

## Special Bridge Inspection – August 26<sup>th</sup>, 2013

West Seattle High Level Bridge – BRG #131

Special Inspection of the cracks in the soffit of the main span box girder near segment 11 as counted from Pier 15 and Pier 16 in both the north and south box girders. The cracks were noted during the routine UBIT inspection earlier this year.

Inspectors, Hal Turner, John Buswell

10:00 AM to 12:00 Noon

approx. 65 deg. and partly cloudy

The UBIT was deployed on the north side of the bridge, facing westbound.

Although, segment 11 was the focus of our inspection, segments 10 and 12 were also inspected. (Note: there are different plan references to segments and joints between the cast-in-place box girder elements. For clarity of discussion, segment 11 is used to describe the same area in all four geometric locations where significant cracks are present. The section, N/W, S/E etc. is used to differentiate between the four geometric locations. For reference, segment 11 is between joint 37 and 38 as shown on construction plan 782-138, sheet S-8. It should be noted that an additional post tension stressing buttress is located at joint 38 which is the joint between segment 11 and 12, reference plan 782-138, sheet S-11 and S-13. See copy of plans attached.

The typical segment is 16'-6" long. The width varies with the depth of the box. The width of the box at segment 11 is 24'-1". The thickness of the bottom slab at segment 11 is 1'-1".

### **Significant findings**

1. All four segments exhibit similar crack patterns but with varying degrees of size, depth and number.
2. Both transverse and longitudinal cracks exist. The transverse cracks are the most predominate.
3. Significant surface spalling of the cracks is apparent throughout.
4. In some locations, faulting across the crack is detectible.
5. The predominate transverse crack transitions from transverse to diagonal near the north and south edges of the bottom slab as the crack nears the web.

6. The SW Section, segments 11 and 12, have visible diagonal cracks in the web that are continuous with the bottom slab cracks.
7. Crack width measured up to 0.010.
8. Sounding of the concrete adjacent to cracks did not detect delamination.

