

Miscellaneous Structural Engineering Services
Sanibel Bridge Beam Inspections

Bridge No. 124115 - Structure B Sanibel Causeway over San Carlos Bay
2nd Structure South of Toll Plaza

Prepared For:
Lee County

Prepared By:
T.Y. Lin International

July 2013



This report evaluates and makes recommendations of bridge maintenance for Bridge No. 124115 (Structure B) Sanibel Causeway over San Carlos Bay 2nd structure from toll plaza. Solicit No.: CN-11-17 Contract No.: 5850



BRIDGE INSPECTION REPORT

PREPARED FOR: Lee County

SUBMITTED BY: T. Y. Lin International

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REPORT IDENTIFICATION

Bridge No. 124115

Bridge Name: Structure B Sanibel Causeway over San Carlos Bay

Location: 2nd Bridge South of Toll Plaza

- | | | |
|---|---------------------------------|---|
| NO
<input checked="" type="checkbox"/> | YES
<input type="checkbox"/> | This bridge contains fracture critical components. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | This bridge is scour critical. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | This report identifies deficiencies which require prompt corrective action. |

Type of Inspection: Routine Interim Special Evaluation – Beams Only

Field Inspection Date: Above Water 07/23/2013 Under Water N/A

Name of Inspector/Diver	Initials	PE Number	Certified Bridge Inspector Number
Charles W. Elliott (Lead)	<i>CWE</i>		00363
Kenneth F. Ulrich	<i>KFU</i>		00288
Farzin Zafarani	<i>FZ</i>	59558	
Sandra Buitrago-Gutierrez	<i>SBG</i>		

Reviewing Bridge Inspection Supervisor

Name Boon Chong P.E. PE Number 48156 Initials BCE

Confirming Registered Professional Engineer

Name Boon Chong P.E. PE Number 48156 Signature *[Signature]* 10/1/2013

Lee County Condensed Bridge Inspection Report

Structure Name: Structure B Sanibel Causeway over San Carlos Bay

Location: 2nd Structure South of Toll Plaza

Prepared For: Lee County Transportation Department

Prepared By: T.Y. Lin International

Overall NBI Ratings

Note: The following ratings are from the Routine Inspection Report dated 11/16/2011.

Only the Superstructure was evaluated during this inspection. No deficiencies were observed to warrant a change of the overall Rating of 7.

DECK = 7 Good

SUPERSTRUCTURE = 7 Good

SUBSTRUCTURE = 8 Very Good

CHANNEL = 7 Minor Damage

PERF. RATING: Good

SUFF. RATING: 79.0

HEALTH INDEX: 99.3

Note: Refer to chart on next page for Numerical Condition Rating Definitions

Scope:

The purpose of this Special Six Month Reevaluation Inspection since the January 2013 Special inspection was to review and document changes in crack quantities, length and width increases in the Beams/Girders of the Superstructure. The beam evaluations were performed over three days using the 50ft. Under Bridge Inspection truck by two CBI or PE qualified inspectors.

Summary:

First inspection was performed in January 2013 which was during the cooler months. This inspection was performed during warmer conditions with the average temperature being in the high 80 to 90's. This may account for some of the increase in crack quantities and crack length increases.

The beams are in overall good condition. Several beam webs have diagonal cracks which have a shear direction appearance. These cracks primarily extend from the bearing areas and/or near the beam ends and extend south or north in direction. The general appearances of the cracks in the exterior beams which are painted make the condition look worse than the cracks in the interior faces. The more significant lengths and any additional length of cracking were marked with a permanent marker and dated 7/13.

Recommendations:

T. Y. Lin. recommends continuing to monitor the cracks for any increase or growth in crack size. If findings show an increase in severity after the next inspection then a repair recommendation would most likely be warranted.

NUMERICAL CONDITION RATING DEFINITIONS

Rating	Condition Category	Description
9	Excellent	
8	Very Good	No problems noted.
7	Good	Some minor problems. Minor maintenance may be needed.
6	Satisfactory	Structural elements show some minor deterioration. Major maintenance is needed.
5	Fair	All primary structural elements are sound but may have minor section loss, cracking, spalling, or scour. Minor rehabilitation may be needed.
4	Poor	Advanced section loss, deterioration, spalling, or scour. Major rehabilitation may be needed.
3	Serious	Loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present. Repair or rehabilitation required immediately.
2	Critical	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	Imminent Failure	Major deterioration or section loss present in critical structural components, or obvious loss present in critical structural components, or obvious vertical or horizontal movement affecting structural stability. Bridge is closed to traffic, but corrective action may be sufficient to put the bridge back in light service.
0	Failed	Bridge is out of service and is beyond corrective action. Replacement necessary.

