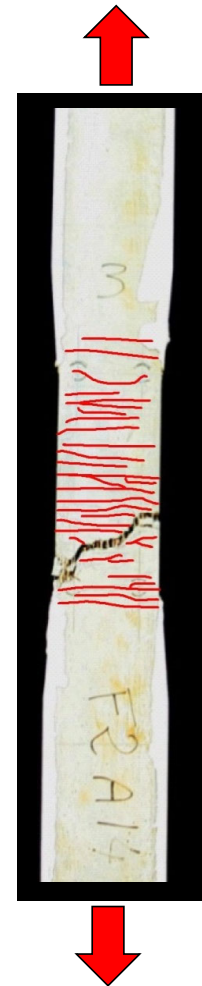
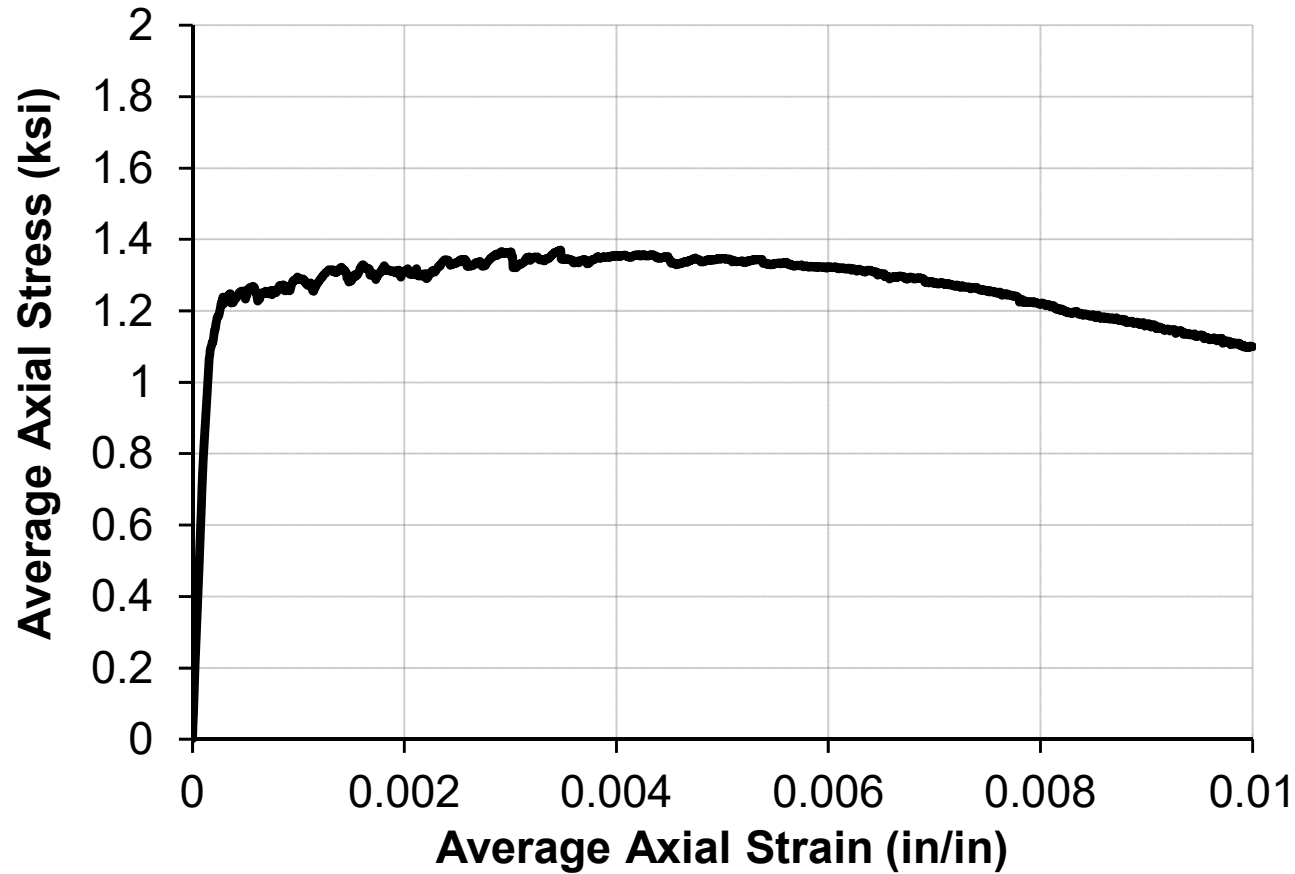
Particle Packing Theory



# Compression Behavior



# Tensile Behavior



# Durability



# UHPC Casting





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# What is Ultra-High Performance Concrete?

## Micro-Reinforced Concrete

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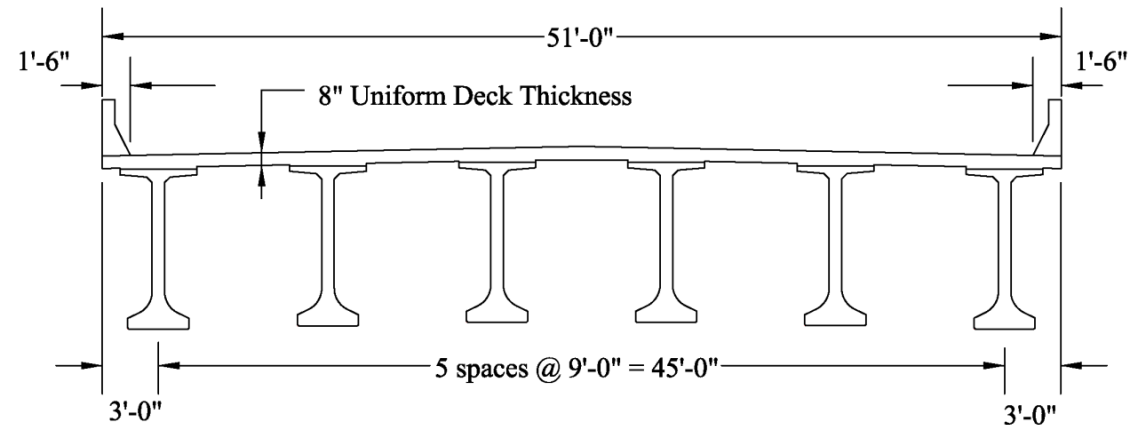
# What is Ultra-High Performance Concrete?

