

Pouring Composite Decks on Prestressed Box Beams

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Introduction

After analyzing the leakage rates of every box beam structure we had, it was decided something needed to be done to better protect the box beams from the elements. In 2013, we began using county crew members to pour composite decks in hopes of finding a cost-effective solution to slow leakage rates and thus extend the life of the structure.

Projects

- BR 105-0.80: Superstructure: Prestressed Box Beam, spring of 2013.
- BR 65-1.85: Superstructure: Prestressed Box Beam, summer of 2013.

Preparations

Two mats of hot-dipped galvanized reinforcing were set on top of the deck.

Gaps between the beams were filled with jute rope & grout.

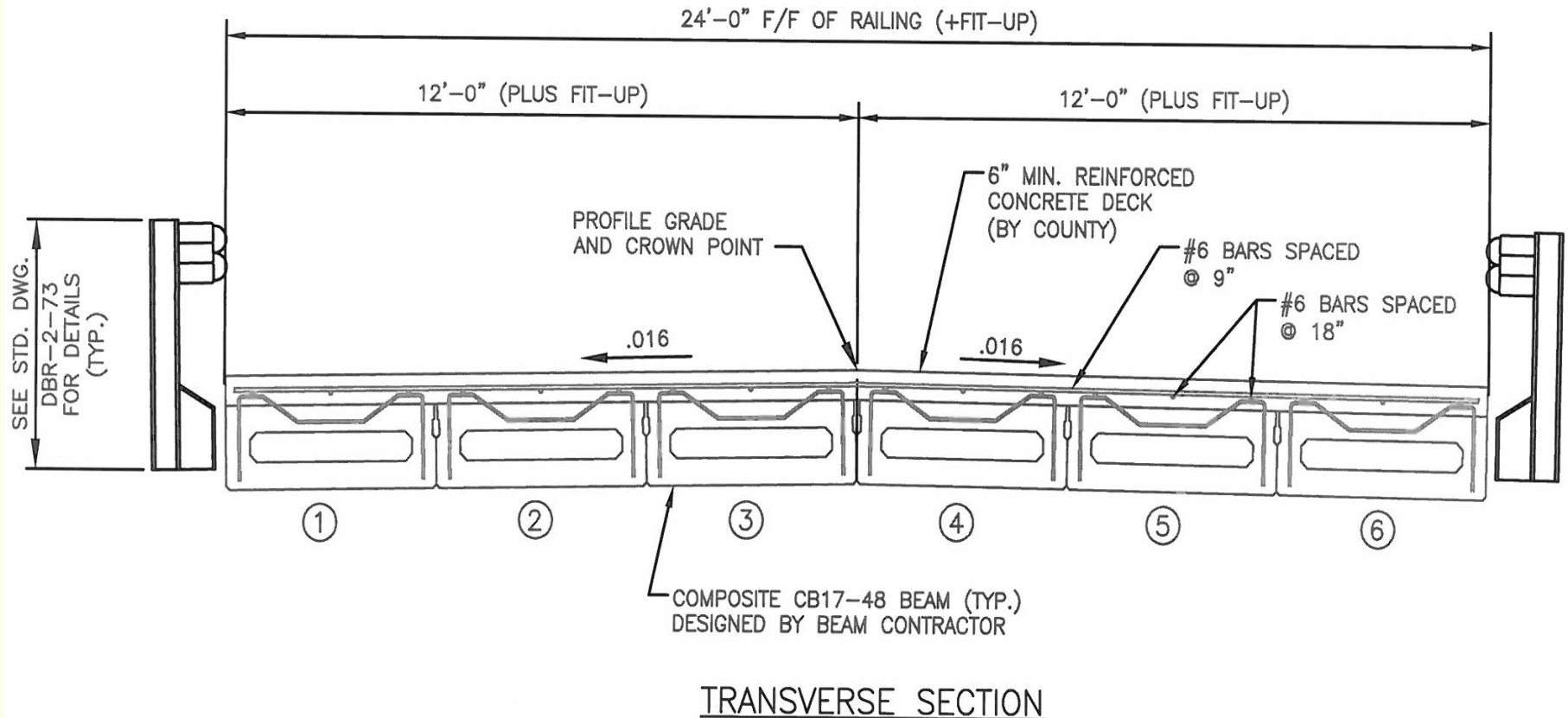
The overhang was constructed using metal brackets to support a 4-wide wooden platform using 2x4s for safety railing.