### **Northeast Box Girder Section**

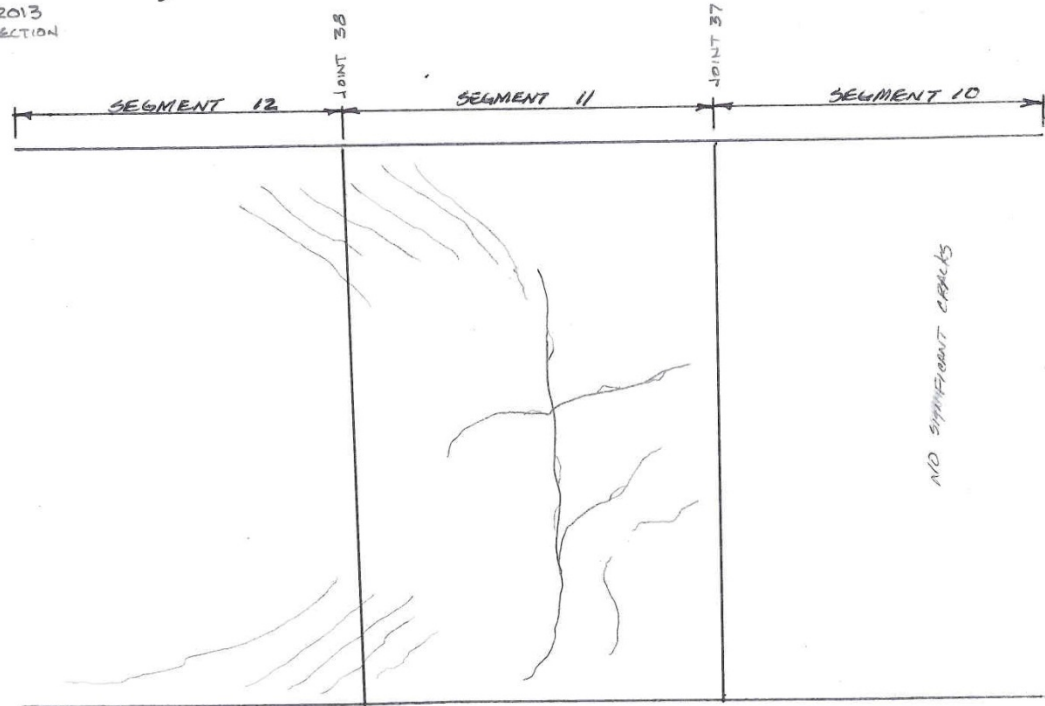
1. Segment 10 had no significant visible cracks.
2. Segment 11 had numerous cracks with the largest most predominant crack running in the transverse direction through the middle 2/3 of box girder width. Towards the north and south edges of the box girder bottom slab the cracks tended to become diagonal and in the direction of the center of the main span. Several cracks began as diagonal, originating near the north and south edges of the bottom slab and continuing into segment 12. The main transverse crack was located approximately 6' from the joint between seg. 11 and seg. 12. The most predominate longitudinal crack was located approximately 6 ½' from the south edge of seg. 11. Many of the cracks have signs of surface spalling with the largest spalls measuring 5" x 1" x ¾" deep. A feeler gage was used to approximate the surface opening of cracks that did not have surface spalls. Crack width measured up to 0.010". Magnification observation suggested that the cracks have significant depth. Previous inspection from inside the box girder did not detect significant cracks on the top surface of the bottom slab. Crack width varied from extremely tight to the measured widths up to 0.01. Spall areas were obviously wider. Faulting was observed across cracks. Although, minor, a detectable lip was observed in some locations, both visually and by rubbing your hand across the crack. Sounding of the concrete adjacent to cracks did not detect any delaminated areas. The concrete was sound. Bondo and a crack gage were installed at this segment location.
3. Segment 12 was relatively crack free except for the continuation of diagonal cracks originating from segment 11. A few of the diagonal cracks did originate in segment 12. All cracks were confined to the area near the north and south edges of the bottom slab.

See attached Crack Map

## NORTHEAST BOX GIRDER SECTION

(REFLECTED VIEW)

