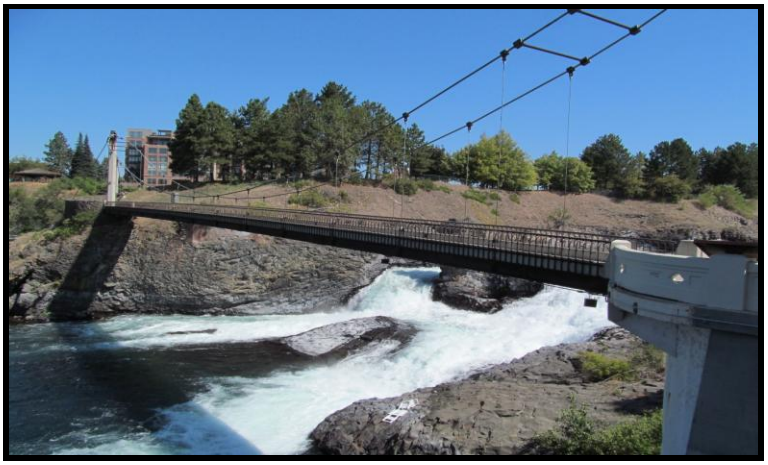

RIVERFRONT PARK BRIDGES

INSPECTION AND ANALYSIS

SOUTH SUSPENSION BRIDGE

NOVEMBER 14, 2014 | Final Report

kpff Consulting Engineers

SOUTH SUSPENSION BRIDGE

November 14, 2014

Prepared for

City of Spokane
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Sub-consultants

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Eileen Heideman
Architectural Historian

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1. BRIDGE DESCRIPTION

The south suspension pedestrian bridge was built for the 1974 Expo to carry pedestrians and bikes across the north channel of the Spokane River in Riverfront Park. The single-span bridge is 228 feet in length from tower to tower. The bridge superstructure is supported by hanger cables vertically connected to the main cables which are suspended from the towers. The floor system consists of weathering-steel edge girders, a concrete deck, horizontal bracing and a floor-beam that supports 15 electrical conduits running below the deck between vaults. The deck consists of concrete with stay-in-place (SIP) steel forms. Large hollow vaults that encompass the lower portion of each tower below the deck level have a ceiling/ cover that serve as an approach span. This approach span is constructed from a concrete filled stay-in-place deck.

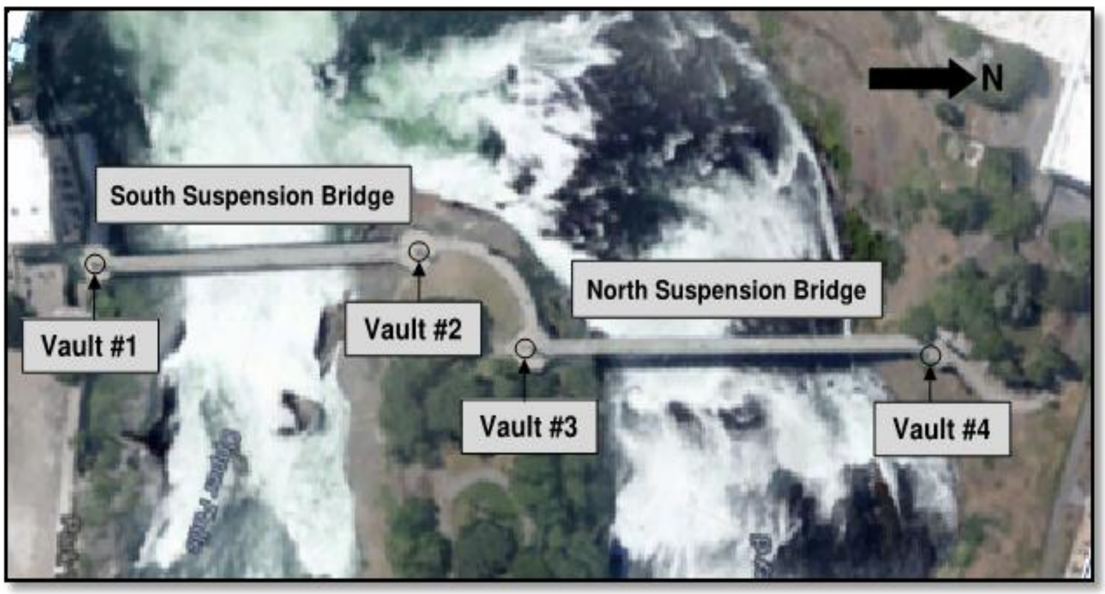


Figure 1: Aerial view of the Suspension Bridges (© 2012 Google Inc.)