Condensed Inspection Report

Pontis Element 109 - PS Concrete Girders:

NOTE: Several cracks throughout all spans were marked with a permanent black marker and dated 07/13 for future reference. A few of the previously marked cracks in the 01/23/2013 inspection have increased in length; however, the cracks did not grow in width.

The following conditions are typical throughout all spans.

- ✓ Exterior faces of Beams 1 and 4 are painted. There are some isolated areas of peeling paint, mostly adjacent to the cracks along the bottom flanges. The worst condition is on west face of Beam 6-1 at north end. Refer to Photo 1.
- ✓ Intermittent length longitudinal cracks in bottom flange less than 0.01in. wide throughout. These cracks are most evident in the exterior beams possibly from exposure to adverse weather conditions. Refer to Photo 2.
- ✓ Transverse and longitudinal cracks in underside face of top flange up to full flange width (24in. long) x 0.010in. wide with some having light efflorescence. Refer to Photo 3.
- ✓ Horizontal cracks in beam webs up to 16in. long x less than 0.010in. wide extending from beam ends typically located near mid-height.
- ✓ Intersecting diagonal cracks in beam webs typically in or near the bearing area of the bottom flange extending up and away giving them a shear crack appearance. These cracks are typically up to 5ft. long x less than 0.010in. wide. Adjacent to these cracks are multiple shorter length diagonal, horizontal and some pattern/map style cracks, all being less than 0.010in. wide. Random beams have longer more evident diagonal/shear cracks up to 10ft. long and less than 0.010in. wide. Refer to Photos 4 and 5. Also refer to the charts on Pages 5 and 6 for crack quantities and the sketch on Page 7 showing typical cracks locations.

The following is incidental to the beams:

- ✓ The poured beam end diaphragms have multiple cracks up to 0.020in. wide with some minor spalling. No exposed steel was evident.

Pontis Element 109 - PS Concrete Girders (Continued):

Non-Typical findings:

- Beam 1-4 east face of web at north end in addition to the typical diagonal/shear cracks has one crack which extends 92in. from the bottom of the beam end/bearing area up and across the bottom face of the top flange.
- Beam 6-4 west face of at north end has a 81in. long x 0.010in. wide diagonal crack in the web which turns longitudinal along the top flange juncture. Refer to Photo 6. (NEW)
- Beam 8-2 west face of web 6ft. from north end at the top flange has a 34in.long x 0.010in. wide horizontal crack with light efflorescence. This crack extends 6in. into the web where it turns diagonally. The east flange has a similar horizontal crack also 6ft. from the north end 24in. long x 0.010in. wide with light efflorescence. Refer to Photo 7. (NEW)

CONDENSED INSPECTION REPORT**Pontis Element 109 - PS Concrete Girders (continued):**

The following charts are provided for future reference to track any increase or reduction in quantities of the diagonal/shear cracks in the beam webs which typically extend up and away from the bottom flange and or bearing areas. Only the cracks which were well defined in direction were quantified.

= A reduction in crack quantities. This is mostly due to two or more cracks connecting together.

+ = Increase in cracks since previous inspection.

() = Amount of length crack has grown since the 01/13 inspection. Refer to Photo 8.