## Micro-Reinforced Concrete

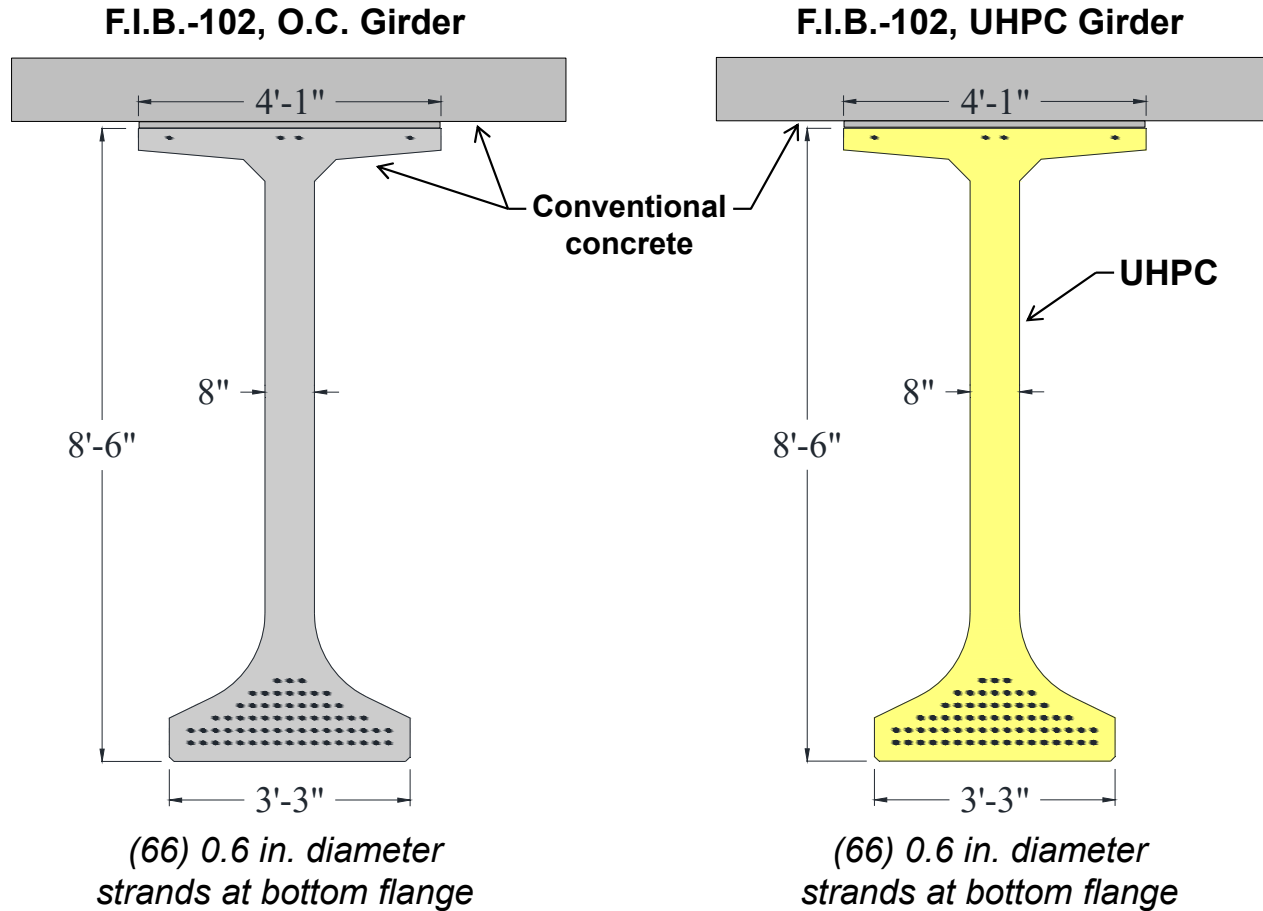
*w/ Enhanced Mechanical and Durability  
Properties*

# Prestressed Single Span Bridge Girder

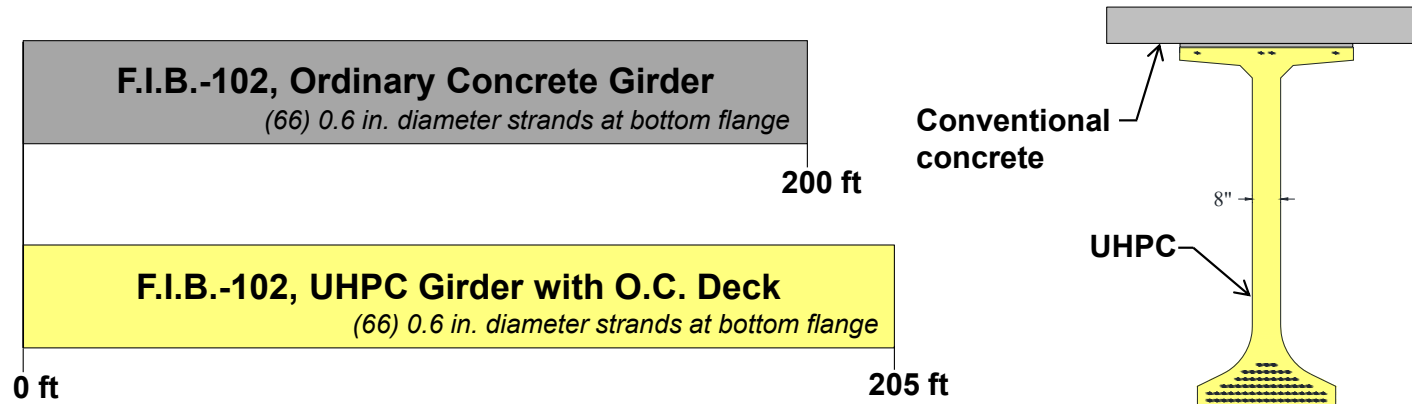
- PCI bridge design manual for Florida I-Beam (F.I.B.-102)
- AASHTO LRFD Bridge Design Specifications, Seventh Edition
- Bridge span of 200 ft
- 6 beams spaced at 9 ft centers
- Clear roadway width is 48 ft leading to 4 design lanes.
- Design live loads is HL-93.
- Girders made of conventional concrete with  $f'_c = 10.0$  ksi
- Composite action with 8 in. thick cast-in-place concrete deck with  $f'_{c,D} = 4.0$  ksi