8/26/2013  
INSPECTION



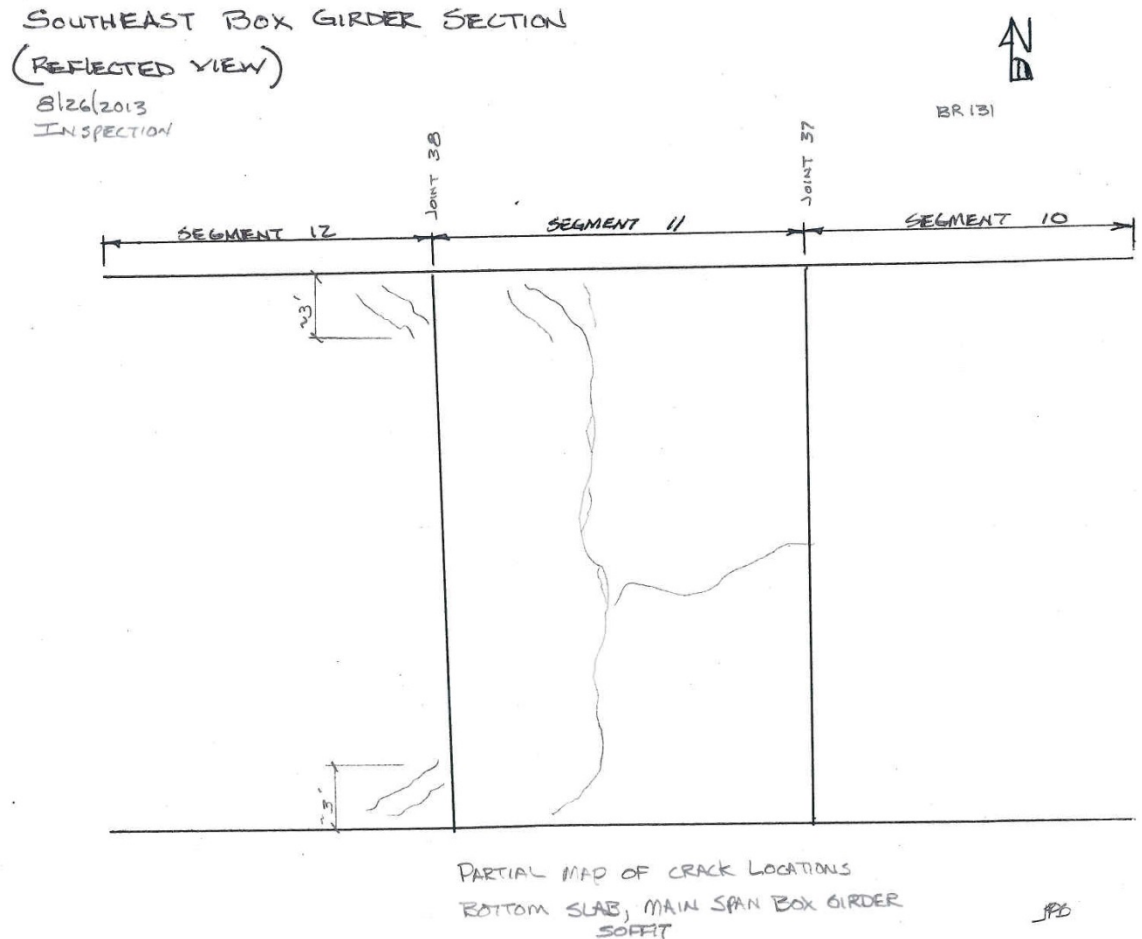
PARTIAL MAP OF CRACK LOCATIONS  
BOTTOM SLAB, MAIN SPAN BOX GIRDER  
SOFFIT

JRB

### Southeast Box Girder Section

1. Segment 10 has no significant visible cracks.
2. Segment 11 has numerous cracks with one predominate crack that runs transverse. The crack patterns were similar to seg. 11 in the northeast section but significantly less severe in both number and apparent width. Due to the access limitation of the UBIT we were not able to reach segment 11, but observed the crack condition from approximately 10 feet. A monocular was used to magnify and inspect the cracks. The predominate transverse crack had two areas of spalling and transitioned from transverse to diagonal within approximately three feet of the north and south edges of the bottom slab. There was at least one longitudinal crack that was near the mid width of seg. 11.

- Segment 12 had no significant cracks noted except for diagonal cracks originating near the segment joint between seg. 11 and seg. 12 and confined to the approximately 3' from the north and south edges of the bottom slab.



### Southwest Box Girder Section

- Segment 10 had no significant visible cracks.
- Segment 11 had numerous cracks with one predominate crack that runs transverse. The crack patterns were similar to seg. 11 in the northeast section but significantly less severe in both number and apparent width. Due to the access limitation of the UBIT we were not able to reach segment 11, but observed the crack condition from approximately 10 feet. A monocular was used to magnify and inspect the cracks. The predominate transverse crack transitioned from transverse to diagonal within approximately three feet of the north and south edges of the bottom slab. The diagonal crack extended into seg. 12 and continued into the north web section. The web

diagonal cracks appeared as typical shear cracks and had an orientation of approximately 45 deg. to 60 deg. with the upper end towards the main span center. We did not have access to the south side of the box and could not verify that similar diagonal crack existed. A significant longitudinal crack was not observed.

3. Segment 12 had the continuation of diagonal cracks from seg. 11 in the approximately 3' near the north edge of the bottom slab. The south edge was not inspected due to access limitations.