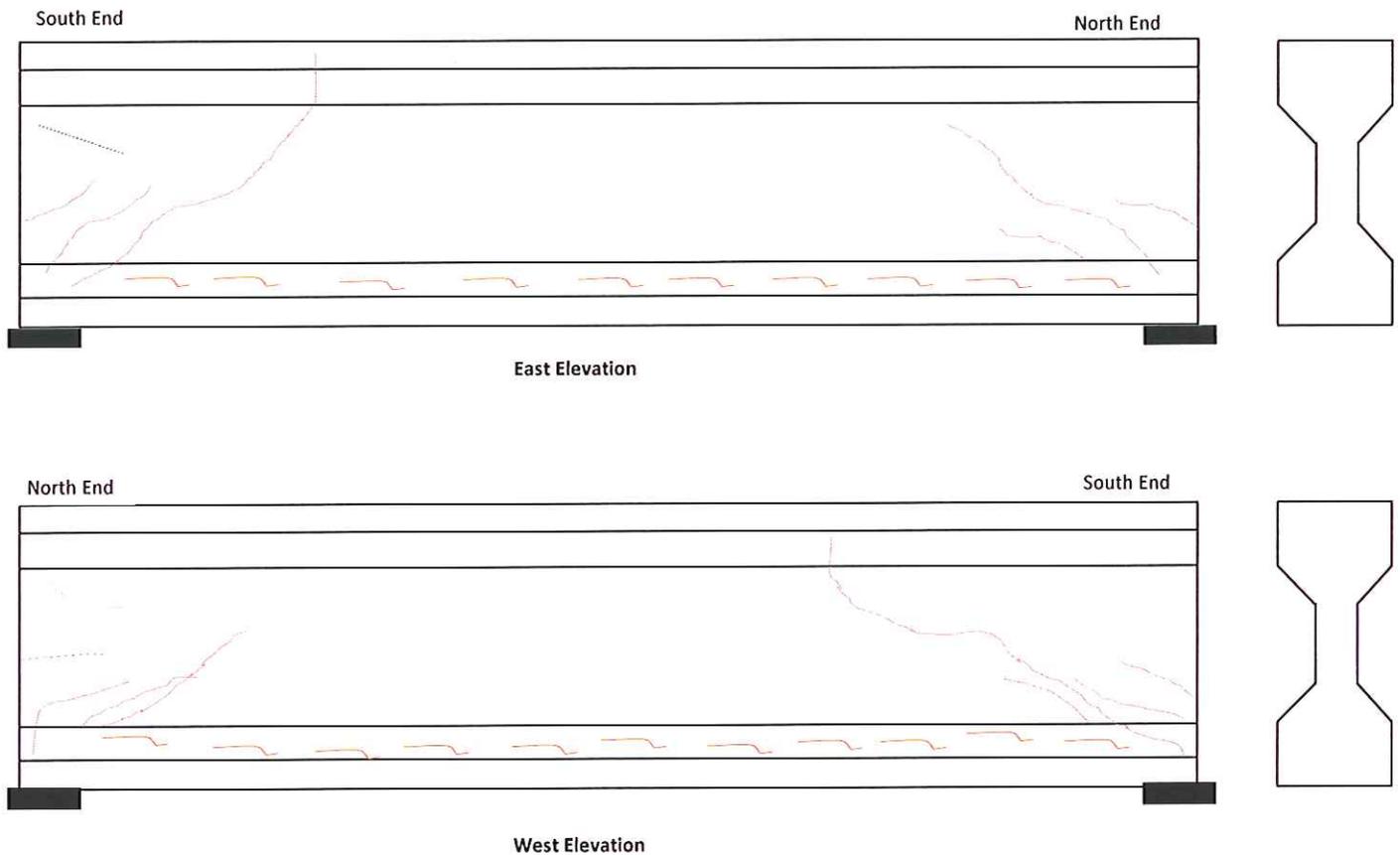
BEAM	SOUTH END				NORTH END			
	WEST FACE		EAST FACE		WEST FACE		EAST FACE	
	01/13/13	07/23/13	01/13/13	07/23/13	01/13/13	07/23/13	01/13/13	07/23/13
1-1	2	+ 5	2	+ 3	5	5	3	3
1-2	1	1	3	3	4	4	4	4
1-3	3	3	3	3	3	3	5	5
1-4	3	3	2	+ 5	2	2	4	4
2-1	5	5	4	4	5	5	4	4
2-2	2	2	2	2	1	+ 2	1	1
2-3	2	2	4	4	4	4	2	2
2-4	3	3	4	4 (7¾")	4	4	7	7 (12¾")
3-1	5	5 (2")	2	+ 4	4	4	4	4
3-2	3	3	3	+ 4	4	# 3 (2")	2	2 (10½")
3-3	2	+ 3	2	+ 5 (14¾")	2	2	2	2
3-4	4	4	10	10	5	5 (76")	6	6
4-1	4	4 (4")	3	3	4	4	1	1 (8½")
4-2	3	3	2	2	5	5	2	2
4-3	2	+ 3	4	+ 5	4	4	4	4
4-4	1	+ 2	5	5	2	2	3	3
5-1	5	5	2	2	6	6	3	3
5-2	2	2	2	+ 3 (15")	4	# 1	2	2
5-3	4	4	5	5	6	# 5	5	5
5-4	4	4	6	6	5	5	5	+ 7
6-1	4	+ 5	2	2	5	5	2	# 1
6-2	3	# 2	3	# 2	3	3	2	+ 3
6-3	2	2	1	+ 2	2	2	2	2
6-4	5	5	6	6	3	3	5	5