The deck surface was kept clean while both grouting and placing concrete.



Forms were sprayed with a form-release agent before the deck pour.

Transverse Section View of Both Decks



Grout

After setting the box beams, a flowable, high-strength grout was used between the beams in an effort to reduce the amount of cracking in the beam joints.



Grout Details

7000 PSI (water/cement ratio = 0.30)

QC Type II Cement (9 ½ bag)	893 lbs.
Concrete Sand – 703.02	2410 lbs.
Water	27.8 gal.
Accelguard 90 (as water)	<u>4.2 gal.</u>
Total Water	= 32 gal.
<i>(including any moisture in sand)</i>	

(3 gal. of this total to be accurately measured and added at the jobsite)

Brackets

“The C49JR is for use on smaller bridge beams...Has a vertical adjustment range of 16" to 28"...Can easily be mounted to steel beams, precast concrete beams and concrete box beams with the appropriate hanger devices.” – www.daytonsuperior.com

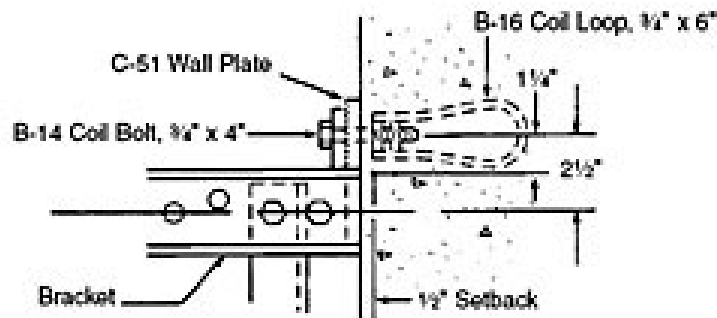
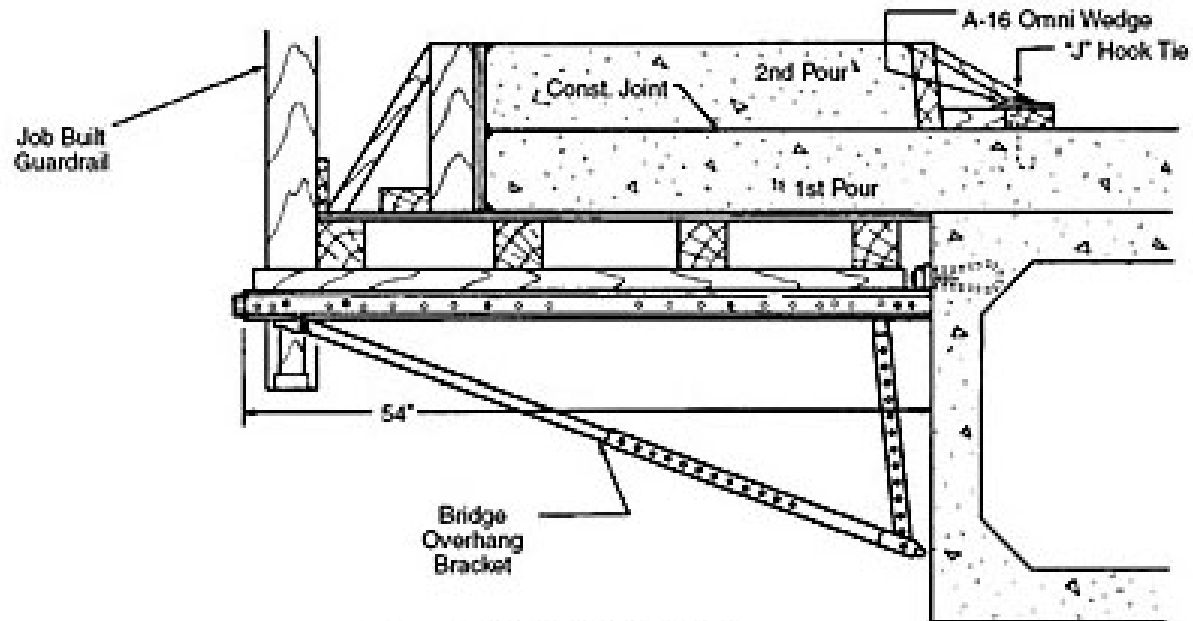
Brackets were spaced 6'3" inches apart & spanned a total length of 112'6" per side. Brackets were inserted between the spaces where the guardrail posts were going to be installed.