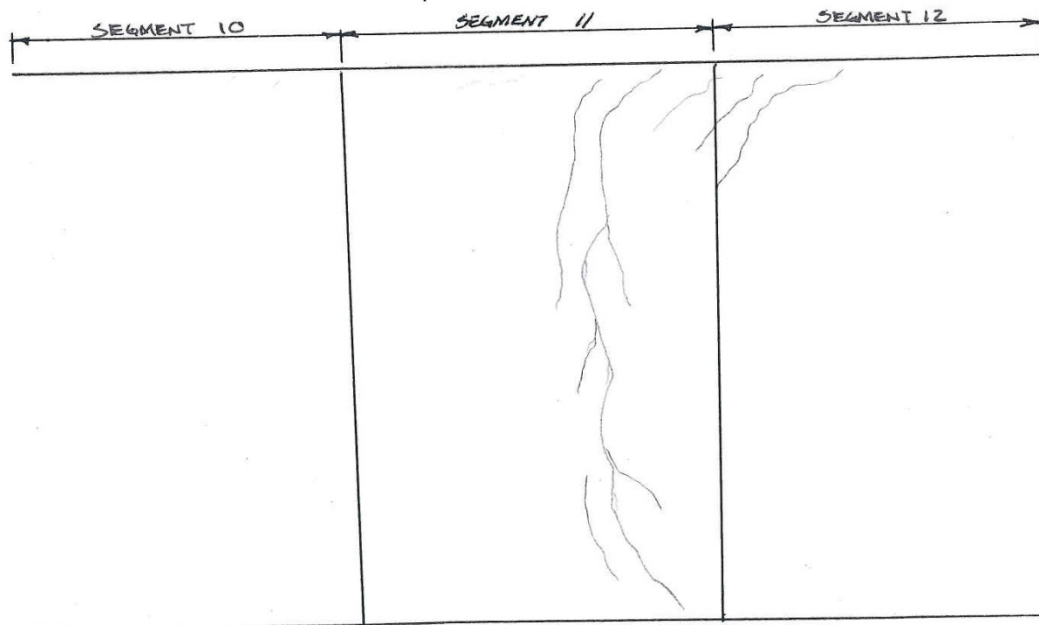
### SOUTHWEST BOX GIRDER SECTION

(REFLECTED VIEW)

8/26/2013  
INSPECTION



BRG 131



PARTIAL MAP OF CRACK LOCATIONS  
BOTTOM SLAB, MAIN SPAN BOX GIRDER  
SOFFIT

JPB

### Northwest Box Girder Section

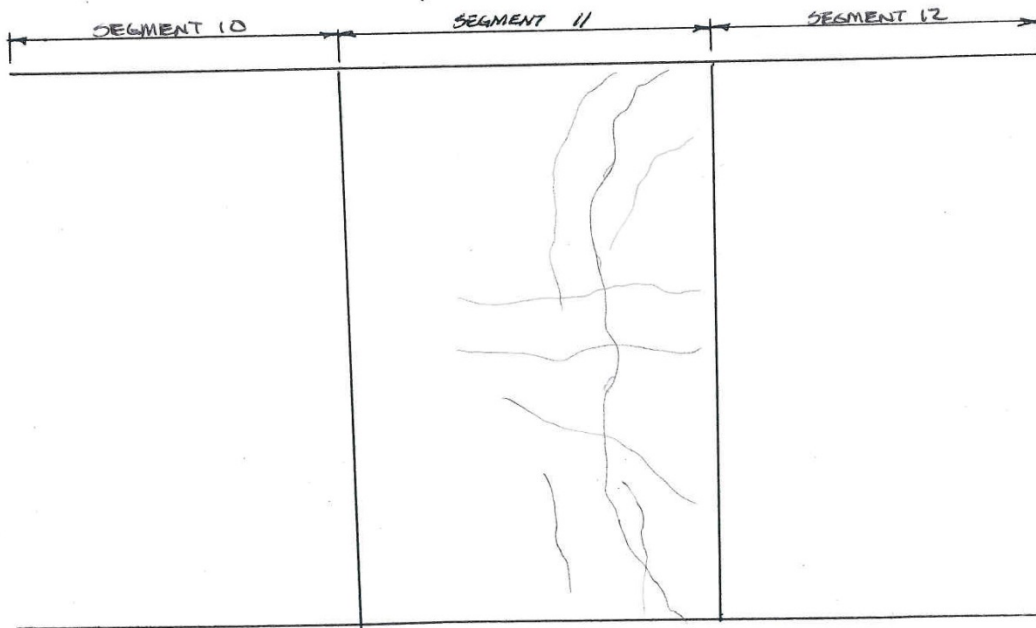
1. Segment 10 had no significant visible cracks.
2. Segment 11 had numerous cracks with one prominent crack that ran transverse. The crack patterns were similar to seg. 11 in the northeast section but significantly less severe in both number and apparent width. Surfacing spalling of cracks is visible. Similar to other segments the transverse crack trends to a diagonal crack as it approaches the north and south edges of the bottom slab. The predominate transverse