2. DOCUMENT REVIEW

In preparation for this evaluation, Kpff reviewed the following documents related to the North Suspension Bridge:

- Structural design drawings (Plan no. G9-G15)
- Previous routine inspection reports
- Ultrasonic testing report (2009)
- Vault inspection report (2011)

3. EVALUATION PROCEDURES

ROUTINE BRIDGE INSPECTION

The bridge was closed to pedestrian traffic for the duration of the bridge inspection. The maintenance department at Riverfront Park provided closure signs.

A visual inspection of the top of the deck, railings, and cable anchorages was performed. These components were accessed by foot. The curb and deck were sounded with a rock hammer to identify areas of delaminations. A visual inspection of the steel framing system, hanger cable bolt connections, and the bottom of the deck (SIP forms) was performed. These components were accessed by a climbing system anchored to the hanger cable connection above the curb and a back-up safety line anchored to the metal railing. The girder flanges and webs were measured with a D-meter and/or calipers at locations which showed evidence of section loss. A hands-on visual inspection of the main suspension cable connections at the towers, spreader bars and adjacent suspender cables was performed. These components were accessed by ascending a rope anchored to the spreader bars. The remainder of the hanger cables and the main suspension cables were also inspected. These cables were accessed with a 32-foot extension ladder (provided by the Riverfront Park maintenance department). A visual inspection of the vaults at the concrete towers was accessed by an extension ladder (provided by Avista). The vaults are considered a confined space; air monitoring equipment was provided by Avista.

STRUCTURAL ANALYSIS

The main suspension cables, suspender cables, and steel girders were load rated using the LRFR method. The analysis was performed using CSiBridge. A uniform pedestrian live load of 90 psf and two vehicle live loads (6-foot-7-inch wheelbase/16,200 pounds and 8-foot-3-inch wheelbase/21,190 pounds) were used in the analysis. The vehicle weight distribution was assumed to be 75 percent of the total weight at the front axle and 25 percent of the total weight at the rear axle. The analysis assumed that there was only one vehicle on the bridge at a time and the vehicle load did not act concurrently with the uniform pedestrian live load. No impact was included for the live loads.

4. EVALUATION FINDINGS

BRIDGE INSPECTION

The elements with the heaviest corrosion and overall deterioration are the deck, floor-beams, hanger cable bolts, and conduit roller supports. The construction joints in the deck allow water to penetrate through the top. The water is trapped in the SIP forms until it eventually rusts through. The water leaking through the deck and corroded SIP form eventually causes corrosion of the floorbeams and the conduit supports. Many of the horizontal plates connecting the lateral bracing to the girders are filled with debris, which traps moisture and causes the connections to corrode.

The metal railing, main suspension cable, hanger cables, steel pins, concrete towers, and cable anchorages are all in good condition. The steel girders are, overall, in satisfactory condition, with the exception of a few isolated areas that have moderate corrosion.

There are tree branches growing around the cable at the anchorage. The south anchorage block is buried. The northwest and south anchor plates only have one lock nut per anchor rod.

The SIP forms and steel supports in the vaults are severely corroded. The heaviest corrosion occurs at the locations were water can penetrate from the top of the deck which are: around the manhole, around the concrete tower, and at the expansion joint at the bridge abutments. A large section of the SIP formwork is no longer is place near the bridge abutment.

The bridge inspection report, component labeling system, and photographs are included in Appendix A.

