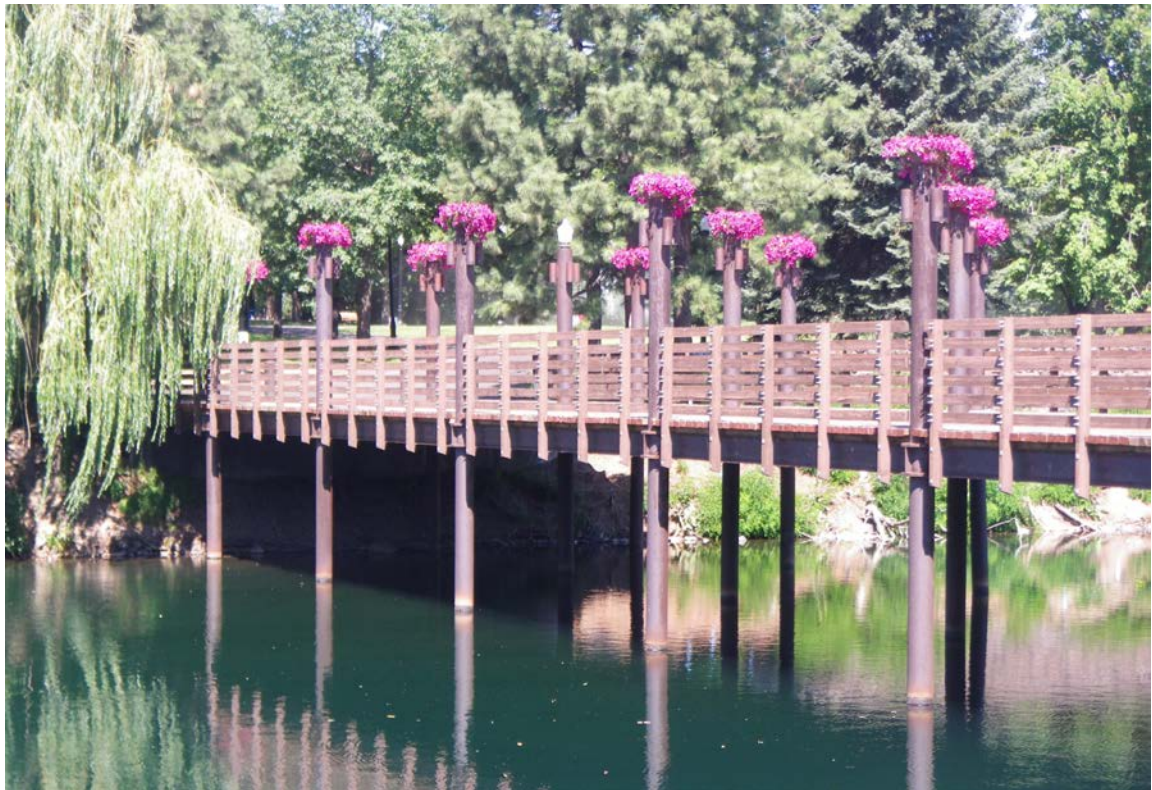




ECHELON ENGINEERING, INC.

Civil/Marine Consulting Engineers

Underwater Inspection Report King Cole Bridge Spokane, WA



Prepared For:

KPFF Consulting Engineers, Inc.
1600 Fifth Avenue, Suite 1600
Seattle, WA 98101

ATTN: Mr. Tom Whiteman, PE
Senior Manager
Tel: 206 / 622.5822

Prepared By:

Echelon Engineering, Inc.
21027 61st Avenue West
Lynnwood, WA 98036

ATTN: Ms. Shelley Sommerfeld, PE
President
Tel: 425 / 672.8924

Inspection Date: July 29, 2014
12-2454B

KPFF Consulting Engineers, Inc.
1600 Fifth Avenue, Suite 1600
Seattle, Washington 98101

ATTN: Mr. Tom Whiteman, PE
Senior Manager

**RE: Underwater Inspection of King Cole Bridge
Spokane, Washington**

Dear Mr. Whiteman:

This report is submitted to document the findings of our recent underwater inspection of the King Cole Bridge in Spokane, Washington. The structure is a pedestrian bridge built for the World's Fair in 1974 and is owned and operated by the City of Spokane. The structure is an eight span steel girder / beam structure supported by two concrete abutments and seven bents of reinforced concrete filled steel pipe piles. Bents 2 – 8 and Abutment No. 9 were located in the channel at the time of the inspection. The project was conducted by Echelon Engineering on July 29, 2014.