CONDENSED INSPECTION REPORT**Pontis Element 109 - PS Concrete Girders (continued):**

BEAM	SOUTH END				NORTH END			
	WEST FACE		EAST FACE		WEST FACE		EAST FACE	
	01/13/13	07/23/13	01/13/13	07/23/13	01/13/13	07/23/13	01/13/13	07/23/13
7-1	3	+ 4 (5")	5	5	4	4	3	+6
7-2	3	3	2	2	2	2	3	3
7-3	3	+4	3	3	0	0	0	0
7-4	2	2	6	+8	3	+4	6	6
8-1	4	4	3	3	4	4	1	1
8-2	2	2	2	2	1	1	2	# 1
8-3	1	1	3	3	2	2	1	1
8-4	2	2	7	7	3	3	6	6
9-1	3	3	2	2	4	+6	4	#3
9-2	4	#3	2	2	1	1	0	0
9-3	2	+ 3	2	+3	2	2	2	+4
9-4	4	4	7	7	1	1	6	+8
10-1	4	4	3	3	4	+5	3	# 1
10-2	2	2	2	2	2	+ 5 (3½")	2	2 (1¼")
10-3	2	#1	3	3	2	2	2	+4
10-4	4	4	4	+ 6 (6½")	3	3	4	4
11-1	3	+4	3	3	5	5	3	+4
11-2	2	+3	1	1	3	3 (8")	3	3
11-3	3	3	3	3	2	+3	2	+ 3 (5")
11-4	2	+3	4	+ 5 (14")	3	3	5	5
12-1	6	6	4	+6	4	4	2	2
12-2	4	4	4	4	5	5	3	+5
12-3	3	+4	4	4	3	+4	4	4
12-4	2	2	3	3	0	+1	4	4
13-1	3	+4	6	+7	2	+3	1	+2
13-2	3	+4	4	# 2	3	+4	3	3
13-3	0	+2	2	2	3	3	2	2
13-4	3	3	3	+5	0	0	3	+4

BEAM SKETCHES

Note: The following shows the general direction and locations of the cracks in the beam webs and flanges:



Legend:

Blue line (- - - - -) indicates horizontal crack extending from beam end near mid height of web.

Gold line (solid) indicates short longitudinal cracks along bottom flanges.

Purple line (·····) indicates diagonal cracks from top of web down and away.

Red Line (- - - - -) indicate diagonal/shear cracks in beam webs extending from bearing areas or beam ends.

