Precast full depth bridge deck

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TEAMWORK is key

Precast full depth bridge deck project participants

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Graduate Students

WisDOT
Stan Woods

Spancrete Ind
Roger Becker

Benesch
Jay W. Carter
Why use a precast bridge deck?

We want to reduce traffic disruption that is associated with bridge construction and maintenance projects. Speed up construction.

And, we can increase durability of the bridge deck by using high quality plant cast concrete. (improved safety)
Wisconsin Prototype Bridge:
US Interstate 39/90 - Door Creek Bridge

Let's look at:

1. the bridge requirements
2. developing a precast deck solution
3. construction of the bridge
Deck Replacement and Widening
83 ft x 64.5 ft,
On steel girders
One of twin structures - comparative study
Staged construction requires panels on \( \frac{1}{2} \) width to be in service while remaining panels are being placed.

What kind of a longitudinal joint can be used?
Staged construction:

Stage 1
Fully Prestressed Transverse

Stage 2
½ of Stage 1 Transverse Prestressing;
½ Post-Tensioning

Longitudinal Joint:
Splice Stage 2 Transverse Post-Tensioning Strands to Stage 1 Prestressed Strands

Blockouts for Shear Studs
Epoxy Overlay

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Developing a Precast Solution

We conducted a series of laboratory tests to insure performance and strength of the deck system.
System Testing - 1

- **Edge Strength of Panels** – Wheel load on edge of transverse joint
System Testing - 2

- Post-Tensioning Levels for Longitudinal & Transverse Joint - Joint capacity at different stress levels
System testing - 3

strength and stiffness of joint - cast when adj. deck is under cyclic flexing

3 specimens and tests
System Testing - 4

- Develop Connection Details Between Deck Panels and Steel Girder – Composite Behavior
Precasting Process

Spancrete Industries
Waukesha, WI
Fabrication at Spancrete
leveling bolts
post-tensioning ducts

longitudinal ducts

transverse ducts
transverse pre & post-tension

poured with self consolidating concrete

pretensioned strand
Bridge Construction

Zenith Tech, Inc.
Waukesha, WI
placing new panel onto girders
panel on leveling bolts, gap will be grouted later
sealing ducts

ducts at joint between panels, steel cables thru ducts tightened to pull panels together
grouting transverse joint
shear studs

steel studs welded to steel beams,
concrete poured into opening attaches the beam to the deck
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welding studs onto beams
Checking prestress - longitudinal

Red jack is used to pull steel cables, this pulls entire deck together and creates a compression in the deck – preventing future concrete cracks.

Load cell
grouting longitudinal ducts
checking grout consistency
grout stud pockets and haunches
surface layer of epoxy and quartzite grit applied for smooth surface
2\textsuperscript{nd} layer = epoxy + sand
Precast deck panels installed

bidder #1 ................ $65/ ft²
bidder #2 ................ $48/ ft²
## COSTS

### Surface finishing

<table>
<thead>
<tr>
<th></th>
<th>bid #1</th>
<th>bid #2</th>
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<tbody>
<tr>
<td>Grinding</td>
<td>$1.03/ft²</td>
<td>$2.25/ft²</td>
</tr>
<tr>
<td>Epoxy overlay</td>
<td>$5.25/ft²</td>
<td>$5.25/ft²</td>
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TOTAL BID COSTS

High cost of precast:  1.) special requirements of staged construction, the longitudinal P/T joint; use of P/T;
2.) surface grinding and overlay;
3.) contractor unfamiliarity; (same time sched. as CIP deck)