1. EXECUTIVE SUMMARY

Based on the observed condition, all inspected substructure components appear sound. Although surface corrosion was noted on the piling, no evidence of any significant corrosive section loss was found. Investigation of the concrete abutments found the concrete to be sound. No evidence of any cracking, spalling or other significant damage was noted. No evidence of any significant general or localized scour patterns were identified. No previous underwater data was available at the time of the inspection.

2. INSPECTION FINDINGS

The King Cole Bridge is a pedestrian bridge located in Riverfront Park in Spokane, Washington. The structure is an eight span steel girder bridge spanning the south channel of the Spokane River. It is supported by two concrete abutments and seven bents of reinforced concrete filled steel pipe piles. Numbering of the structure has been designated north to south. Bents 2 – 8 and Abutment No. 9 were located within the channel during this inspection. No construction drawings or other information on the bridge were available at the time of the inspection.

Investigation of the reinforced concrete filled steel pipe piles found them to be in generally good condition. Investigation of the submerged surfaces noted surface corrosion, rust nodules and areas of minor pitting, but no significant corrosive section loss. Several horizontal welds were noted on a number of the piles. Inspection found no evidence of any anodic loss of weldment or other deterioration of these welds. No evidence of any impact damage, cracking or exposure of the internal concrete was found on any of the inspected piling. A number of horizontal welds were evident on the piling both above and below water. Inspection of these welds found them to be in good condition with no visible loss of weldment.

Level III ultrasonic thickness readings of the outer steel piles found the steel thickness to range from 0.325 to 0.400 inches with an average thickness of 0.367 inches, (refer to Table 1).

TABLE 1 – Steel Pipe Pile Thickness Readings

| Bent | Row | Readings (in.) | | | | |
|----------------------------------------|-----|----------------|-------|-------|-------|---------|
| | | Elev. | #1 | #2 | #3 | Average |
| 4 | C | +0.5' | 0.400 | 0.400 | 0.400 | 0.400 |
| | | -1' | 0.375 | 0.375 | 0.375 | 0.375 |
| | | -4' | 0.375 | 0.385 | 0.380 | 0.380 |
| | | -9' / MDL | 0.390 | 0.392 | 0.395 | 0.392 |
| 7 | B | +0.5' | 0.355 | 0.355 | 0.355 | 0.355 |
| | | -1' | 0.365 | 0.365 | 0.365 | 0.365 |
| | | -6' | 0.330 | 0.325 | 0.327 | 0.327 |
| | | -13' / MDL | 0.345 | 0.345 | 0.345 | 0.345 |
| Average of all Readings | | | | | | 0.367 |
| Average of all Waterline (+0.5 to -1') | | | | | | 0.374 |
| Average of all Mid-depth (-4 to -6') | | | | | | 0.354 |
| Average of all Mudline Readings | | | | | | 0.369 |

Cursory inspection of Abutment No. 1 noted it to be in generally good condition with no evidence of any cracking, spalling or other significant damage. Underwater inspection of Abutment No. 9 found the concrete to be sound with no evidence of any cracking, spalling or exposed reinforcing steel. Refer to Photo's No. 2 and 10.

A number of large submerged logs (~6 - 24 in dia.) were found primarily on the upstream side of the bridge between Bent 4 - 6. Additionally, a tree was noted on the upstream side of Bent 3 - 4. Although a number of additional items of debris were present beneath the

structure, including several lengths of wire rope, no other significant debris was found around the piling or in the channel beneath the structure.

No design or datum information was available for the structure at the time of this inspection. All elevations have been determined utilizing the top of the timber deck at Pier 8 of El. 1,000.0'. The water level experienced during the inspection was El. 988.5'.

Investigation of the mudline in the area around the piles found the bottom to consist of gravel, rock (2-10" dia.) and areas of soft-silty sand. Penetration of the bottom with a #3 rebar noted 6 - 18 inches of penetration. No evidence of any significant general scour was identified. However, local scour was noted downstream of the submerged logs found between Bent 5-6. No previous bottom profile information was available for comparative purposes.