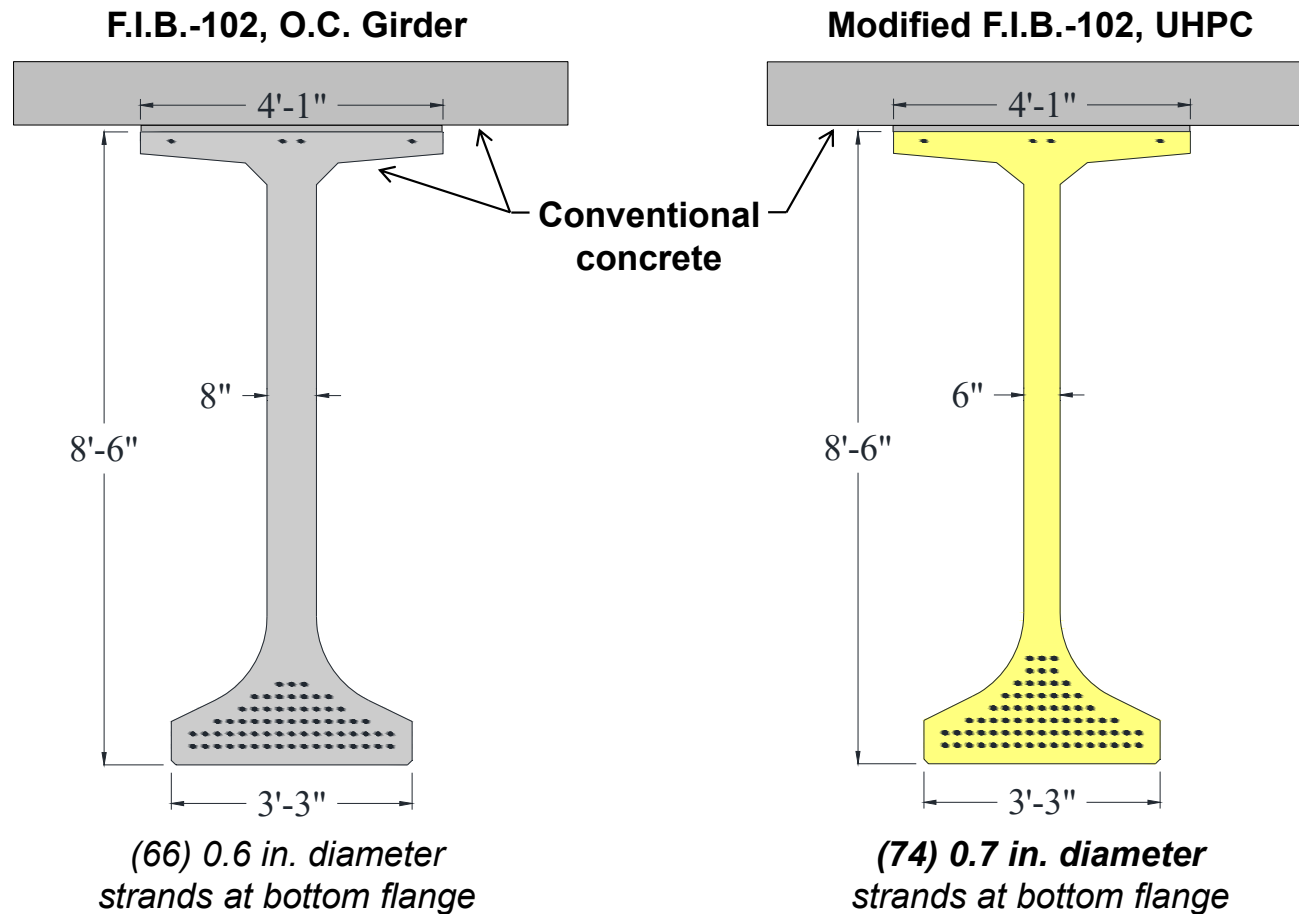
# UHPC Girder with Cast-in-Place O.C. Deck



