

Iowa DOT – Deck Overlays & UHPC Experience

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Introduction

- Bridge deck overlay history
- UHPC use in Iowa
- UHPC Overlays & Performance
- Future
- Conclusions

History of Iowa Deck Overlays

- Low slump deck overlay mid 1960s (Iowa Method)
- Class O Mix
- 825 lb/cy - $\frac{3}{4}$ " slump
- Volumetric mixer



History of Iowa Deck Overlays

- Vibrated into place
- 98% rodded density tested by nuclear gage
- Experience more cracking than in the past



History of Iowa Deck Overlays



Grouting Operation



Finishing

History of Iowa Deck Overlays

- After 9/11 - nuclear gage requirements increased
- 2004 - HPC-O mix
- Use of slag, fly ash & Mid range WR
- Higher slump mix allowed ready mix
- Conventional bridge deck machine



History of Iowa Deck Overlays

- HPC-O mix - Lower permeability but still some cracking issues
- Fibers have helped
 - Jasper IA 117
 - 4 lb/cy macrofibers

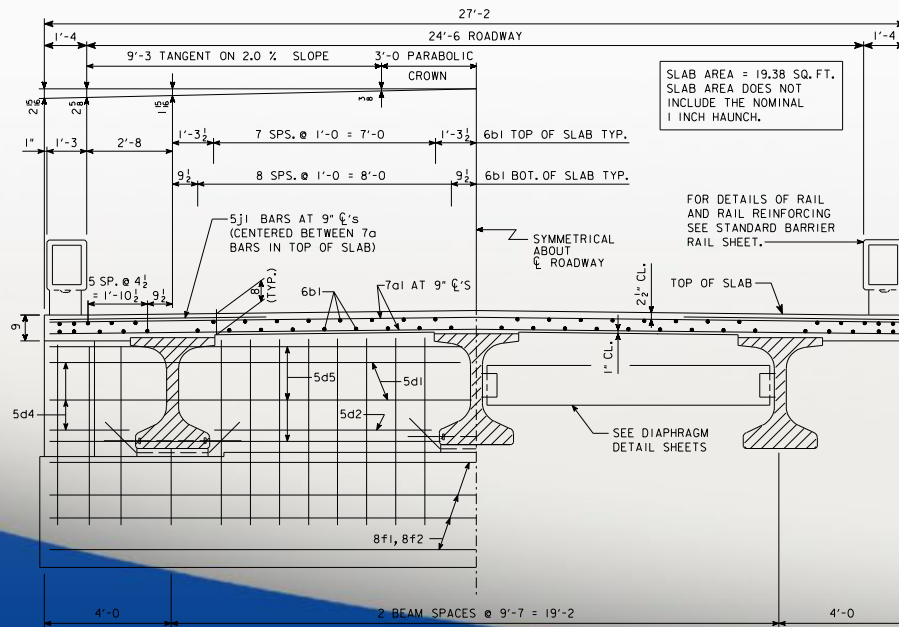




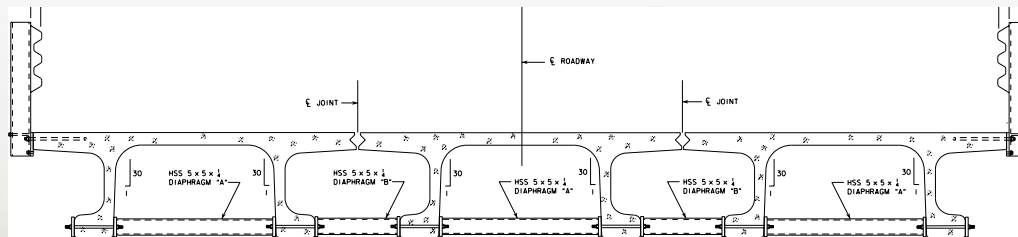
Experience with UHPC in Iowa



2006 First UHPC I-Girder Bridge in North America, Wapello County



2008 First UHPC PI-Girder Bridge in North America, Buchanan County



2011 UHPC Waffle Deck Wapello County



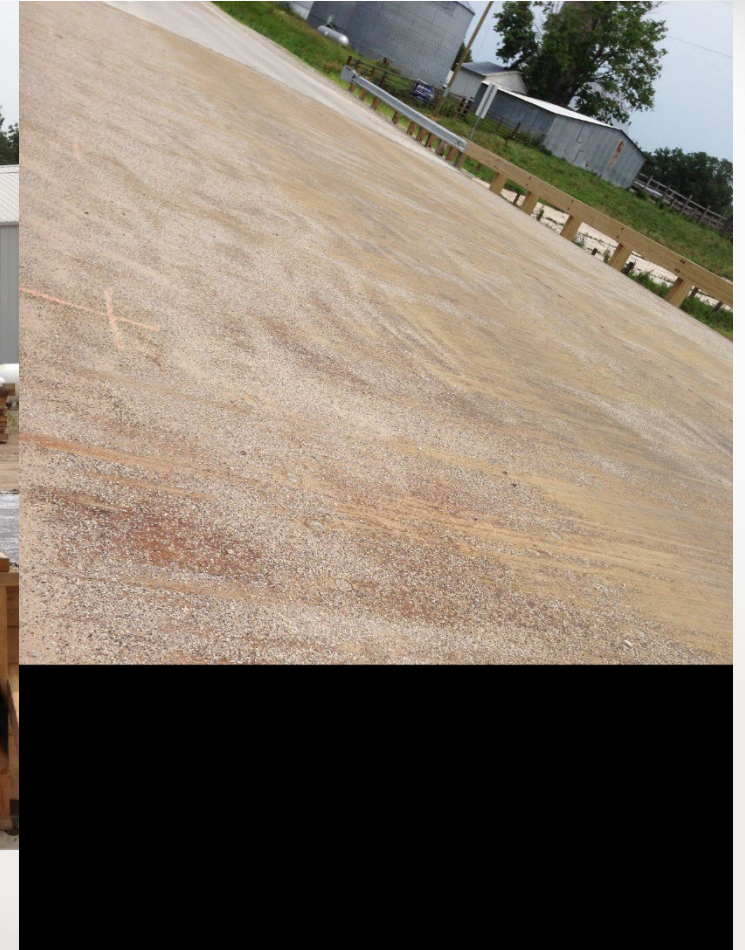
2012 UHPC Precast Piling Sac US 20



2015 UHPC Beam Buchanan Co



South Korea UHPC



UHPC Other Applications

- ABC deck connections
- ABC post lateral slide connections
- Beam end repair



2016 UHPC Deck Overlay Buchanan Co



2018 UHPC Deck Overlay US 18 Sioux Co



2022 UHPC Deck Overlay Jasper IA 163 EB



2023 UHPC Deck Overlay Cass Co IA 92



2023 UHPC Overlay Humboldt US 169



2024 UHPC Deck Overlay Polk Co IA 141



UHPC Deck Overlay Lessons Learned

- Sioux US 18
