USE OF PRECAST-PRESTRESSED CONCRETE FOR BRIDGE DECKS

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USE OF PRECAST-PRESTRESSED CONCRETE FOR BRIDGE DECKS

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Interim Report
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by

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The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Purdue University
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INTRODUCTION

Concrete bridge deck repair is a problem on many highway bridges. The concept of a precast, prestressed concrete bridge deck can be applied to replacement decks for old bridges as well as decks for new bridges.

The use of precast prestressed concrete decking should increase the durability of the deck through better concrete control under plant placement conditions. It will minimize bridge down-time for deck replacement on old bridges and reduce deck placement time for new bridges.

A completed deck would consist of precast concrete pieces, each having a minimum thickness of 6", as long as the transverse dimension of the bridge, and at least four feet wide. The pretensioned slabs are placed transversely to the bridge girders and clamped to the top flanges of the girders by means of spring clips and bolts screwed into preset anchors in the concrete. A pretensioning stress is applied in the longitudinal direction of the slabs at a level intended to maintain compression stress in the concrete under full design load bending stresses. The concrete slabs are post-tensioned in the longitudinal direction of the bridge with cables strung through preformed slab ducts. A thin neoprene sheet placed between the slabs minimizes the stress concentrations due to surface irregularities. The neoprene sheet and the nominal post-tensioning stress of approximately 80 psi help to prevent water movement through the joint. Figure #1 shows a typical slab section used on a deck replacement near Bloomington, Indiana.

The following report is a continuation of research by James H. Ford . A slab joint configuration proposed by Ford was laboratory tested together with a joint sealant. Both the joint configuration and the joint sealant performed satisfactorily in the laboratory.

A replacement deck for an existing bridge (See Figure #2) on SR 37 near Bloomington, Indiana, and a deck for a new bridge (See Figure #3) on SR 140 near Knightstown, Indiana, were installed during the summer of 1970 using the precast, prestressed concrete slabs. Both bridges are being periodically

monitored through the use of strain gages mounted on the steel beams and the precast slabs. To date both bridges have performed satisfactorily.

FIELD INSTALLATIONS

Bloomington Bridge

During the spring and summer of 1970, the precast deck was installed on two Indiana state highway bridges. The two lane bridge on SR 37, 3 miles north of Bloomington, is a single span steel pony truss 125 feet long over Beanblossom Creek. Construction was started on June 1, 1970 with the removal of the old decking using a pneumatic impact hammer powered by a 350 psi air compressor mounted on a tractor backhoe. After all the old concrete reinforcing steel was removed, the top flanges of the stringers and floor beams were sandblasted and a coat of epoxy was applied with a brush. The top flanges were cleaned in order that a layer of epoxy mortar could be placed on the stringers. This was necessary for proper bearing of the new precast slabs on the steel stringers, since the roadway crown had been built in with the stringers. It was calculated that a 2" layer of epoxy mortar would have to be placed on the outside stringers to prevent cracking of the precast slabs due to the existing crown in the stringers. It was decided that 2" of mortar was too thick and that the outside stringers would be raised 2" and a 5/8" thick continuous plate would be tack welded to the stringer next to the outside one on both sides. These adjustments, coupled with the existing stringer crown, allowed the precast slabs to deflect to conform to the adjusted contour without cracking. Since the top flanges of the stringers were higher than the floor beam flanges, steel shims were tack welded on the floor beams to the same elevation as the top of the stringers framing into the beam.

The slabs were cast by Construction Products Corporation of Lafayette, Indiana. The specified concrete strength was 5000 psi at 28 days and each slab was lightly broomed longitudinally for added skid resistance. A typical slab (See Figure #1) contained twelve 7/16" diameter 270K strands with an initial pull of 21,700 lbs. Each slab was 32 feet long and 6 1/4 inches

deep. After each slab was detensioned and removed from the form, a 1/16" x 4 3/4" x 32 ft neoprene strip was bonded to the male keyway. Just before the slabs were placed on the bridge a 3/8" diameter x 32' long polychloroprene flexible rod was bonded to the male keyway to serve as a back-up material for the joint sealant.