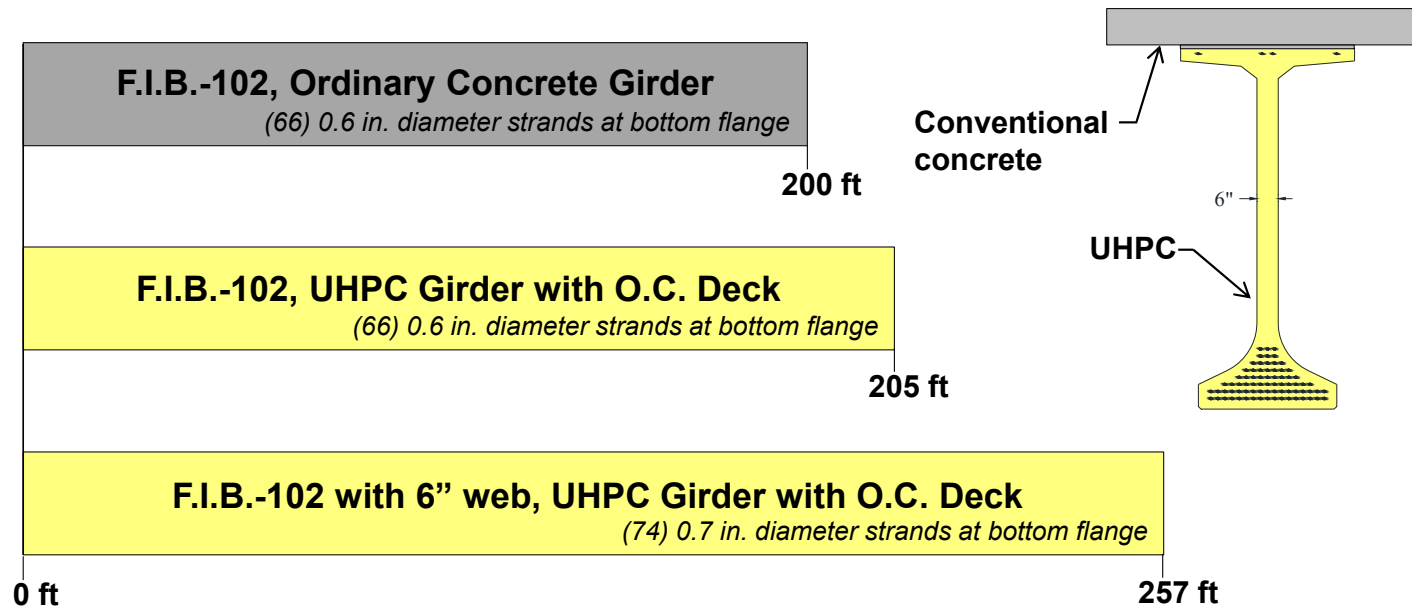
# Resulting Span Length



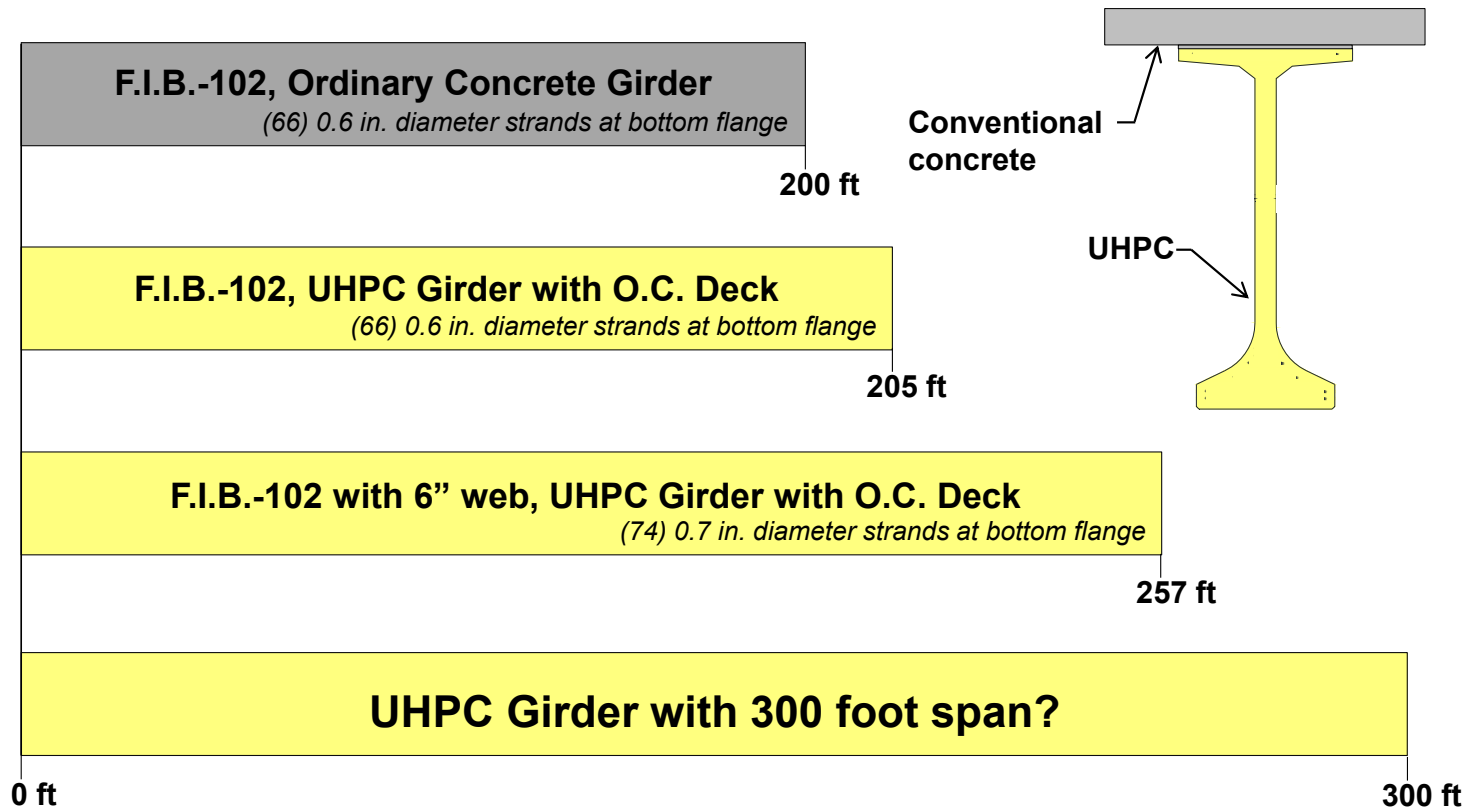
# UHPC Girder with Cast-in-Place O.C. Deck