PHOTOS

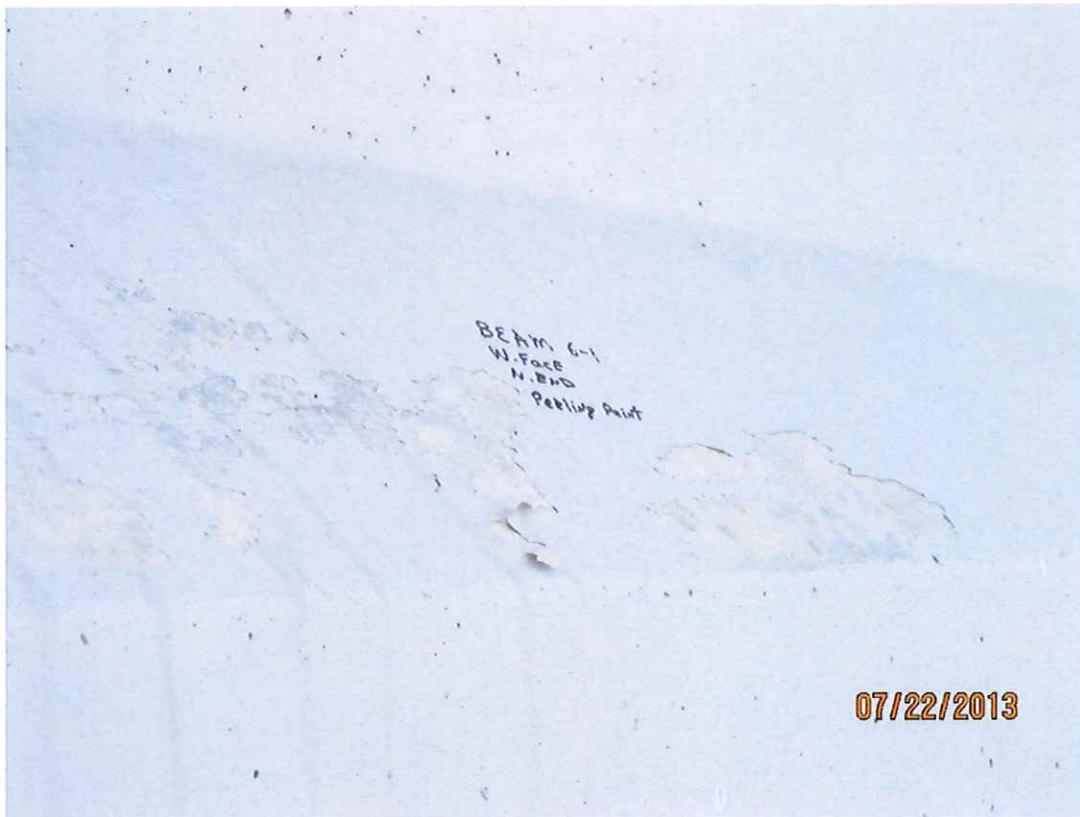


Photo 1 – Typical of minor areas of peeling paint (Beam 6-1 west face shown)