The slabs were delivered to the bridge site by trucks with 4 slabs per truck. The slabs were lifted directly from the truck and placed on the bridge using a truck-mounted crane. On the first day 21 slabs were set in 7 1/2 hours. On July 1 the remaining 12 slabs were placed and the entire deck was post-tensioned.

Slab placement began at the north end of the bridge and proceeded southward. Figure 4 shows the placing operation. After four slabs had been placed, 3 strands of post-tensioning cable were fed through the slabs, one at each edge and one in the middle of the slabs. A force of 2000 lbs. was then applied to each of the three cables to snug up the slabs. This process was repeated after another four slabs were placed until all the slabs were placed.

After each slab was in place, the slab was lightly fastened to the two outside stringers and also to the middle one using 115-RE-F railroad clips and 3/4" bolts. The bolts were not tightened so that during the post-tensioning stage the slab could move longitudinally, but would not buckle.

After all slabs had been placed, the remaining five cables were fed through the slabs. All eight 1/2" diameter 270 kip post-tensioning cables were encased in a watertight tubing. The post-tensioning was done symmetrically using two hydraulic jacks, one of which was a manually operated ram and the other a motor driven ram. An initial force of 16,000 lbs. was applied to each of the 8 cables using the two jacks symmetrically. During the initial post-tensioning, the truck crane that was used to place the slabs was parked at the north end of the bridge to keep the first 8 or so slabs from developing too much compressive force in them since they were fairly tight to begin with.

After the 16,000 lbs. was applied to each of the eight cables the truck crane was driven up and down the center of the bridge. This was done to release any slabs that had somehow locked up on the stringers. The length of the bridge shortened by $3/8$ " after this was done. The truck crane was then driven off the bridge and the final post-tensioning force of 28,900 lbs. was symmetrically applied to all 8 cables. One of the problems encountered was that the chucks on some of the post-tensioning cables would not release immediately during the final tensioning increase from 16,000 lbs. to 28,900 lbs. The chucks had been "set" in the strand and had the initial force level been higher than 16,000 lbs., it is doubtful whether the chucks would have released upon re-tensioning.

The only problem which arose during the actual slab placement came in placing the individual slabs which were directly above a floor beam. A block out had been detailed in the ends of the slab to accommodate connection angles protruding from the top of the floor beam. The placement difficulty was due to the fact that the block out at each end of these slabs was not wide enough. The detail of the formed blockout did not allow for enough "slack" in the slab placement. This caused the slab to rest on the top of two angles connecting the top of the floor beam to the vertical web member. The difficulty was remedied by burning off a piece of each angle which was protruding at each end of the floor beam.

Following the final post-tensioning operation all of the clips were bolted to the flanges. The clips that were supplied could not be drawn up against the lower part of the top flange so the offset spacer of each clip had to be burned off. The bolts were greased and then tightened with an electric torque wrench to approximately 50 foot - lbs. of torque.

The joints between the slabs were cleaned with an air jet and brushed in preparation for applying the joint sealant. After the joint was cleaned, a DuPont primer VM-222 was applied to the walls of the joint. The primer was allowed to dry and

the joint material was placed. Two types of polyurethane elastomeric joint sealant were used. This type of joint material could be used since the relative movement at the joints is minimized due to the post-tensioning of the slabs. On the first four joints at the south end of the bridge Dupont 829-915 Imron was used. This is the same sealant used in the laboratory tests on joint sealants. The material requires an approximately square cross-section for best results, necessitating the use of the previously described polychloroprene rod near the top of the joint. The sealant was placed using a caulking gun and then tooled into the joint with a soapy finger. The sealant used on the remaining joints had essentially the same composition, but was in liquid form. This was applied by pouring it into the joint. Since it was a liquid it seeped past the beaded strip and the joint had to be filled several times. One problem that was encountered was that air became entrapped in the sealant and expanded, pushing some sealant out of the joint and forming a permanent bubble above the surface of the slabs. Under traffic this bubble wore off leaving a void in the seal.