It has been a pleasure to have worked with you on this project. Should you have any questions concerning this report, or if we can assist you further, please do not hesitate to contact our office.

Sincerely,
Echelon Engineering, Inc.



Shelley D. Sommerfeld, P.E.
President

SDS:jds
Enclosures



EXPIRES: 6 / 6 / 2015



**Echelon
Engineering**

Underwater Inspection Report

| | | | |
|-----------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------|--------------------------------------|
| Bridge Number N/A | Route Spokane Riverfront Park | Agency/Owner City of Spokane | Date July 29, 2014 |
| Bridge Name King Cole Bridge | | | Intersecting Spokane River |
| Inspector Shelley Sommerfeld, P.E. | | Identification No. WA Br. Insp. No. G9912 | Hours on Site 2 |
| Dive Contractor Echelon Engineering, Inc. | | | |
| Diver Name Erling Vegsund | | Diver Name | |
| Structure Type Steel Girder / Beam | | Substructure Type Reinforced Concrete Filled Steel Pipe Piles | |
| Foundation Type Driven Pile | | Number of Spans 8 | Number of Piers in Water 8 |

| | | |
|--------------------------------------------------------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> Interior Bents (1) | 1 | Reinforce Concrete Filled Steel Pipe Piles / Concrete Abutments - |
| Abut/Pier Wall (2) | 6 | - Inspection found the submerged portions of the pedestrian bridge to be in |
| Web Wall (3) | 8 | good condition with minor surface corrosion, rust nodules and minor pitting |
| Columns (4) | 11 | of the outer steel pile encasements noted. |
| Shaft (5) | | - Several horizontal welds were noted. They were found to be in good condition. |
| Piles (6) | | - No cracking or impact damage to the piles was found above or below water. |
| Bracing (7) | | - Visual inspection did not identify any significant corrosive section loss. |
| Foundation (8) | | - Inspection noted a number of horizontal welds on the piles. Close examination |
| Footing (9) | | found them to be in good condition with no evidence of deterioration. |
| Seal (10) | | - Level III thickness readings were obtained on two steel pipe piles. Readings |
| Piles (11) | | ranged from a low of 0.325 in. to a high of 0.400 in and an average of 0.367 in. |
| <input checked="" type="checkbox"/> Scour (12) | | - Inspection in the vicinity of Abutment 9 noted damage to the utility conduits |
| Scour Mitigat. (13) | | between Row A-B. (Refer to Photo No. 3) |
| <input checked="" type="checkbox"/> Channel (14) | 12 | - No general scour patterns were noted. The channel elevation is gradual |
| Streambed(15) | | and consistent across the channel with no evidence of any significant |
| Drift(16) | | aggradation or degradation. No previous data was available for comparison. |
| Flow (17) | | - Localized scour was noted downstream of the submerged logs between Bent |
| | | 4 – 6, but appears minor at this time. |
| 14 | | - The channel bank is formed concrete along the southern end at Abutment No. 9. The bank at Abutment No. 1 was noted to be a steep dirt bank with minimal vegetation immediately adjacent to the bridge. |
| 15 | | - The channel bottom in the vicinity of the pier was found to consist primarily of gravel, rock (2-10" dia.) and areas of soft-silty sand. Probing of the bottom with a #3 rebar noted 6-18 inches of penetration. |
| 16 | | - A number of large logs (i.e. 6-24 in. dia.) were noted on the mudline primarily upstream of the bridge. The majority of the logs were found between Bent 5-6 and one tree was noted between Bent 3 – 4. Although several additional items of minor debris were also noted, including several lengths of wire rope, no other significant items were found. |