crack is located 5'-5" from the joint between seg. 11 and seg. 12. Other diagonal cracks originate near the north and south edges. The diagonal cracks do not extend significantly into segment 12. There are approximately three longitudinal cracks that are near the mid-width of seg. 11.

- 3. Segment 12 did not have any significant visible cracks.

NORTHWEST BOX GIRDER SECTION  
(REFLECTED VIEW)

8/26/2013  
INSPECTION



PARTIAL MAP OF CRACK LOCATIONS  
BOTTOM SLAB, MAIN SPAN BOX GIRDER  
SOFFIT

JPB



Photo #1 N/E Section - Prominent transverse crack



Photo #2 N/E Section, Segment 11 – transverse crack transitioning to diagonal





Photo #3 N/E Section, Segment 11 – diagonal cracks spanning into segment 12



Photo #4 N/E Section, Segment 11 - close up on transverse crack with spalling, 5"x1"x3/4"





Photo #5 N/E Section, Segment 11, close up of transverse crack



Photo #6 N/E Section, Segment 11, same location as Photo #5



Photo #7 NE Section, Segment 11, typical cracks



Photo #8 NE Section, Segment 11, typical cracks



Photo #9 N/E Section, Segment 11, Cracks transitioning to diagonal near web.



Photo #10 S/E Section, Segment 11, typical crack





Photo #11 S/W Section, Segment 11/12, continuous cracks into web



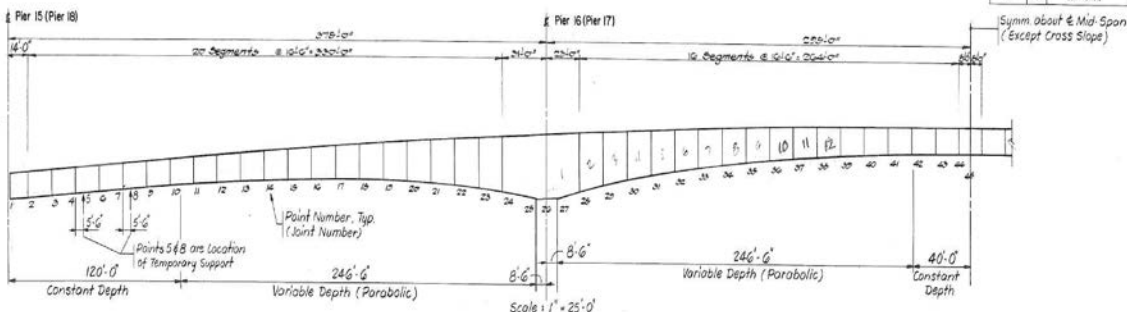
Photo #12 S/W Section, Segment 11, close up of continuous cracks into web