Total Cost: **\$5,452.53** (includes brackets, 2x4 rail receptacles, plate assemblies, coil bolts, and shipping for 52 units)

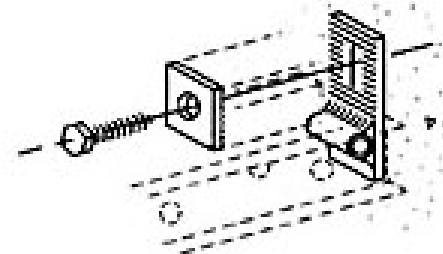
Brackets



Bracket Assembly



Wall Plate Assembly Detail

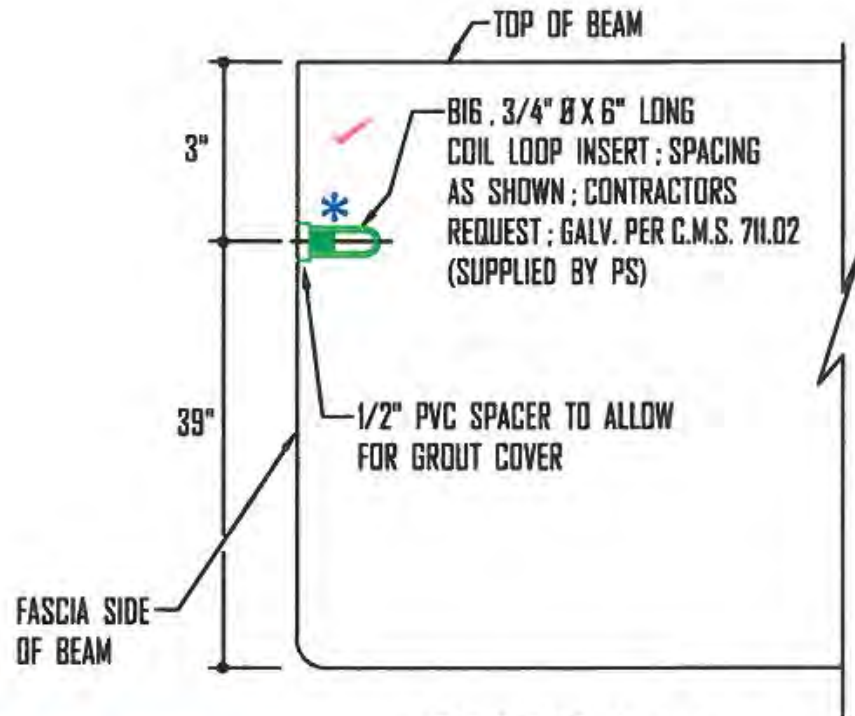


C-51 Wall Plate Assembly

Brackets



Forming Insert Detail



AM

***NOTE:**

FORMING INSERTS TO BE SPACED AS SHOWN, BUT ADJUSTED AS NECESSARY IN SHOP TO AVOID CONFLICT WITH STIRRUP BARS.

SECTION I-I
FORMING INSERT DETAIL

(NOT TO SCALE)
(SEE SHEET 4 FOR LAYOUT)

Field View of Bracket Assembly



Concrete Screed



BEEM Construction has provided the concrete screed on each project to date. County crew members assist in setting up and tearing down the screed. BEEM Construction provides 1 employee to assist with tear-down and set-up and also operates the machine during the concrete pour.

Concrete Screed



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Concrete Screed



Anchor used to pull screed by being attached to a winch on the screed. For this long of a project, the anchor had to be quickly moved from its current position to the end of the bridge mid-pour.



Surface Finishing



After concrete was placed, a spud vibrator and vibrating screed was used to consolidate the concrete. A bull float, brush, and tine was then used to finish the deck surface.

Using the tine for a finished texture along with the cross slope helps prevent water & ice accumulation.

Curing

Immediately after tining, pre-wetted burlap was placed over the entire deck and overhung the deck by one foot. Soaker hoses, which were connected to one of the county's 1600 gallon portable water tanks, were then placed on top of the burlap to keep the deck surface from drying out. These hoses were placed longitudinally, starting 6" from the crown and placed ~2' apart. Clear plastic tarps were placed over the soaker hoses and rebar was used to keep these tarps down.

Curing



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Curing



This burlap system was kept saturated for 3 days with an average of ~465 gal/day of water used.