Daily Site Dive Log

| | | |
|-----------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------|
| Inspector Shelley Sommerfeld, P.E. (WA Bridge Inspector No. G9912) | | Date July 29, 2014 |
| Bridge Number N/A | Bridge Name King Cole Bridge | |
| Bridge Type Steel Girder / Beam | | Waterway Name Spokane River |
| Dive Objective Inspect submerged bridge members and obtain hydrographic data. | | |

| | |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|
| Dive Operation | |
| Type of Operation | <input checked="" type="checkbox"/> SCUBA <input type="checkbox"/> Snorkel <input type="checkbox"/> Other _____ |
| Equipment | Suit <u>Dry Suit</u> |
| | Air Supply <u>Aluminum 80 / Air</u> |
| | Site Access <u>Shore</u> |
| | Inspection Tools <u>Nikonos camera, probing rod, hammer, scraper, U/W light, misc. inspection tools</u> |
| | Repair Tools <u>Not Applicable</u> |
| | Repair Materials <u>Not Applicable</u> |

| | |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conditions | |
| Water | <input type="checkbox"/> Salt <input checked="" type="checkbox"/> Fresh <input type="checkbox"/> Brackish Temperature <u>60</u> °F Visibility <u>~10 ft.</u> |
| Surface | <input checked="" type="checkbox"/> Calm <input type="checkbox"/> Choppy <input type="checkbox"/> Rough |
| Surf | <input type="checkbox"/> Small <input type="checkbox"/> Medium <input type="checkbox"/> Large <input checked="" type="checkbox"/> Not Applicable |
| Tide | <input type="checkbox"/> High <input type="checkbox"/> Low <input type="checkbox"/> Flood <input type="checkbox"/> Ebb <input checked="" type="checkbox"/> Not Applicable |
| Current | <input type="checkbox"/> Fast <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Slow Velocity <u>0.0 ft/sec</u> |
| Weather | <input checked="" type="checkbox"/> Sunny <input type="checkbox"/> Cloudy <input type="checkbox"/> Overcast <input type="checkbox"/> Overcast Air Temperature <u>90</u> °F |
| Thermocline | Temperature <u>N/A</u> °F Depth <u>N/A</u> |

| | |
|-----------------------------------------------------------------|----------------------------------------------------------------------------|
| Dive Checks | |
| <input checked="" type="checkbox"/> First Aid Equipment on Site | <input checked="" type="checkbox"/> Physical Condition of Diver(s) Checked |
| <input checked="" type="checkbox"/> Communications For EMS | <input checked="" type="checkbox"/> Communications for Diver(s) Checked |
| <input checked="" type="checkbox"/> Dive Gear Inspected | <input checked="" type="checkbox"/> Team Briefed and Understand Dive Plan |
| <input checked="" type="checkbox"/> Air Source Checked | <input checked="" type="checkbox"/> Special Site Hazards Noted |
| <input type="checkbox"/> _____ | |
| <input type="checkbox"/> _____ | |

| |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dive Plan and Dive Team Procedures |
| General – Verify drawings and investigate submerged elements. |
| 1. Determine access location – Access for inspection obtained from south shore. All inspection activities conducted from the shore with assistance from personnel using a small skiff. |
| 2. A pre-dive safety meeting was held with AVISTA and Echelon personnel to discuss planned dive, roles, responsibilities, review emergency procedures and condition of divers. Set-up dive equipment and conduct function and safety checks. |
| 3. Conduct Level I visual/tactile, Level II cleaning/detailed inspection and Level III thickness readings of Bent 2-8 and Abutment 9. |
| 4. Take underwater photos. Once photos complete, conduct probing of the mudline and obtain hydrographic information. |



Consulting Engineers

[illegible]

The bridge was accessed from the south shore. Investigation of Bents 2 - 8 and Abutment 9 were conducted by diving. Data was relayed to support personnel using underwater wireless voice communications. Support personnel assisted the dive inspector from a small skiff.

Underwater inspection was conducted of Bent 2 – 8 and Abutment No. 9. All underwater elements appear sound. The steel pipe piles located in Bents 2 - 8 were found to be in generally good condition. Additionally, the concrete abutments, No. 1 and 9, were also inspected and found to be in generally good condition.

Investigation of the reinforced concrete filled steel pipe piles supporting the pedestrian bridge noted generalized surface corrosion and rust nodules, as well as locations of minor pitting. No evidence of any impact damage, cracking or significant corrosive section loss was found on any of the inspected piling. A number of horizontal welds were evident on the piling both above and below water. Inspection of these welds found them to be in good condition with no visible loss of weldment. Level III ultrasonic thickness readings were taken on the Bent 4, Row C pile and on the Bent 7, Row B pile. The steel thickness ranged from a low of 0.325 in. to a high of 0.400 in.