# Resulting Span Length

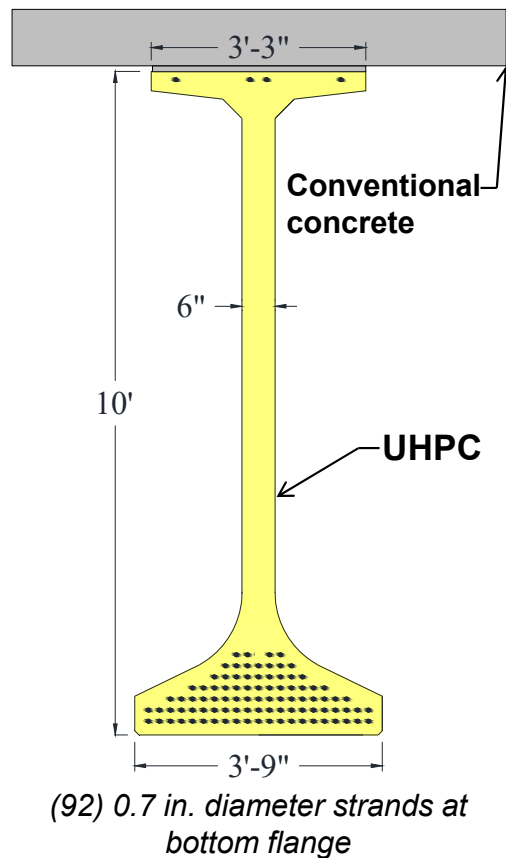


# Resulting Span Length

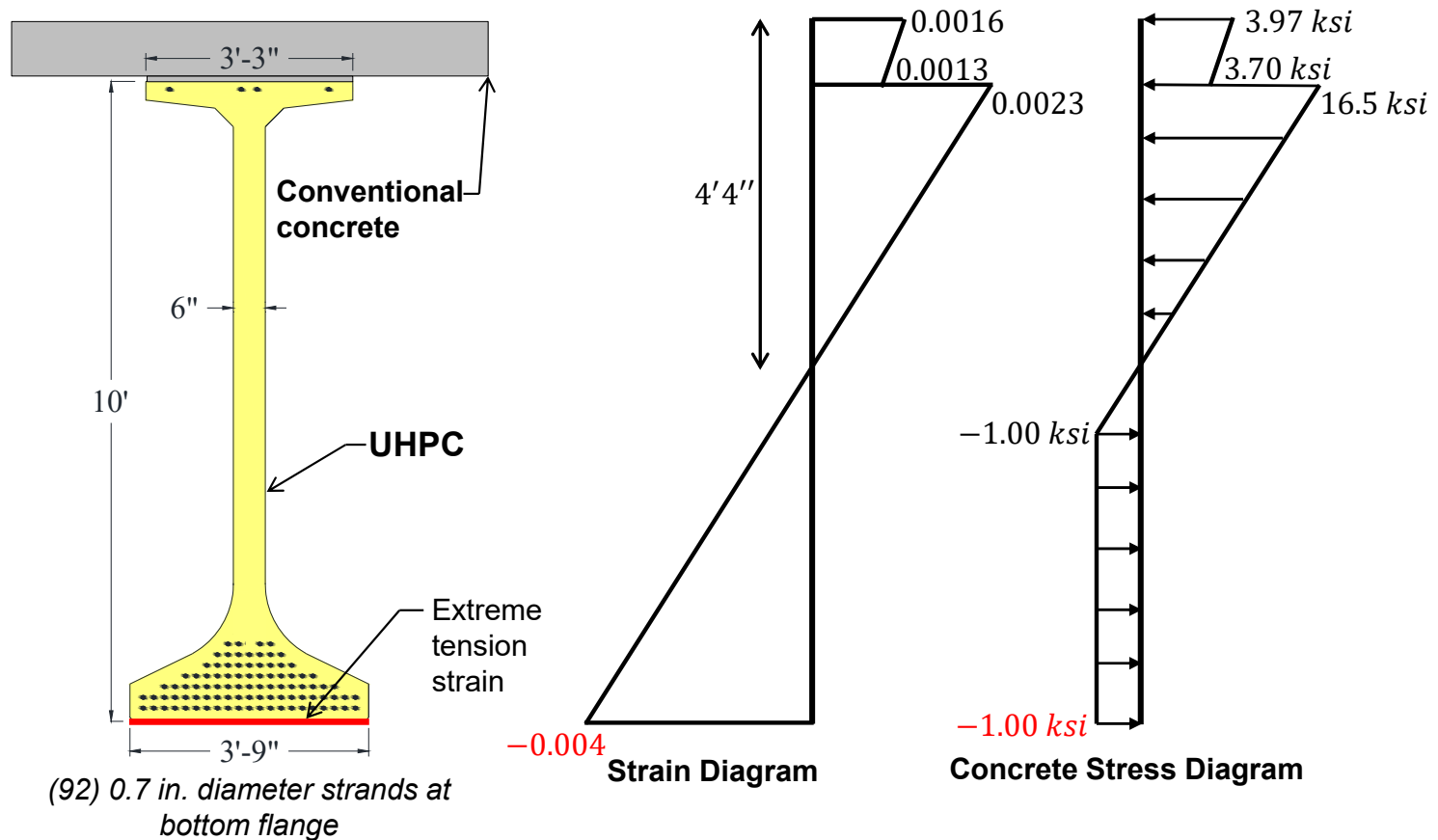




# 300 ft UHPC Girder with Ordinary Concrete Deck



# 300 ft UHPC Girder with Ordinary Concrete Deck



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# UHPC I-Girder Bridge



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# UHPC in a Segmental Cable Stayed Bridge



