Buchanan County Iowa

- 259 Bridges over 20’
- 29-Railcar Bridges
- 6-GRA-IBS Abutments
- 2-Cast on Site Slabs
- 1-Press Brake Tub Girder
- 3-UHPC
- 3- Glue –Laminated Bridges
- 3 Internal Curing Concrete Bridges
- Working on UHPC
- Continue Using railcar bridges
Many of our bridges were old
New Construction Costs

- Receives about $420,000/Yr. for BRS/BROS

- 30x100 slab x $150/sf. or $450,000.
Note the 3 ton posting
a 14 ton weight restriction. Sheriff’s officials say the semitrailer was 29 tons over that limit.

The driver, who was not injured, faces an $11,400 overload fine. Officials say it will cost as much as $1 million to replace
ECONOMIC IMPACT OF CLOSING LOW-VOLUME RURAL BRIDGES

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Figure 3. Determining Bridge Closure / Repair / Replace Based on ADT and Detour Length
Asphalt Over Concrete
Simplified Deck Overlaying
Over Time the backwall kicks out
A LONG TERM Solution
Current Repair Method
Encase to Beams $12,000+materials
Pier encasement
Sometimes there are no GOOD repairs
We have constructed 3 with open grated decks
We have constructed 29 Bridges from Railroad Flatcars
What Do They Look Like?
What They Look Like To Us
Flatcars Not Boxcars
68 Ft Railcar
89 Ft. Flatcars require a pier
Load Capacity

• All our Bridges Carry LEGAL LOADS

Figure 2. BCB5 RRFC Bridge Test (May 11, 2006)
Iowa State University has Load Tested all of our RRFC Bridge Designs
A full-scale railroad flatcar (RRFC) bridge was constructed in Bowen Laboratory. One objective of the research project was to determine if the system displayed adequate load redundancy after fracturing a primary member. The bottom flange and a portion of both webs of one of BOTH main girders at midspan were fractured under a controlled setting. This video displays the fracture of the second main girder. With BOTH main girders of the RRFC bridge fractured, the bridge was loaded to 190 kips.
UTILIZE NEW TECHNOLOGIES

BRIDGES AND BOXES on GCS™ Abutments

- 30% Less Cost
- One Day to Construct
- No Bump
- No Expansion Joint
- Longer life

DESIGNED BY BARRETT AND RUCKMAN
COMPLETE ONE SIDE
SET SUPERSTRUCTURE
CAST ON SITE SLABS with INTERNAL CURING CONCRETE
Compacted Concrete on GRS
1:1 Slopes
Roller Compacted Bridge Abutment.
UHPC Bridges Jakway Park 2008
Design and Construction of Hawkeye UHPC Bridge
Timber String/multi-beam or girder
32 x 23.3 (0ºSkew) Built 1899
SR=30 Scour=5
Last Insp: Jan 2015
Next Insp: Jan 2016 (12 mo cycle)
Dr. Joh, Mr. Keierleber, Dr. Kim, Mr. Davis, Dr. Koh
Testing showed the Initial Designs Failed in Transverse Flexure and Local Stresses
Preliminary PI Girder Test Beam
Korean UHPC Design
# Mixing Proportions and Process

<table>
<thead>
<tr>
<th>Mixing orders</th>
<th>SC180 KICT MIX</th>
<th>Total (lb/5.5CY)</th>
<th>Location</th>
<th>Mixing instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-mix</td>
<td>4386</td>
<td>County</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cement</td>
<td>7310</td>
<td>Ready Mix Plant</td>
<td>Mix for 10 min</td>
</tr>
<tr>
<td>3</td>
<td>Wet Sand (MC = 4.2%)</td>
<td>8041</td>
<td>Ready Mix Plant</td>
<td>Mix for 5 min</td>
</tr>
<tr>
<td>4</td>
<td>Water</td>
<td>1710</td>
<td>Ready Mix Plant</td>
<td>Rotate at 10 RPM and move to county shop</td>
</tr>
<tr>
<td>5</td>
<td>SRA</td>
<td>73</td>
<td>County</td>
<td><strong>After adding all liquid additives,</strong>  &lt;br&gt;<strong>Mix for 5 min at 10 RPM then,</strong></td>
</tr>
<tr>
<td>6</td>
<td>Defoamer</td>
<td>5</td>
<td>County</td>
<td><strong>Mix for 5 min at Maximum speed</strong></td>
</tr>
<tr>
<td>7</td>
<td>Superplasticizer</td>
<td>140</td>
<td>County</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Steel Fiber (0.63 inch long)</td>
<td>362</td>
<td>County</td>
<td>Add for 7 min at 10 RPM</td>
</tr>
<tr>
<td>9</td>
<td>Steel Fiber (0.78 inch long)</td>
<td>723</td>
<td>County</td>
<td><strong>Add for 13 min at 10 RPM then,</strong> <strong>Mix for 2 min. st maximum speed</strong></td>
</tr>
</tbody>
</table>
Alex Building the forms
(Dr. Joh, Dr. Ryu, Haena)

May 19, 2015
County Constructed Forms
Pouring the Beams
Steam Curing in our yard

JUNE 23, 2015
County Post Tensioning
Limited Finish Work
Completed K UHPC Bridge
First in the Western Hemisphere UHPC Deck Overlay
Lessons Learned

• It Can be done on a 5% grade
• High Shear Mixers work well
• Grind After 4 days do not wait!!
• Dump the Buggy perpendicular to the bridge

• What I did not try
• Would a bull float work if sprayed with Vegetable Oil?
• Would a roller screed work?
• Would a Bidwell Deck Paver work?
Public Private Partnership Donated materials Jesup South