A number of large diameter logs (i.e. ~6 – 24 inch diameter) were found on the mudline primarily on the upstream side of the bridge between Bent 5 - 6. One tree was also found on the upstream side of Bent 3 – 4. Although a number of additional items of debris were present beneath the structure including several lengths of wire rope, no other significant debris was found around the piling or in the channel.

Investigation of the mudline in the area around the piles found the bottom to consist of gravel, rock (2-10" dia.) and areas of soft-silty sand. Probing of the bottom with a #3 rebar noted 6-18 inches of penetration. No evidence of any significant localized scour or scour patterns were identified. No previous data was available for comparison.

| | |
|----------------------------------------|-------------------------------|
| Shelley Sommerfeld, PE (Print Name) | Team Leader / Notes (Role) |
| Erling Vegsund (Print Name) | Dive Inspector (Role) |
| Ryan Jenson (Print Name) | Topside Support (Role) |
| (Print Name) | (Role) |
| (Print Name) | (Role) |



PHOTO No. 1: King Cole Bridge, Looking North - Note the steel girder and beam construction of the superstructure. This bridge is supported on steel pipe piling which extend up above the deck and provide lighting and decorative functions.



PHOTO No. 2: Abutment No. 1, Looking Northwest - Note the good condition of the concrete which was found to be sound. Also note the general good condition of the steel with minor surface corrosion and the apparent stable condition of the bank.



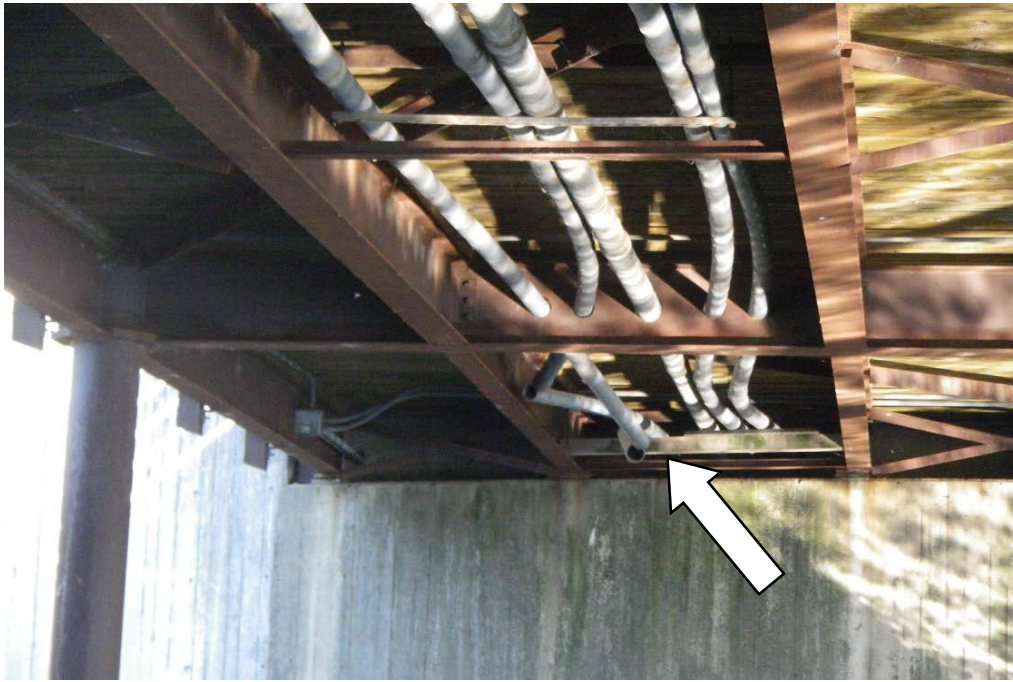


PHOTO No. 3: Typical Bridge Superstructure - The bridge is of steel girder and beam design with utilities supported beneath the deck. Note the arrow showing separated conduit in the bay adjacent to Abutment No. 9. The bridge is supported by two concrete abutments and seven, three pile bents.