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In-Depth: BR 105-0.80



Deck size: 42'-8" x 24'-0"

20 deg RF skew

Design year ADT: 681

Min deck thickness: 6"

Cross Slope: 0.016

Total concrete used on
deck: 24.5 CY

Weather conditions:

High: 71 F Low: 57 F

Humidity: 60

In-Depth: BR 105-0.80



Money was saved by using the steel beams from the old bridge and lumber from previous projects to build the walking planks.

In-Depth: BR 105-0.80



A crew of 6 people, which included the bridge supervisor, worked on the deck pour.



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Cost Breakdown: BR 105-0.80

- Screed services provided by Beem Construction: \$450.00
- Labor (for pour only): \$1,252.96
- Lumber for Deck Forms & Walking Platforms (reusable): Used lumber from previous county projects
- Rebar: \$3,141.40
- Grout: \$310.25
- Burlap rolls (reusable): \$320.00
- Concrete: \$3,711.75

Total Cost: \$9,186.36
\$8.97/SF

Finished Product: BR 105-0.80



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In-Depth: BR 65-1.85



Deck size: 117'-6" x 24'-0"

No skew

Design year ADT: 353

Deck thickness: 6" minimum

Cross Slope: 0.016

Total concrete used: 59 CY

Weather conditions: High: 78 F Low: 68 F Humidity: 98 Rain: 0.19"

A crew of 11 people, which included the bridge supervisor and 2 college interns, worked the deck pour.

In-Depth: BR 105-0.80



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Concrete Test Results

Used Class S, 5500, air-entrainment with Ipanex at 13.8 oz. per 100 lb. of cement.

CTL ENGINEERING PROJECT NO. 13020033WAP

FIELD DATA - ASTM C 31, C 138, C 143, C 172, C 173 or C 231, C 1064

CONTRACTOR: N/A

INSPECTOR: Client

CONCRETE SUPPLIER: Ohio Ready Mix, Inc.

WEATHER: Cloudy

CYLINDERS MADE BY: Made By Client

HIGH TEMP: 80°

MIX TYPE: Class S, 5500, air-entrainment, Ipanex

LOW TEMP: 65°

TICKET NO	TIME BATCHED / TIME PLACED	CU YD	AIR ¹ (%)	SLUMP ² (in)	TEMP (°F)	UNIT WT (pcf)	WATER ADDED (g)	SET NO	LOCATION OF TEST SAMPLE
53689	- / -		7.8 / -	3.00 / - / - / -	78			2	same as below

TOTAL YARDS:

1- Before/After Placement

HIGH INITIAL CURING TEMP:

2- Before/After Water /After Admix/ After Placement

LOW INITIAL CURING TEMP:

NOTE: Cylinders made by client.

LOCATION OF PLACEMENT: Project 65-.85, WO #5246

ELEVATION: Not Indicated

LAB DATA - ASTM C 39, C 617 or C 1231

SAMPLE NUMBER	DATE TESTED	AGE (days)	WEIGHT (lbs)	DIAM (in)	AREA (in ²)	LOAD (lbs)	COMPRESSIVE STRENGTH (psi)	TYPE OF BREAK
2 - A	8/15/2013	7	8.21	4.00	12.56	57990	4630	2po
2 - B	8/22/2013	14	8.24	4.00	12.56	63250	5030	2pf
2 - C	9/5/2013	28	8.28	4.01	12.62	69190	5490	Type 2-Fracture
2 - D	9/5/2013	28	8.24	4.00	12.56	66290	5280	Type 2-Fracture

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Cost Breakdown: BR 65-1.85

- Screed services provided by Beem Construction: \$675.00
- Labor (for pour only): \$2,209.09
- Brackets (reusable): \$5,432.53
- Lumber for Deck Forms & Walking Platforms (reusable): \$2,038.45
- Rebar: \$8,527.68
- Grout: \$715.00
- Burlap rolls (reusable): \$320.00
- Pump Truck: \$1,231.25
- Concrete: \$8,732.00

Total Cost: \$29,881.00
\$10.60/SF

Finished Product: BR 65-1.85



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Summary

The most recent poured-deck operation was on SIP metal forms on top of a steel beam superstructure in the summer of 2014.

Total average cost to install these decks was calculated to be \$10.16/SF.

We plan on continuing this operation as a cost-effective way to limit leakage rates and, while it's too soon to see the long term effects of this method, we are pleased with the results to date and plan on continuing to pour composite decks.

Questions?

**For more information please contact
Dan McMillen, Bridge Supervisor,
at 937-592-2791.**

**This presentation can be found online at:
www.loganco.co.logan.oh.us/engineer/**