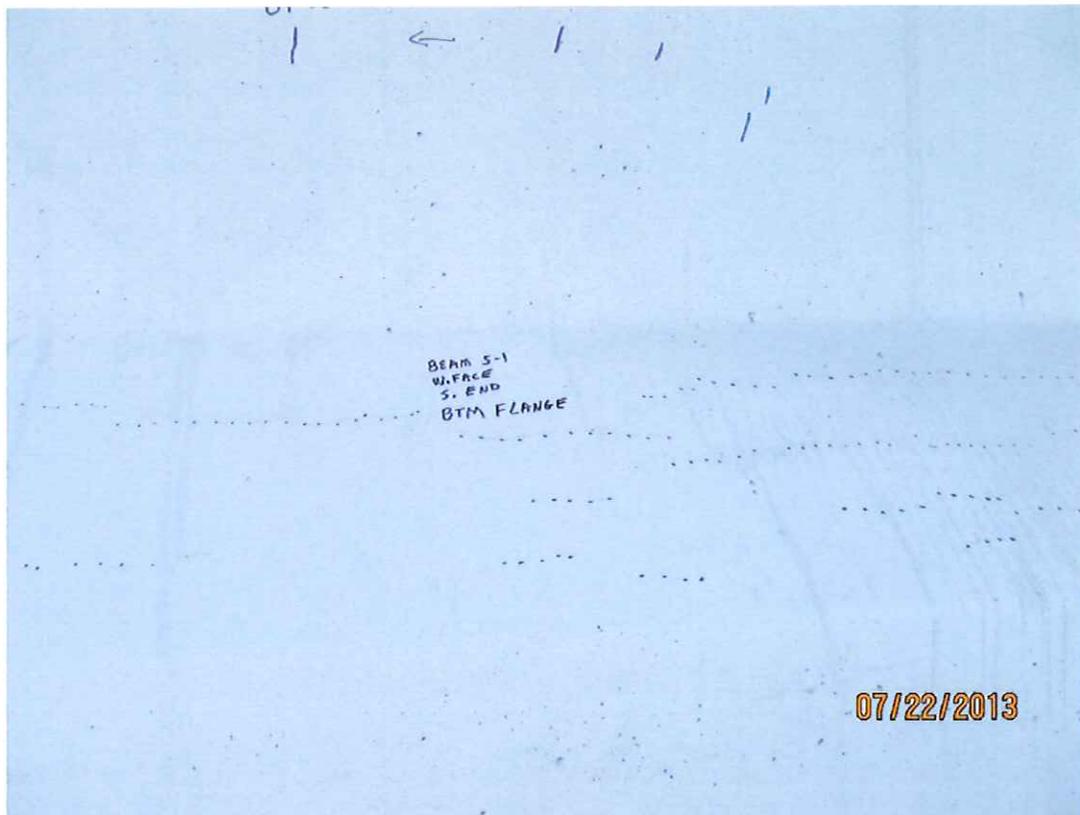


Photo 2 – Typical longitudinal cracks in bottom flanges of beams

PHOTOS



Photo 3 – Typical crack in bottom face of top flange



Photo 4 – Typical width of diagonal/shear cracks extending from beam ends (Beam 13-4 shown)



Photo 5 – Typical diagonal/shear cracks extending from beam ends (Beam 5-4 shown)

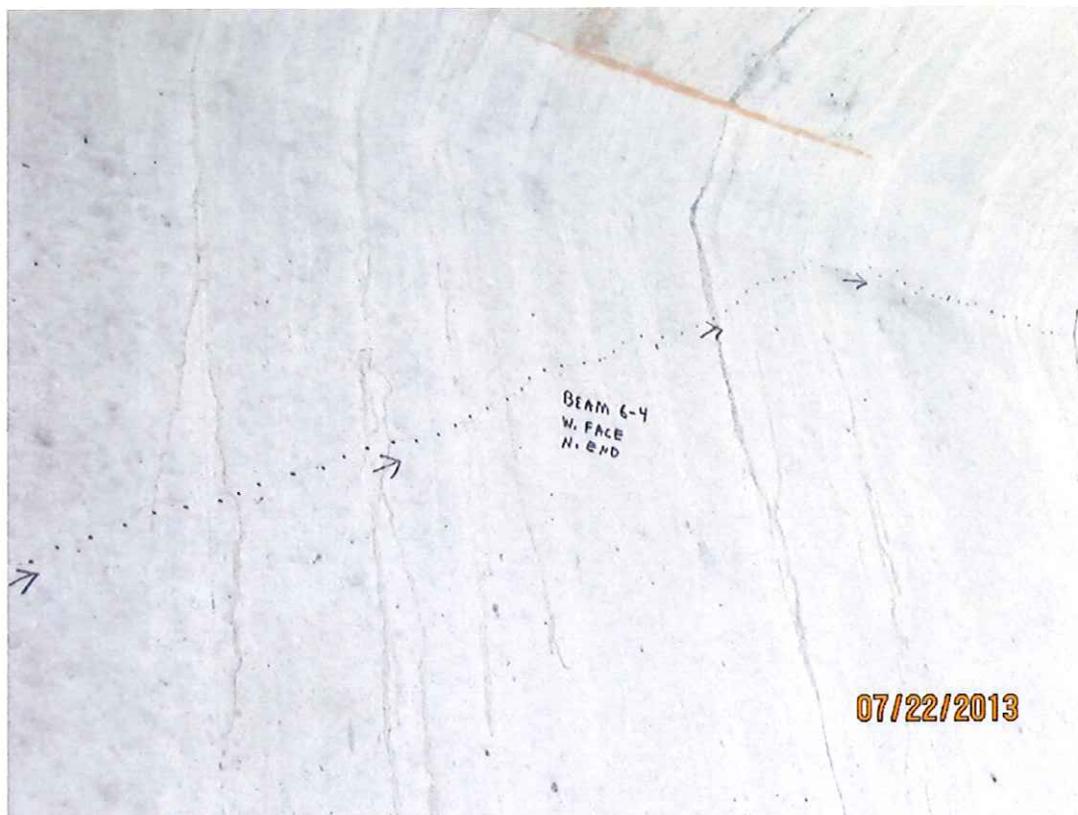


Photo 6 – Diagonal crack turning longitudinal on west face of Beam 6-4 at north end



Photo 7 – Horizontal crack at top west face of web 6ft. from north end turning diagonally