STRUCTURAL ANALYSIS

The load rating analysis is reported as a Rating Factor (RF). The RF is the ratio of available capacity in each primary superstructure component over the specified live load combination under investigation. Based on AASHTO specifications, a RF less than 1.0 is interpreted to mean that one or more of the superstructure components do not meet current minimal capacity code standards and consideration should be given to either strengthening the subject component(s), or posting a sign identifying a maximum allowable load for the structure linked to the actual RF of the structure. Rating factors greater than 1.0 are interpreted to mean that all of the superstructure components have sufficient capacity to safely support the load under investigation, per the AASHTO specifications.

The minimum rating factor under the pedestrian live load, excluding the deck, is 1.56. The associated controlling component is the axial strength of the backstay anchorage cable. The minimum rating factor under the inspection vehicle live load is 1.59. The associated controlling component is the girder in flexure.

An analysis of the deck based on its current existing condition was also performed. In the original design of the deck the SIP forms were designed as a permanent structural member. Since the SIP place forms are heavily corroded in many locations, they were ignored for determining the capacity of the deck. The deck was analyzed assuming the average moment demands between a fix-fix and pin-pin connection between the slab and girders. The capacity of the deck is based on the tensile strength of the concrete. This analysis resulted in a RF = 0.51 for the deck in flexure under pedestrian loads. A load rating for the deck under vehicle loads was not performed, since vehicles are not currently allowed on the bridge.

The load rating calculations are included in Appendix C.

5. CONCLUSIONS AND RECOMMENDATIONS

The South Suspension bridge structural condition, minus the deck, can be characterized as very good to fair - depending on which part of the bridge is being viewed. In General, the area above the deck including the tower is very good and the areas below the deck are satisfactory to fair. The steel area below the deck will be further investigated and upgraded as needed under our recommendations. Upon completion of this rehabilitation work the area both above and below the deck can be considered to be in good to very good condition. Some minor defects will remain but they will be immaterial to the inherent structural functioning capacity of the bridge as a whole.

In general, structural steel components that support bridges are conducive to corrosion from environmental conditions such as water, moisture, salts, air pollution, dirt and plants, bird droppings and bird nests. The more these items are kept a bay the longer the bridge will last. Maintenance is critical, especially in the form of cleaning and removing debris, bird nests and droppings from anyplace on the structure they can or do collect. The

Suspension bridges structural components while experiencing all degrees of corrosion (minor to severe) over the past 30 years has really overall performed fairly well.

Currently, there is no reason to suspect that this bridge will not be in service for at least another 50 years if repaired as recommended below, bi-annually inspected and maintained (cleaned) on an annual basis.

The steel used for this bridge is weathering steel. Its protective coat is a result of a thin film of rust. It is an excellent system for this environment. However, if over time this protection system appears to degrade, painting the bridge becomes an option which can easily buy another 20 to 30 years of service life for those components. Currently we are recommending painting for those areas already exposed to at least moderate levels of corrosions – generally around the panel point connections.

The deck is in poor to critical condition and must be replaced. A new, properly designed and constructed, deck should function well for another 30 to 50 years. It is recommended that salt not be applied ever to the new deck. It is far better to close the bridge if it seems the slippery to walk on with snow and ice. Salt leads to deterioration of concrete, the deck SIP forms, and any part of the steel components it touches.

Overall, the suspension bridges and vaults require a substantial amount of rehabilitation work to preserve their lifespan. The details of the bridge and vault improvement plans are included in Appendix B, along with a detailed cost estimate. The combined total cost for the recommended repairs for the North and South Suspension Bridges and Vaults is $2.8 million.

Our recommendations to improve the bridge are summarized below

DECK

Due to the heavy corrosion of the SIP forms and the numerous areas of delaminations in the concrete, the deck and curb should be replaced. The new deck should have an improved drainage system to prevent future corrosion of the superstructure. A drainage channel could be added along the curb. The deck should receive a waterproofing sealant.

STEEL FRAMING SYSTEM

The steel framing should be cleaned of debris and flaking steel. After the deck is removed and the steel is cleaned, another inspection should be performed to determine if there are areas of section loss that need to be reinforced. Floorbeams that are moderately to heavily corroded should be replaced. Floorbeams with minor corrosion should be cleaned and painted.

METAL RAILING

The hand rail screws that have been stripped near hanger H9 LT and between hangers H10-H11 RT and H4-H5 RT should be replaced.