In places where the slabs did not directly bear on the steel beams, epoxy mortar was used to fill up the voids. The tuck pointing was done using a small masonry trowel to force the epoxy mortar into the spaces between the steel and the slab bottoms.

The bridge was opened to traffic on July 16, 1970. The contract specified that the bridge would be closed for thirty days but due to the extra work of raising the stringer elevations and a delay in the delivery of the slabs, the bridge was opened fifteen days behind schedule. Table #1 shows the time spent on the various construction operations.

Knightstown Bridge

The second experimental field installation is on Indiana State Road 140 over the Big Blue River just south of Knightstown. The structure is a three span continuous steel beam bridge having spans of 70'-70'-60'. The deck consists of 52

individual slabs, 38'-4" wide, positioned on steel beams spaced six feet on centers. The slabs, unlike the Bloomington slabs, have a built in crown, the thickness of each slab varying from seven inches at each end to ten and one-half inches at the center. Figure 5 shows an elevation and cross section of a typical slab. The keyway dimensions are identical with those used on the Bloomington bridge. The neoprene sheet between each slab is 1/16" x 6", bonded to the male keyways over the full length of each slab. The slab was anchored to the beams with 3/4" diameter bolts and 115 - RE-F railroad clips. As in the Bloomington installation, a flexible polychloroprene back-up rod was used at a distance of 3/16" below the top of each slab. A typical slab contained eight 1/2" diameter 270 kip pretensioning strands with an initial pull of 28,900 lbs. The top strands were harped at the center to follow the crown of the slabs and to maintain a uniform compressive stress across the slab section. The concrete strength at 28 days was specified at 5000 psi and the surface was broom finished. The Knightstown slabs were also manufactured by Construction Products Corporation of Lafayette, Indiana.

The construction of the bridge was started in the early spring of 1970. After completion of piers and erection of beams, the first 15 precast slabs were placed on June 24 and on June 25 the remaining 37 slabs were placed and post-tensioned. Figure 6 shows the slab placement operation. A problem which arose during the post tensioning operation was the appearance of about eight cracks running transversely to the slabs. This was due to the irregularities in the slab crown section which caused a poor fit between adjacent units. The post-tensioning operation caused a bending stress in the slabs which fit poorly, resulting in the cracks. Due to the fact that water could seep down into the cracks and rust the pretensioning cables, a coat of epoxy was applied to the bridge in order to seal the cracks. Integral curbs were poured in place on the bridge deck. The bridge was opened to traffic on August 6, 1970.

Field Testing

In order to interpret the results of periodic static load tests, strain gages were attached to both the precast slabs and the supporting steel structure at Bloomington and only to the precast slabs at Knightstown. Tests have been run on both structures since construction was completed. In all cases, the strain gages were positioned so as to attempt to record maximum stress under working loads. Figure 7 shows the Bloomington gage locations and Figure 8 shows the Knightstown gage locations.

On the Bloomington bridge there are a total of eighteen steel gages and forty-five concrete gages. The steel gages are Microdot type SG 189-6 having a gage factor of $1.80 \pm 3\%$, a gage length of 1", and a nominal resistance of 120 ohms. The concrete gages are Micro-measurement foil gages with a gage length of two inches, a resistance of $120 \text{ ohms} \pm 0.2\%$ and a gage factor of $2.11 \pm 0.5\%$.

Prior to mounting each steel gage, the surface was prepared using a disk sander to remove all paint and pits in the steel. The surface was then cleaned with acetone and the gage was mounted using a resistance type welder. The concrete surface was prepared by sanding followed by cleaning with acetone. A seat of Bean BR-104 epoxy was then applied and allowed to dry. The gage was then attached to the slab using additional BR-104 epoxy.