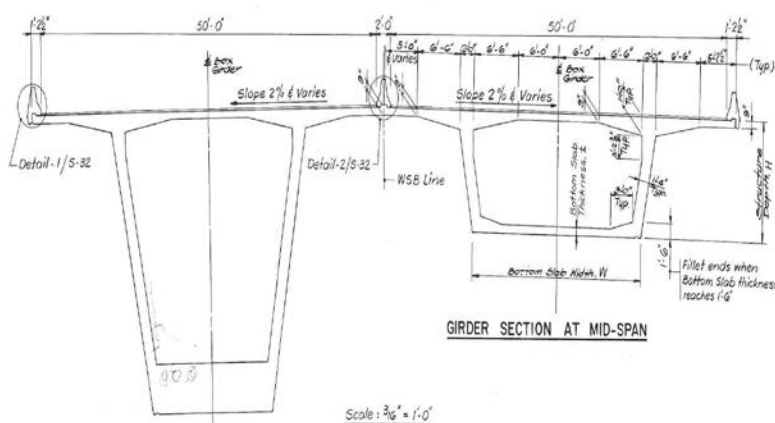
Photo #13 N/W Section, Segment 11, typical cracks



Photo #12, N/W Section, Segment 11, typical cracks



Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45				
Elev. (ft)	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	
7' Slope (ft)	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	
1' Slope (ft)	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250



Notes:  
 1. For Elevations and Cross Slopes see Ref No S-3.  
 2. All Section Cuts are in Plumb Vertical Direction.

CONSULTANTS, INC.  
 YORK, N.Y.

EST SEATTLE BRIDGE DESIGN TEAM  
 Seattle, Washington  
 Design: Kenneth J. Kane, Inc.  
 Project: Brackerhoff



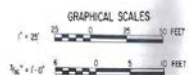
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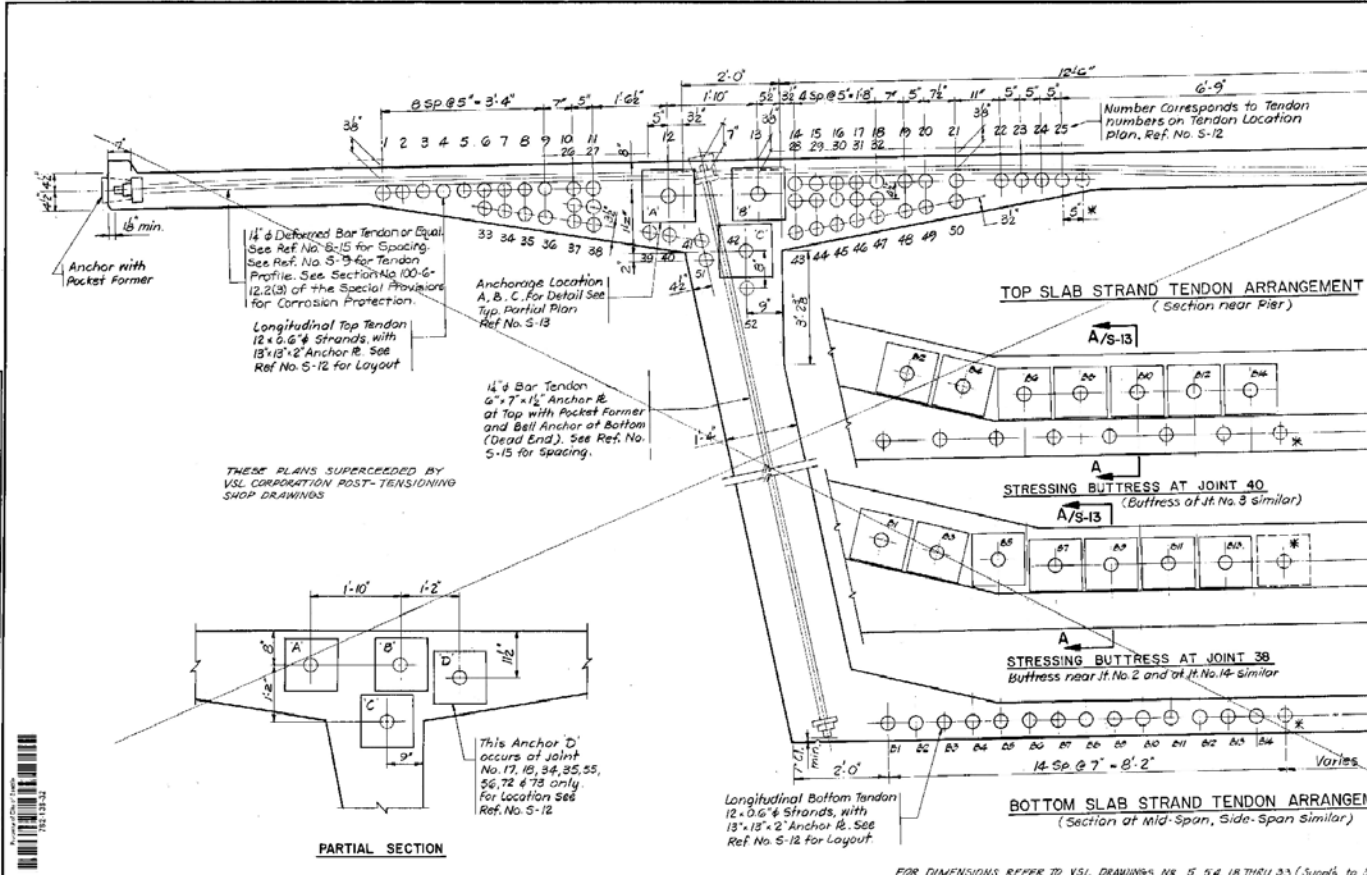
THE CITY OF SEATTLE  
 DEPARTMENT OF ENGINEERING  
 R.E. Hight  
 License No. 12345  
 Date: 8/12/88