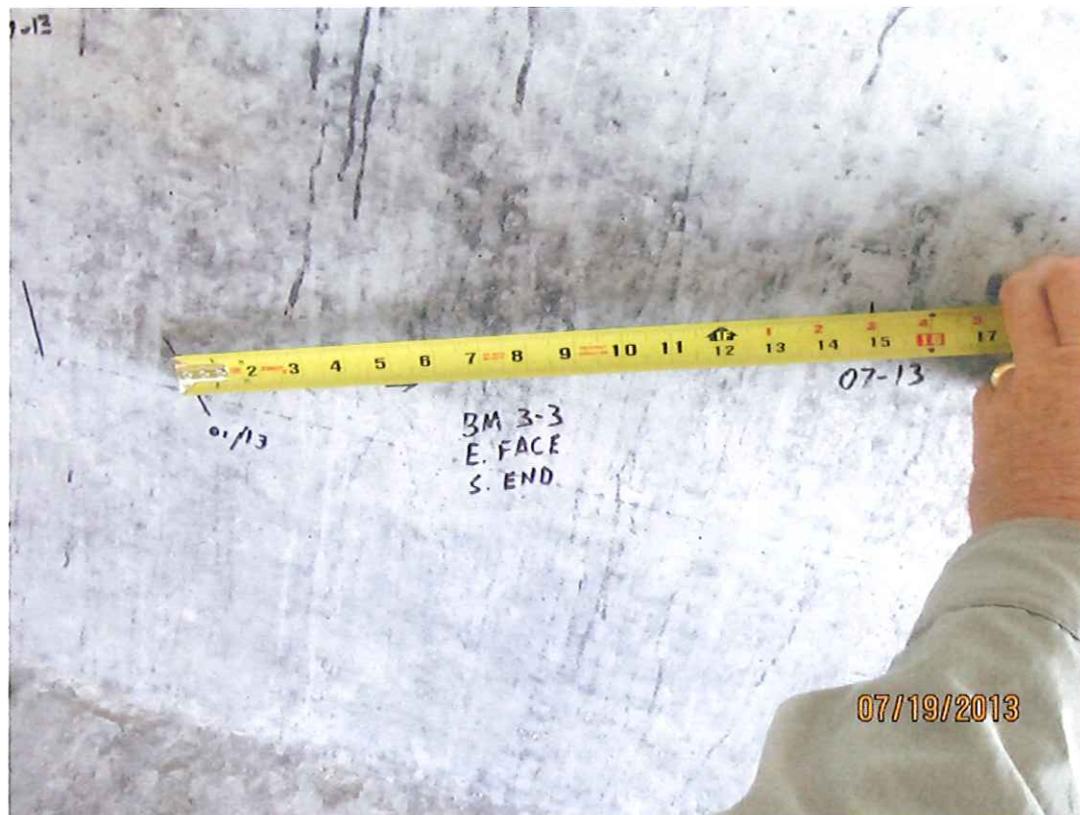


Photo 8 – View showing crack growth (Beam 3-3 shown)

RECOMMENDED MAINTENANCE REPAIR AND REHABILITATION

Based on the findings of the bridge inspection from 7/19, 7/22 and 7/23/2013, the following recommendations and repairs are recommended:

- (1) Continue to monitor cracks in the beams for any increase in severity by performing follow up inspections.
- (2) If cracks continue to increase in length or width then suggest applying a clear protective coating over all cracks in the beam webs, top and bottom flanges extending from the beam ends.
- (3) Apply clear protective coating over diagonal/shear cracks on the following beams:
 - Beam 2-4 – North End – East Face – 7 Cracks.
 - Beam 8-4 – South End – East Face – 7 Cracks.
 - Beam 8-4 – North End – East Face – 6 Cracks.
 - Beam 9-4 – South End – East Face – 7 Cracks.
 - Beam 9-4 – North End – East Face – 8 Cracks.
- (4) Inject epoxy into diagonal/shear cracks which have grown in length 10in. or more since the 01/2013 inspection on the following beams:
 - Beam 2-4 – North End – East Face.
 - Beam 3-2 – North End – East Face.
 - Beam 3-3 – South End – East Face.
 - Beam 3-4 – North End – West Face.
 - Beam 5-2 – South End – East Face.
 - Beam 11-4 – South End – East Face.
- (5) Epoxy inject diagonal /shear crack in east web of Beam 1-4 at north end.
- (6) Epoxy inject diagonal /shear crack in west web of Beam 6-4 at north end.
- (7) Monitor cracks in west and east webs of Beam 8-2 at north end.