The lead wires from both the steel and concrete gages were protected by EMT thinwall conduit which took the wires to a central watertight junction box. Inside the junction box each gage wire was soldered to a female 52 pin Amphenol connector with each connector accommodating ten strain gages. During a load test a male 52 pin connector is attached to the female connector in the junction box and the various strains are recorded using a data acquisition system.

At Knightstown, the forty concrete gages were identical to those used on the Bloomington bridge. They were installed in the same manner and all gages are wired to four 52 pin Amphenol connectors in a junction box as shown in Figure 9.

The equipment used to record strain readings during a test was manufactured by Matrix Corporation of Indianapolis, Indiana and is shown in Figure 10. The data acquisition system will record the strains from one hundred gages in a matter of seconds. Before a test is made the acquisition system is connected to the junction box using cables, each of which contains wiring for 10 gages. The end of each cable is attached to the Amphenol connector in the junction box and the other end is plugged into the data acquisition system. Gage zero readings and calibration data are taken, prior to the test load application.

Static Load Testing

In order to run a load test, an Indiana State Highway Commission tandem dump truck (Figure 11) is loaded with material, usually sand, and both the front axle and tandem axle weights are recorded. The strain gages are attached to the data acquisition system, the bridge is closed to traffic, the test truck is positioned on the bridge and a record is made of the strains from all gages. The truck is then directed to a new position and the process repeated. Each truck position is selected so as to attempt to give maximum strain in as many strain gages as possible. Figure 12 shows the test truck wheel dimensions. Figure 13 shows the truck positions used on the Bloomington bridge and Figure 14 shows the truck positions for the Knightstown bridge.

A static load test was performed on the Bloomington structure on June 1, 1970, prior to removal of the original bridge deck. The purpose of the test was to record steel strains with the original deck in place for later comparison with steel strains obtained after reconstruction. Fourteen (of the final nineteen) steel strain gages were fastened to the stringers and floor beams. A strain indicator box and two ten channel switching units were used to record the strains. The test truck was an Indiana State Highway Commission tandem dump #1536 with a front axle weight of 12,050 pounds and a tandem axle weight of 31,640 pounds.

The truck was positioned over the points shown in Figure 13 and the strains recorded for each truck position. The stresses obtained by multiplying measured strains by a steel elastic modulus of $29(10)^6$ psi are shown in Table 2.

Static Test Results

The main purpose for running load tests on the bridges was to determine if there was any significant change in stresses over a period of time. Since the Bloomington bridge had much higher traffic loads than the Knightstown bridge, the tests at Bloomington were more frequent. The first few tests were spaced at a few weeks intervals and then changed to one month intervals. The Knightstown bridge was tested at two months intervals.

During each test the test truck axle weights and its identification number were recorded along with the weather conditions. The data print-out was punched on IBM cards along with test day, test number, bridge location, truck weight and identification number, and the weather conditions. A computer program was written to interpret the data and the computer print-out included the original input data plus the measured strains and computed stresses for each truck position. A representative portion of this data is shown in Tables 3 and 4. Table 3 includes the results from eight of the sixty-three gages at Bloomington and Table 4 contains the results from six of the forty strain gages at Knightstown. The tabulated stresses in these tables are put into graph form in Figures 15 through 21 for the purpose of showing the stress variation with time. Figures 15 through 18 show the results for the Bloomington Bridge gages and Figures 19 through 21 show the results for the Knightstown Bridge gages.

It can be seen from the graphs that the stresses for most gages vary considerably over a period of time. In order to see how reliable the test data were, two complete tests (4 and 4A) were taken consecutively at Bloomington on January 14, 1971. The same truck and truck positions were used and the resulting stresses are shown in Table 3. Differences in the results from the two runs indicate the influence of such things as exact truck positioning on the results.