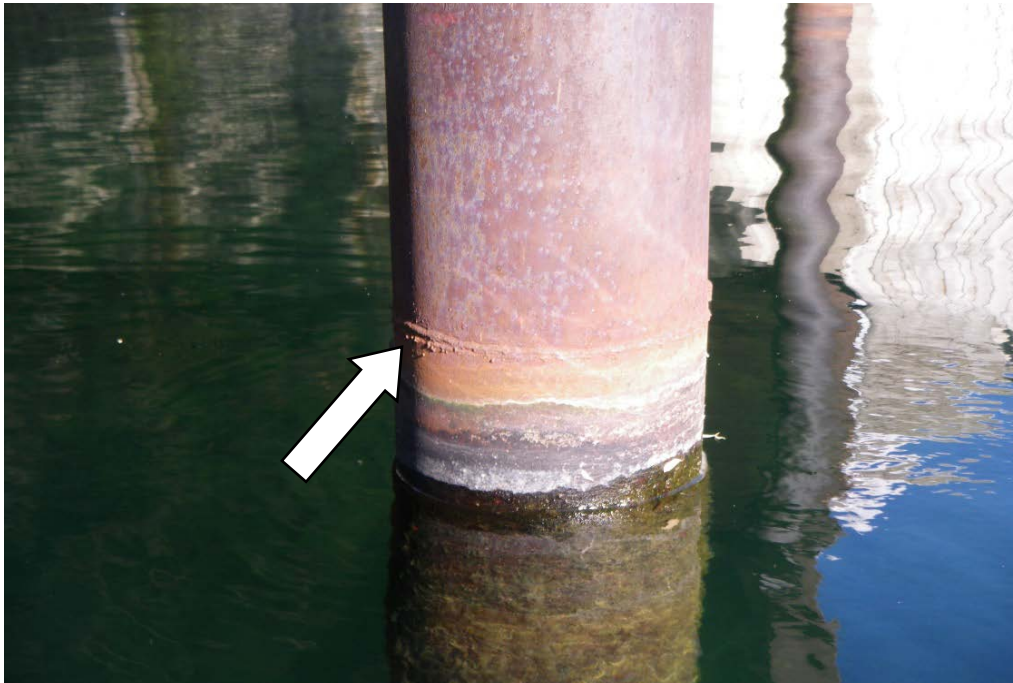


PHOTO No. 4: Bent 7, Row C Pile - Note the good condition of the steel and the general surface corrosion that is typical of COR-TEN steel. Also note the good condition of the weld located approximately 1 foot above the water.





PHOTO No. 5: Bent 4, Row A Pile - Note the general surface corrosion and rust nodules evident on this pile in the submerged zone. This condition was found to be typical of the submerged surfaces of the inspected piling.



PHOTO No. 6: Bent 4, Row A Pile - Inspection also found general surface corrosion and algae growth evident on this pile at the mudline. This condition was found to be typical of the inspected piling near the channel bottom. Also note the logs that have collected on the upstream side of the bent.





PHOTO No. 7: Bent 7, Row B Pile - Note the generally smooth condition of the steel in the cleaned area. Level II cleaning and Level III ultrasonic thickness readings were taken at this location approximately 6 feet below water. The average steel thickness readings obtained at this location is 0.327 inches.



PHOTO No. 8: Bent 7, Row B Pile - This pile was also subjected to Level II cleaning and Level III thickness readings at the mudline. The average steel thickness obtained at this location was 0.345 inches at the mudline. Note the gravel / rock and timber debris evident on the channel bottom.