**Chuncheon  
Bridge,  
Korea**

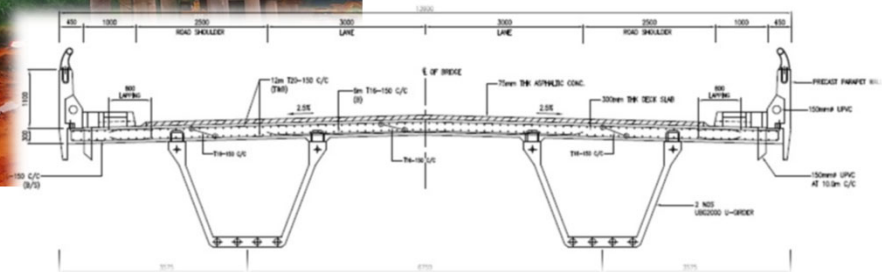


# 420 m Multi-span U-Girder Bridge



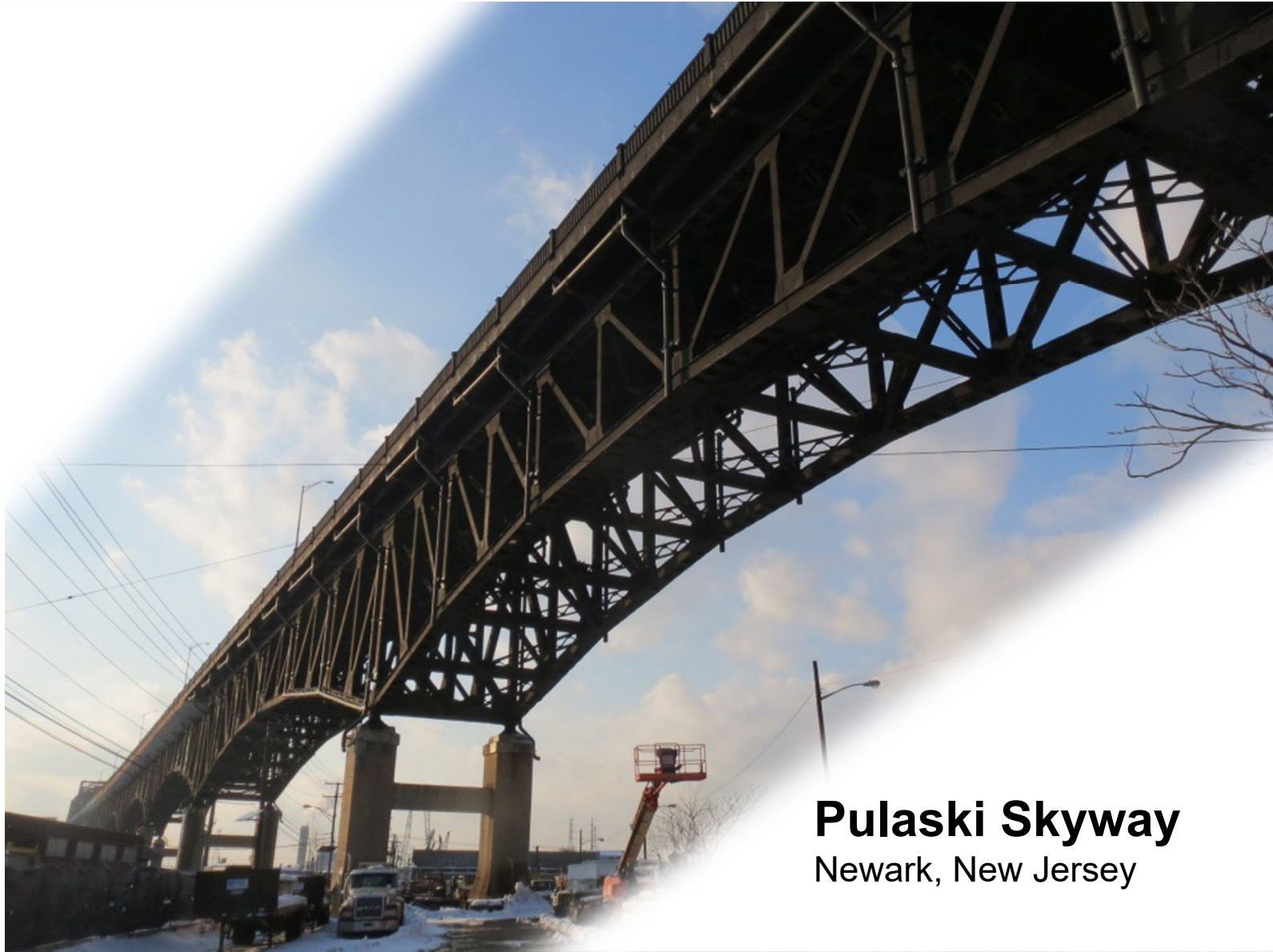
Images from  
Dura Technology  
Sdn Bhd

Kampung Telok  
Malaysia



# UHPC Connections ... A Great Place to Start





**Pulaski Skyway**  
Newark, New Jersey

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# Precast Deck Panel Connections

Pulaski Skyway  
Newark, New Jersey





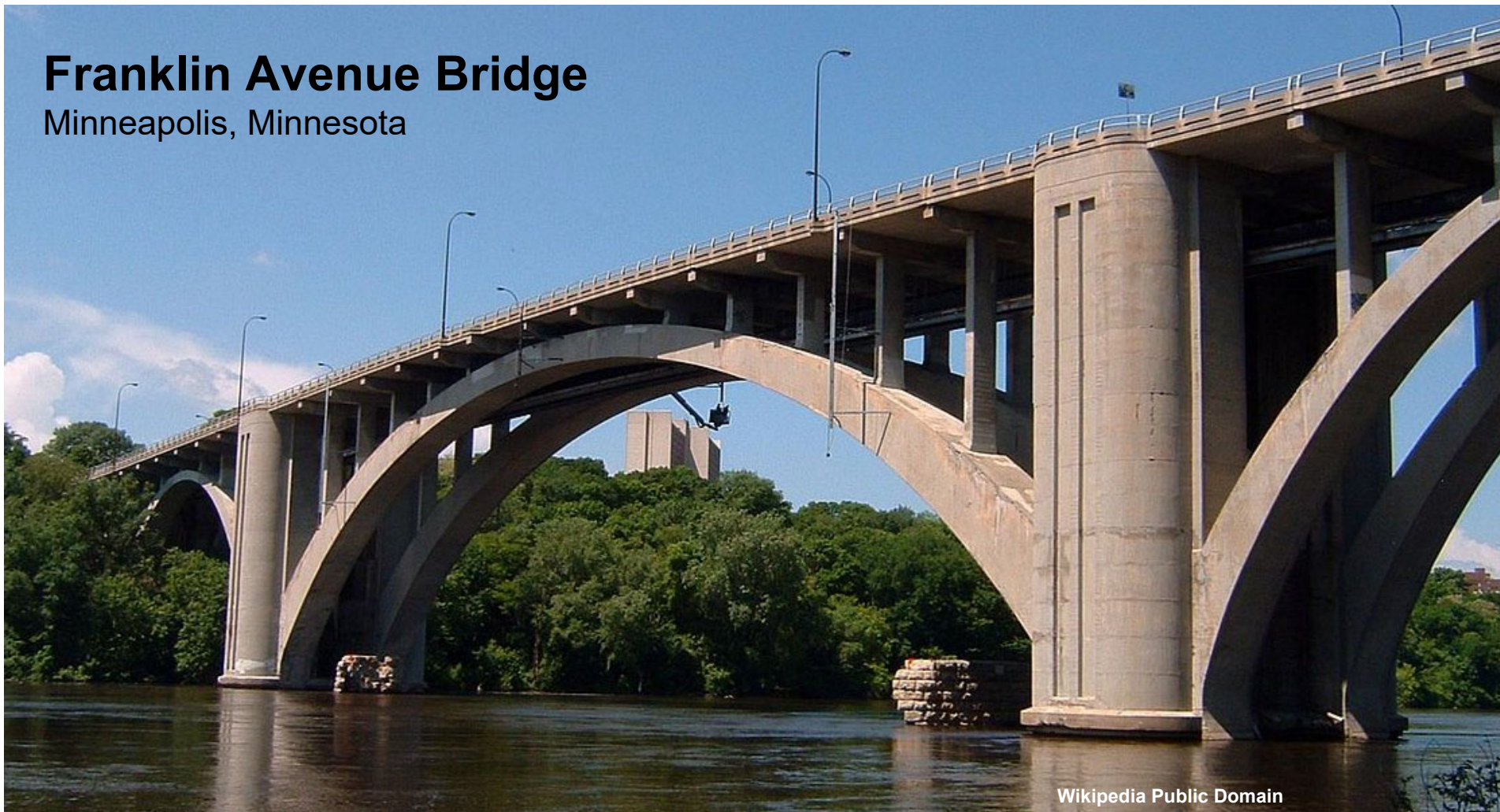
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# UHPC Connection Casting Video