At this point in the bridge monitoring program, there seems to be little definite change in the stress magnitudes. Additional data obtained during the remaining testing period should allow more definitive conclusions on this point.

Bridge Physical Conditions

Bloomington Bridge

The bridge has been in service for two years since the precast deck was installed and it has performed very well although some problems have been encountered. The problems that developed were not due to the concept used in the design of the precast bridge deck.

After the bridge had been opened to traffic, the north approach was resurfaced in order to remove a dip in the pavement. During the resurfacing a steel wheeled roller was driven onto the north end of the bridge. The high resultant pressures from the applied line loading cracked a few of the top concrete portions at the female joints. After a few weeks traffic pressures worked out the cracked concrete joints. Repair of these joints was done using quick-setting epoxy mortar filling, following joint cleaning. DuPont "Imron" joint material was then used to reseal the joint. One-way traffic was maintained on the bridge during the repair operation.

Another problem that arose was that some of the bolts clamping the slabs to the steel beams worked loose and had to be tightened. During construction a torque of 50 ft. lbs. was applied to each bolt and it was discovered that this was not sufficient. Approximately three quarters of all the bolts were retightened using a torque of 125 ft. lbs. after making sure that each bolt was greased. None of these bolts have since worked loose.

After two years of traffic some of the joints have started to leak. As was previously stated, two types of joint material were used and DuPont's "Imron" sealant has proven to be superior to the liquid polyurethane sealant. Extreme care should be taken to insure that the manufacturer's directions are followed during the application of the joint material.

DuPont's requirement is that the depth of the sealant be equal to the width of the joint. This requirement was not followed at all locations, consequently the "Imron" has worked out of some of the joints.

Knightstown Bridge

The main problem encountered with the Knightstown bridge was due to irregularities in the joint widths of the top of the slabs. When the slabs were post tensioned together, there were locations where the indicated 1/4 inch clearance at the tops of the joints did not exist. There were no immediate effects except that the joint leaked since no joint material could be placed in the joint. A few months after the bridge was opened, the concrete around the closed joints spalled off. The forms used to cast these slabs had additional metal strips tack-welded to the tops of the metal forms, in order to form the crown sections. Irregularities due to warping of these strips caused bad fit of the slabs in the field. In the future the sides of the forms used to cast the slabs should be parallel and as straight as possible.

SPACING FOR TWO ROWS
OF 6-0.438" ϕ 270^K STRAND

FIGURE NO. 1 - TYPICAL PRECAST
SLAB SECTION and JOINT
MATERIAL DETAIL
BLOOMINGTON BRIDGE

Figure #2. Bloomington Bridge SR-37

Figure #3. Knightstown Bridge SR-140

Figure #4. Precast Slab Placements at Bloomington

ELEVATION

NOTE: SEE FIGURE NO. 1 FOR
KEYWAY DIMENSIONS

SECTION

FIGURE NO. - 5 TYPICAL ELEVATION AND CROSS SECTION
OF THE KNIGHTSTOWN BRIDGE SLABS

Figure #6. Knightstown Slab Placement

NOTES: ALL STEEL GAGES ARE CIRCLED. ALL ARE POSITIONED ON THE BOTTOM OF THE BOTTOM FLANGE - GAGE ORIENTATION AS SHOWN. ALL CONCRETE GAGES ARE POSITIONED ON THE BOTTOM OF THE SLABS AS SHOWN. GAGE ORIENTATION AS SHOWN

FIGURE NO. 7
PLAN - SHOWING GAGE LOCATIONS
BLOOMINGTON BRIDGE

SCALE: HOR - 1" = 3'
VER - 1" = 4'

Figure #9. Junction Box at Knightstown Bridge Showing Strain Gage Hook-Up from the Connectors to the Data Acquisition System

Figure #10. Data Acquisition System with the Switching Unit to the Left and the Strain Recorder to the Right

Figure #11. Typical Test Truck

FIGURE NO. 12
TYPICAL TEST TRUCK DIMENSIONS

POSITIONS: 1,2,3,4,5,6,11,12 - TRUCK FACING SOUTH WITH LEFT SET OF TANDEM
LOCATED SYMMETRICALLY OVER THE POSITION.