WEST SEATTLE FREEWAY BRIDGE REPLACEMENT  
 MAIN SPAN, SUPERSTRUCTURE  
 (CONCRETE GIRDER, CAST IN PLACE)  
 CEMENT LAYOUT

REVISION NO. 3  
 DATE: 8/12/88  
 BY: R.E. HIGHT

THIS DRAWING HAS BEEN REDUCED  
 ONE HALF SCALE





SCALE: AS SHOWN  
 DATE: 11/18/80  
 DRAWN BY: J. J. JACOB  
 CHECKED BY: J. J. JACOB  
 PROJECT NO.: 2-15-80

CONTECH CONSULTANTS, INC.  
NEW YORK, N.Y.

**WEST SEATTLE BRIDGE DESIGN TEAM**  
Seattle, Washington

Anderson - Bjornstad - Kane - Jacob, Inc.  
Kramer, Chin & Mayo, Inc.

Parsons, Brinckerhoff  
Tudor Engineering Co.



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DESIGNED BY: J. J. JACOB  
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CHECKED BY: J. J. JACOB

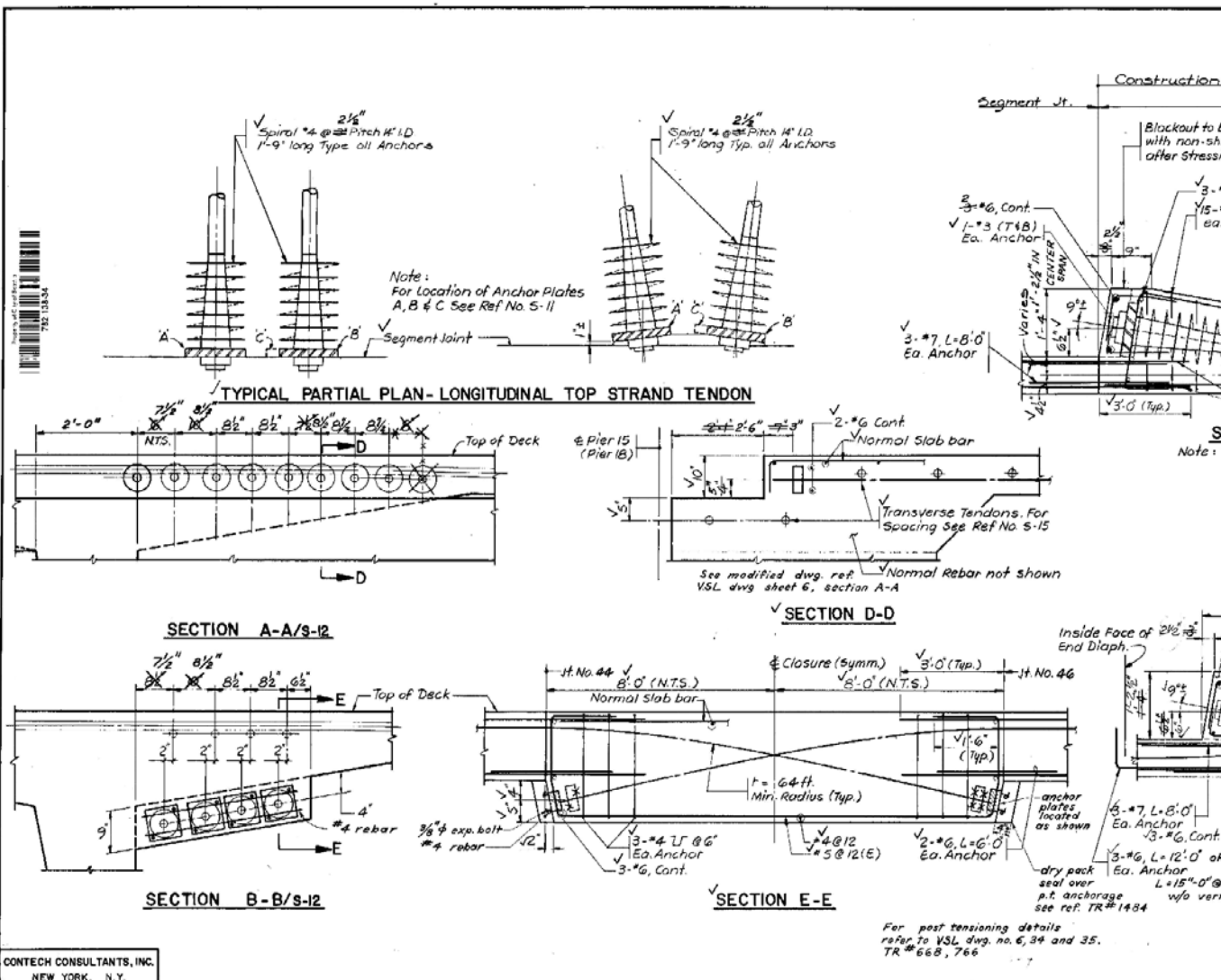
DATE: 11/18/80

THE CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

DATE: 11/18/80

**WEST SEATTLE FREEWAY BRIDGE**  
MAIN SPAN, SUPERSTRUCTURE  
(CONCRETE GIRDER, POST-TENSIONED)  
TENDON LOCATION - C





782 13334  
 259886  
 DATE: 11/15/00  
 DRAWN: J. J. JENSEN  
 CHECKED: J. J. JENSEN  
 APPROVED: J. J. JENSEN

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NEW YORK, N.Y.

**WEST SEATTLE BRIDGE DESIGN TEAM**  
Seattle, Washington

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REVIEWED: J.J.J. 11/15/00  
FINAL CHECK: J.J.J.

ATTN: J.J.J. 11/15/00

REGISTERED PROFESSIONAL ENGINEER

APPROVED: \_\_\_\_\_  
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APPROVED: \_\_\_\_\_

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DEPARTMENT OF ENGINEERING

APPROVED: J.E.B. 11/16/00

SCALE: N

INSPECTOR'S CODE NO.