# Franklin Avenue Bridge

Minneapolis, Minnesota



Wikipedia Public Domain

# Deck Panel Connections

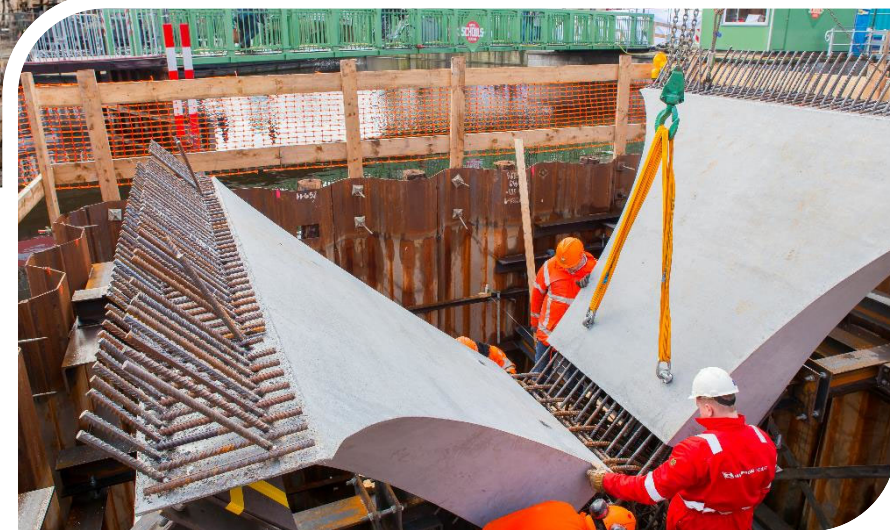


Franklin Ave. Bridge  
Minneapolis, MN

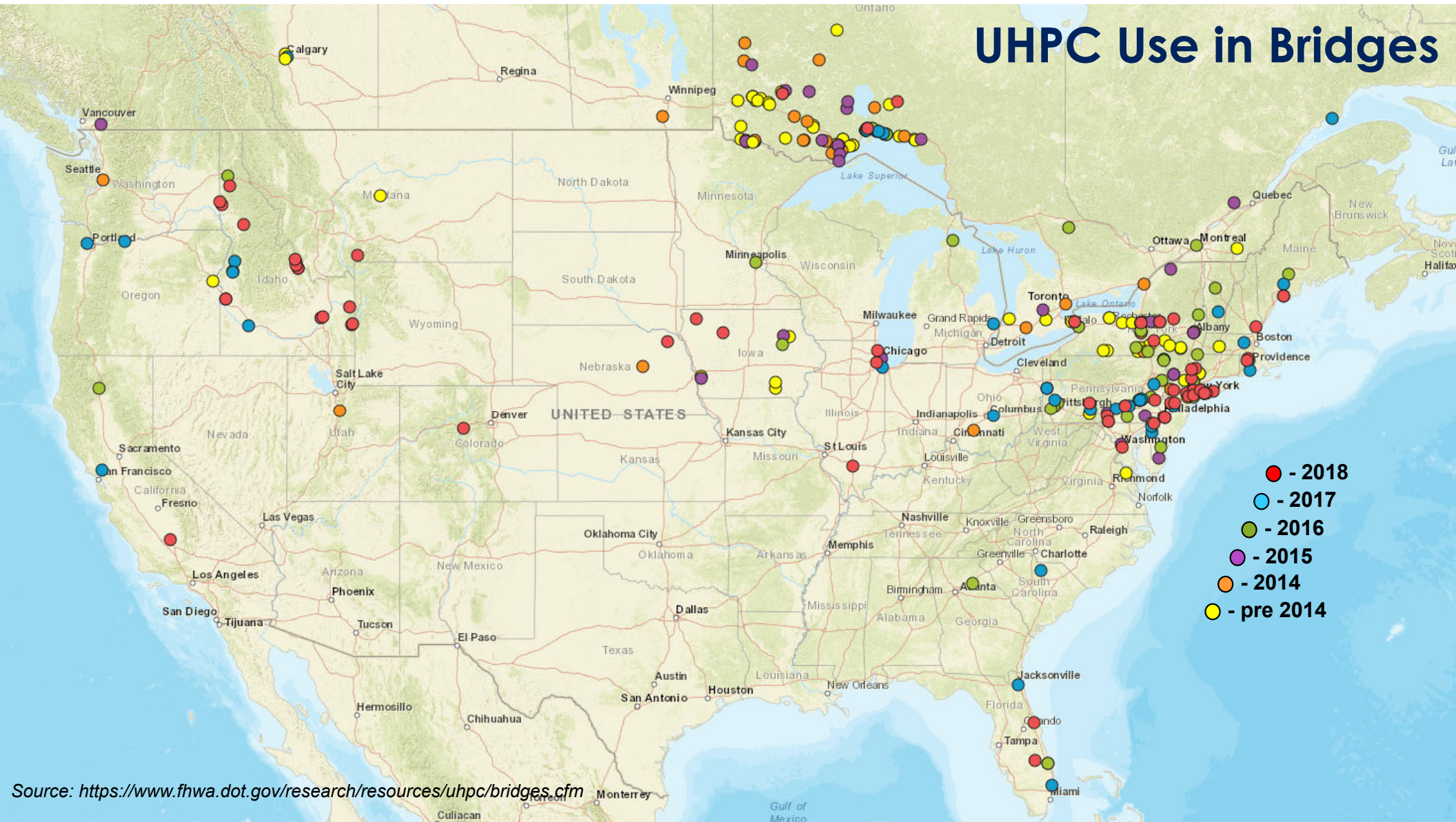
# Precast Element Connections



**Catharina Bridge  
Leiden, Holland**

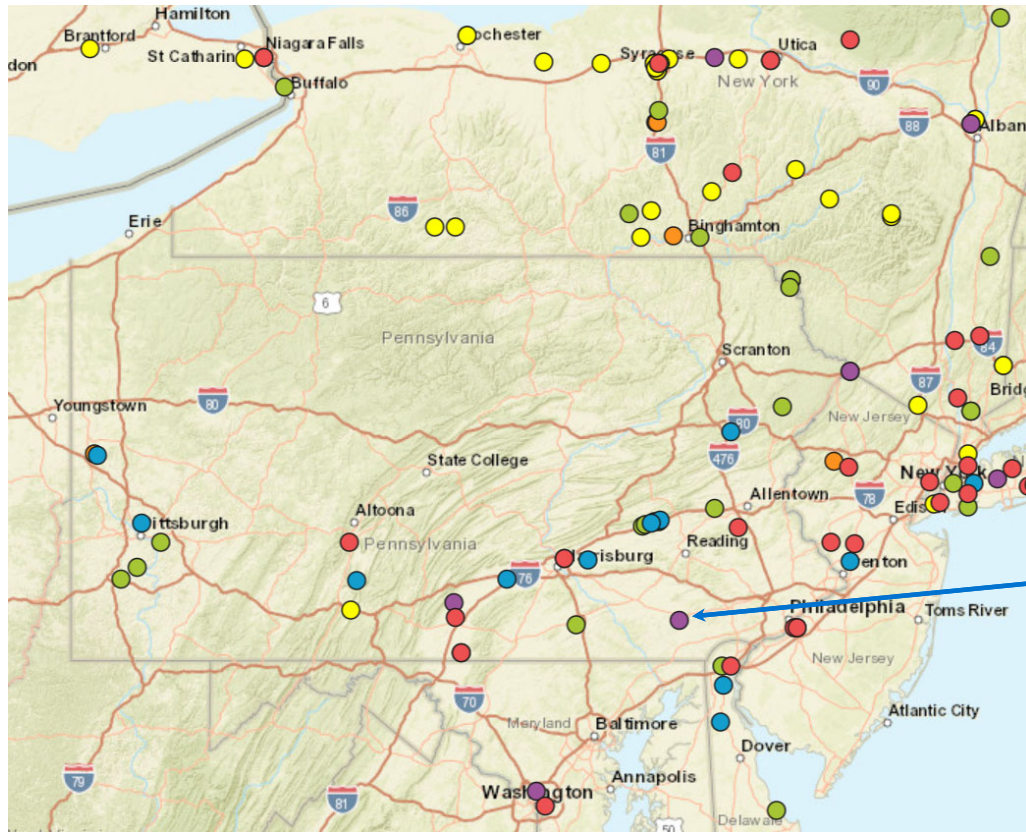


# UHPC Use in Bridges



Source: <https://www.fhwa.dot.gov/research/resources/uhpc/bridges.cfm>

# UHPC Deployments in Pennsylvania



## SR 41 (Gap Newport Pike) Bridge

**Bridge Name / Route:** SR 41 (Gap Newport Pike)

**Crossing Feature:** Officers Run

**State or Province:** PA

**City or County:** Atglen

**Owner:** Pennsylvania Department of Transportation

**UHPC Application:** Deck-level connections between prefabricated decked modular steel superstructure units.

**Year Constructed:** 2015

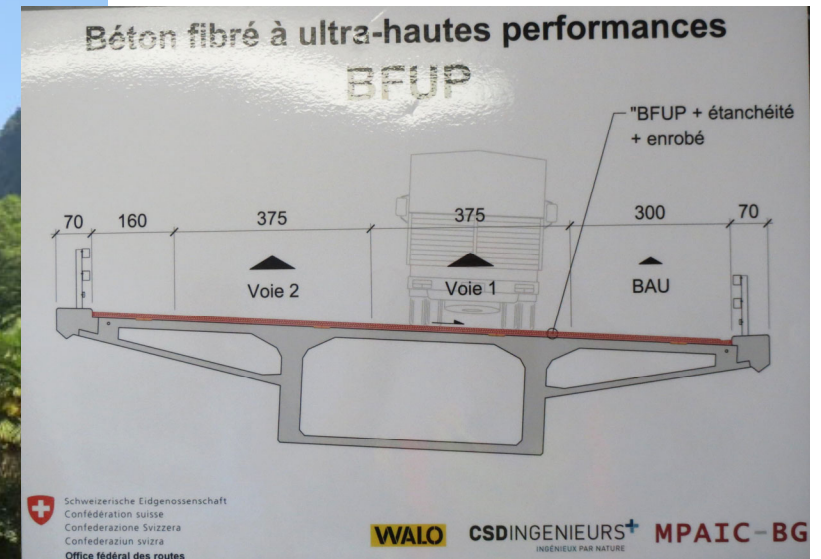


*In-service bridge using modular steel superstructure elements and deck-level UHPC connections - Photo Credit: FHWA*

Link: <http://usdot.maps.arcgis.com/apps/webappviewer/index.html?id=41929767ce164eba934d70883d775582>

Web Search: "FHWA UHPC" then click Deployments tab

# UHPC for Bridge Deck Rehabilitation



Chillon Viaduct near Lausanne, Switzerland