7,8,9,10 - TRUCK FACING SOUTH WITH RIGHT SET OF TANDEM LOCATED
SYMMETRICALLY OVER THE POSITION.

NOTE: SEE FIGURE NO. 12 FOR TEST TRUCK DIMENSIONS.

FIGURE NO. 13
TEST TRUCK LOADING POSITIONS
BLOOMINGTON BRIDGE

TEST TRUCK IS IN NORTH-BOUND LANE FACING NORTH WITH THE LEFT SET OF TANDEMS LOCATED SYMMETRICAL OVER THE POSITION POINT,
-SEE FIGURE NO.12 FOR TEST TRUCK DIMENSIONS.

FIGURE NO. 14
TEST TRUCK LOADING POSITIONS
KNIGHTSTOWN BRIDGE

FIGURE NO. 15

PLOT OF STRESS VS. TIME FOR GAGES 25 & 36

TRUCK POSITION NO. 3

BLOOMINGTON BRIDGE

FIGURE NO. 16 PLOT OF STRESS VS. TIME FOR GAGES 39 & 40
TRUCK POSITION NO. 3
BLOOMINGTON BRIDGE

FIGURE NO. 17 PLOT OF STRESS VS. TIME FOR GAGES 50 & 52
TRUCK POSITION NO. 3
BLOOMINGTON BRIDGE

FIGURE NO. 18
PLOT OF STRESS VS. TIME FOR GAGES 55 & 56
TRUCK POSITION NO. 3
BLOOMINGTON BRIDGE

FIGURE NO. 19 PLOT OF STRESS VS. TIME FOR GAGES 26 & 28
 TRUCK POSITION NO. 13
 KNIGHTSTOWN BRIDGE

FIGURE NO. 20 PLOT OF STRESS VS. TIME FOR GAGES 29 & 30
TRUCK POSITION NO. 13
KNIGHTSTOWN BRIDGE

FIGURE NO. 21 PLOT OF STRESS VS. TIME FOR GAGES 35 & 36
 TRUCK POSITION NO. 14
 KNIGHTSTOWN BRIDGE

TABLE 1

TIME SPENT FOR VARIOUS OPERATIONS - BLOOMINGTON BRIDGE

<u>Operation</u>	<u>Time Spent</u>
Removal of old deck and the north and south approaches	5 days
Sandblasting stringers, floor beams - applying epoxy coating	7 days
Raising outside stringers, tack welding plate to stringers and floor beams	3 1/2 days
Placing precast slabs and post tensioning	2 days
Bolting slabs to stringers	5 days
Joint preparation and applying joint sealant	5 days
Epoxy mortar tuck pointing between the stringers and floor slabs	3 days
Expansion joint installation	2 days
Forming and pouring mudwalls	4 days
Forming and pouring approaches - guardrail installation	5 days
No work due to delivery delays	4 days
No work due to weather conditions	1 day

Table 2
Static Load Test Stresses (psi) With Original Deck in Place
Bloomington Bridge

Gage No. *	Test Truck Position**											
	1	2	3	4	5	6	7	8	9	10	11	12
45	1540	29	1189	290	87	348	1566	377	58	-145	0	0
46	3306	-406	1885	377	-232	609	3364	986	174			
47	3219	-145	2871	725	-145	841	1334	464	-87	-58	-58	-29
48	1247	-29	1363	261	58	290	783	232	0	58	29	0
49	2262	-58	2987	551	-58	464	348	217	0	-116	0	0
50	928	-174	2088	493	-145	290	261	261	116	58	203	-174
51	348	-29	1247	406	0	290	348	406	319			
52	1392	3654	754	580	2146	696	1276	609	3422	493	406	290
53	1972	1392	1363	1653	1015	2436	2146	2523	1566	377	290	174
54	551	2610	493	638	2436	696	145	145	1029	290	58	290
55	58	609	58	174	1044	174	116	145	203	0	58	0
56	1566	1160	1537	1885	1189	1885	1102	1276	870	319	290	290
57	667	1624	1305	609	3074	406	290	290	522	203	522	725
58	319	667	348	522	1044	522	145	319	348	406	203	493