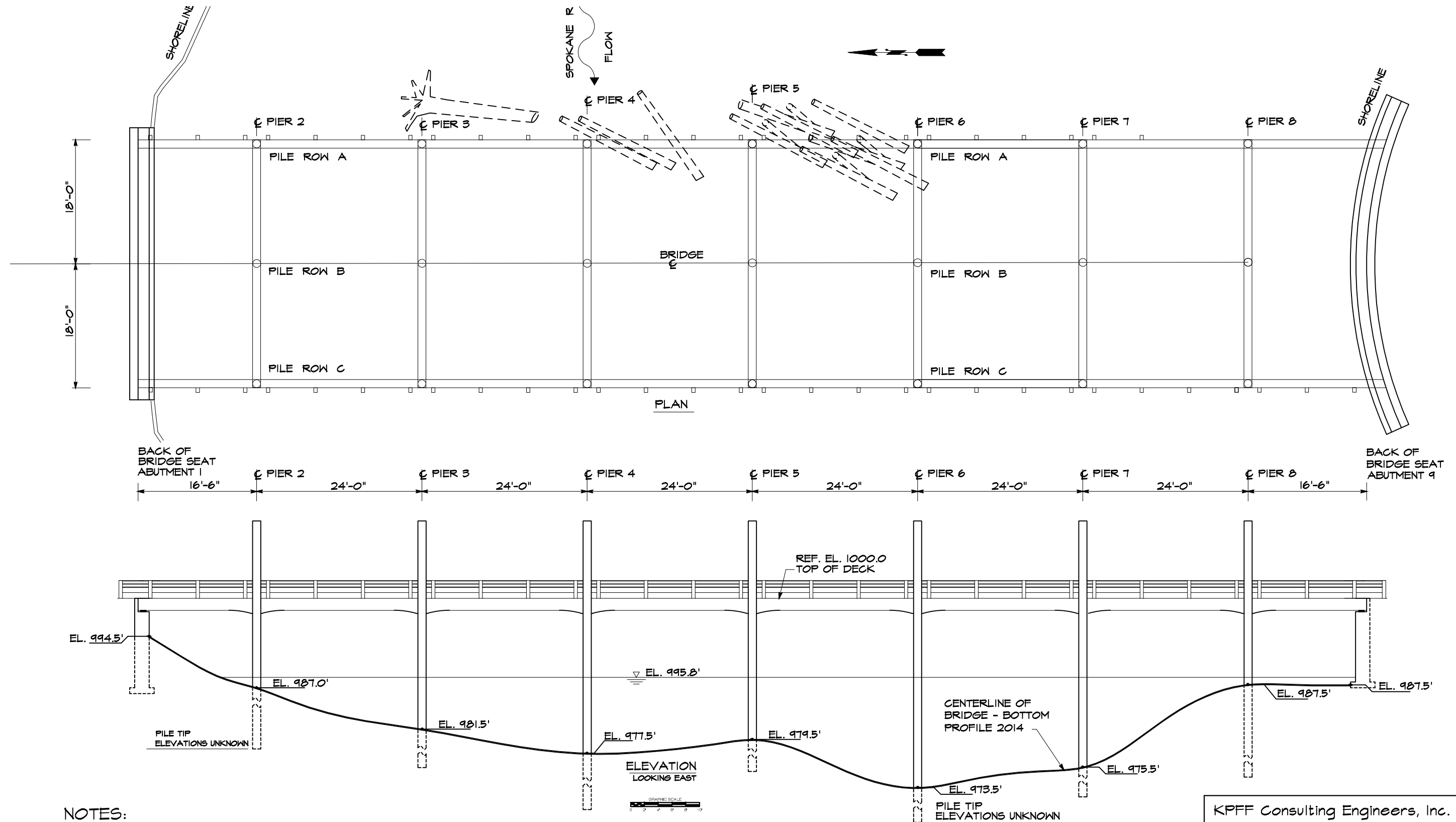


PHOTO No. 9: Bent 4, Row C Pile - This pile was also subjected to Level II cleaning and Level III thickness readings at the mudline. The average steel thickness obtained at this location was 0.392 inches at the mudline. Note the gravel / rock and timber debris evident on the channel bottom.



PHOTO No. 10: Abutment No. 9 - Note the good condition of the concrete footing on this abutment. Although no evidence of any undermining was found, the footing was exposed for a height of 4-6 inches along its full length.





NOTES:

1. Reference elevation: Top of Roadway El. +1,000.0'.
2. Bridge layout developed from field measurements. All dimensions should be field verified.
3. No previous design or inspection information was available at the time of this inspection.

KPFF Consulting Engineers, Inc.

King Cole Pedestrian Bridge
Riverfront Park, City of Spokane, WA

PLAN & PROFILE

DATE: July 2014

PROJECT: 12-2454B

SHEET: 1 of 1

DRAWN: SDS / JDS

E ECHELON ENGINEERING, INC.
Civil/Marine Consulting Engineers
Lynnwood, Washington
Tel: (425) 672-8424

| DATE | REVISION |
|------|----------|
| | |