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# UHPC for Bridge Deck Rehabilitation



Photo Credit: WALO

**Chillon Viaduct near Lausanne, Switzerland**



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# UHPC for Bridge Deck Rehabilitation



CR L over Mud  
Creek near  
Brandon, Iowa

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# 18-inch Square Prestressed Pile



Florida, USA

Images from Cor-Tuf  
and Durastress



# 18-inch Square Prestressed Pile



Video Credits: Cor-Tuf

Photo Credit: Cor-Tuf



The image features a central, circular concrete spiral structure, likely a modern architectural element like a staircase or a decorative column. The concrete has a light, textured appearance with some subtle variations in tone and texture. The spiral is composed of several concentric, slightly overlapping rings that create a sense of depth and movement. The background is dark and out of focus, making the concrete structure stand out. In the center of the spiral, the text "The Future of Concrete" is written in a clean, white, sans-serif font, arranged in two lines.

**The Future  
of Concrete**

# UHPC

## A Solution for Today and Tomorrow

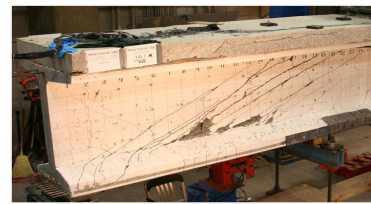
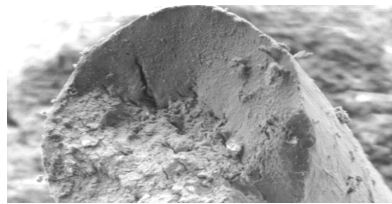


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