*See Figure 7 for gage location

**See Figure 13 for Test Truck Positions
Stress units are psi, tension is positive.

Table 3

Bloomington Bridge
Stresses from Selected Gages for the Static Load Tests

Test	Date	Weather	Temp. (°F)	Truck Wt. (lbs.)	Gage 50	Gage 52	Gage 55	Gage 56	Gage 25	Gage 36	Gage 39	Gage 40
1A	6-1-70	Cloudy	70	43,690	2088	754	58	1537				
1	11-12-70	Cloudy	40	44,900	3208	582	1107	2131	168	256	137	186
2	11-19-70	Cloudy	45	43,000	3233	554	905	2187	151	221	110	126
3	12-17-70	Cloudy	35	48,400	3317	536	928	2116	156	217	100	88
4	1-14-71	Cloudy	28	47,300	2936	800	1147	1808	139	188	111	129
4A	1-14-71	Cloudy	28	47,300	3010	704	1031	1971	157	193	123	120
5	2-18-71	Cloudy	40	48,500	3015	807	1058	2169	158	203	135	156
6	4-6-71	Clear	55	58,500	2974	827	1006	2154	257	439	143	
7	5-6-71	Rain	61	43,300	2921	669	1154	2034	171	297	139	121
8	6-3-71	Clear	84	46,500	3252	628	1108	2139	199	535	127	137
9	7-1-71	Clear	85	53,000	3206		331	1367	174	394	68	76
10	7-29-71	Clear	80	53,300	3126	271	781	2079	183	363	82	11
11	9-9-71	Clear	81	51,000	2659	165	436	1511	114	264	26	30
12	10-7-71	Clear	54	54,500	2949	448	809	2097	153	192	59	58
13	11-11-71	Clear	58	45,000	2813	322	1231	2429	160	212	70	72
14	12-9-71	Rain	39	55,200	2698	252	1294	1966	149	169	100	156
					Steel Gages				Concrete Gages			

*All stresses were corrected by proportioning the truck loadings using the truck loading for Test #1 as a base. Stresses correspond to Truck Position #3.

Table 4

Knightstown Bridge
Stresses from Selected Gages for the Static Load Tests

Test	Date	Weather	Temp. (°F)	Truck Wt. (lbs.)	Stress* (psi)				
					Gage #26	Gage #28	Gage #29	Gage #30	Gage #35
1	3-4-71	Clear	26	53800	128	242	201	248	232
2	4-6-71	Clear	50	48100	122	231	154	208	183
3	5-6-71	Rain	61	52600	86	195	132	202	162
4	6-3-71	Clear	78	49600	124	237	187	206	212
5	7-28-71	Rain	70	54300	126	234	171	210	191
6	10-6-71	Clear	65	55000	120	246	186	219	216
7	12-9-71	Rain	39	53000	181	294	266	252	275
8	1-20-71	Rain	52	54800	82	160	134	170	197

*All stresses were corrected by proportioning the truck loadings using the truck loading for Test #1 as a base. Stresses correspond to Truck position #14.

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16. Abstract A precast, prestressed concrete bridge deck system has been designed to be used either on new bridges or for reconstruction of deteriorated decks. The report describes the construction activities involved in the use of the prestressed plank on two installations in Indiana. Actual time required to place the elements and post-tension them together was two days for each bridge. Load tests have been made on both bridges at intervals since their construction. Results have indicated no significant changes in deck performance during this period.			
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