- Two lift – second lift depth $\frac{1}{4}$ "
- Delamination of surface



UHPC Deck Overlay Lessons Learned

- Cass IA 92
- Introduction of fibers caused fiber balls
- Continuous feed of fibers
- Do not drop in clumps
- Epoxy repaired



UHPC Deck Overlay Lessons Learned

- Humboldt US 169
- Lots of Cracking
- HMWWM sealed



UHPC Deck Overlay Lessons Learned

- Polk IA 141
- Air bubbles trapped in mix
- Common with thixotropic material
- Epoxy filled



UHPC Deck Overlay Lessons Learned

- Polk IA 141
- Mixer truck transmission broke down
- Had to transfer material from one truck to another



UHPC Deck Overlay Lessons Learned

- Mixing Equipment
- RM truck or high shear mixer – plan for introducing materials
- Ensure that backup equipment available



UHPC Deck Overlay Lessons Learned

- Aggressive Surface Hydrodemolition
- Extra UHPC material quantity needed
- Thixotropic material & fibers fill all voids?
- Shot blast or hydroblast



UHPC Deck Overlay Lessons Learned

- Low w/c mix can form elephant skin
- Keep mix temp below 80°F
- Colloidal silica finishing aid available



UHPC Deck Overlay Lessons Learned

- Grinding & grooving timing
- Begin at ~12 ksi compressive strength
 - 3-4 days
- For smooth cutting rather than tearing the material



Future UHPC

- ISU Non-proprietary mix
- Crawford Co US 30 UHPC-NP deck overlay in 2026
- SP-230382
- Shot blast surface



Conclusions

- Expensive material to have problems
- Do not use thin two lift
- Slowly feed fibers to avoid clumping
- Variance in material suppliers
- Mixing equipment have extra available
 - RM truck or high shear mixer
- Environmental conditions impact on finishing and curing
- Timing of grinding and grooving operations



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Questions ?