The clear opening between the railing posts does not meet current code. Consideration should be given to modifying the railing to meet code when the deck is replaced.

HANGER CABLE ANCHOR BOLTS

The load rating analysis determined that the original anchor bolts had much more capacity than required based on the design loads. Therefore, if the anchor bolts only have a small to moderate amount of corrosion (less than 25%

section loss), they will still have well above sufficient capacity to support dead and live loads. These anchor bolts should be cleaned of all rust and painted. Anchor bolts with severe corrosion (more than 25% section loss) should be replaced.

ELECTRICAL CONDUITS

The conduit supports at the floorbeams are heavily corroded. The conduits are corroded in many locations. The conduits will need to be removed in order to clean and replace the floorbeams. The estimated cost and improvement details assume that all of the conduits and supports will be replaced.

CABLE ANCHORAGE

The tree branches should be cut back around the south cable and the soil should be removed from around the anchors and anchorage block. The lock nuts at the northwest and south anchors should be tack welded in place.

VAULTS AT CONCRETE TOWERS

The deck and the steel framing in the vaults should be replaced and additional framing around the manhole opening should be provided. The conduits should be removed during construction, and the new deck should be constructed with removable formwork. The sidewalk around the vaults should also be replaced. A compression seal should be installed at the expansion joints to prevent the large intrusion of water at the joint.

FUTURE INSPECTIONS

A routine walk-through inspection should be performed every two years. KPFF has provided inspection forms, which if utilized on a continual basis will, over time, provide an invaluable record of the bridge condition, areas of continual problems, and help inform the best way to care for the bridge and preserve the City's investment in its infrastructure.

6. PERMITS AND CULTURAL RESOURCE REQUIREMENTS

PERMITS

An environmental permit matrix was prepared by SWCA Environmental Consultants for the Riverfront Park Bridges. The proposed bridge improvement work may require the following permits or approvals:

- Hydraulic Project Approval permit from the Washington Department of Fish and Wildlife.
- Critical Areas Review from the City of Spokane
- Shoreline Substantial Development Permit from the City of Spokane

More information can be found in SWCA's report.

APPENDIX A

PAGE

LIST OF PHOTOGRAPHS

PAGE

CITY OF SPOKANE

PEDESTRIAN BRIDGE INSPECTION FORM

				Bridge No.	871
Bridge Name	South Suspension Bridge		**Bridge Location**	South abutment near Avista Powerhouse	
Inspection Date	9/3/14-9/5/14	**Inspector(s)**	Frymoyer, Whiteman, Georgieff	**Agency**	KPFF
Access Method	Climbing equipment-below deck and upper cables, 32 ft ladder-vaults, hanger cables			**Weather**	Sunny/Warm

Load Rating Date	Nov. 2014		**Live Load**	**Pedestrian**	**Vehicle**
				90 psf	Inspection Trucks
Load Rating Factor(s)	**Ped.**	**Veh.**	**Controlling Component**	**Pedestrian**	**Vehicle**
	0.51	1.59		Deck	Girders

Description of Bridge

Pedestrian suspension bridge built in 1974, spans middle channel of Spokane River. Bridge is 228 ft long between towers. The primary structural system is: tower, main cables, hanger cables, longitudinal girders and deck. All steel, except the cables is weathering steel. The deck cannot be seen from below due to the S.I.P forms. The floorbeams do not support the deck - they support 15 conduits. There is a large enclosed vault around each tower.

Summary of Condition and Critical Findings

The heaviest corrosion occurs at the floorbeams, the hanger bolt connections, and the lateral bracing connections. The stay in place deck forms are heavily corroded and are missing at some places above the floor beam. The main suspension cables, hanger cables, pins, towers, and anchorages are all in good condition.

Summary of Recommendations

1) Deck, heavily corroded floor beams, and suspender cable bolts should be replaced. 2) After the deck is removed, the girders should receive another thorough inspection to determine if there are any areas of significant section loss that need repair. 3) Remove debris from the connections. 4) Remove tree branches/soil from south cable anchorage. 5) Tack weld lock nut at NW and South anchorages. 6) Vault deck and supports should be replaced. 7) Repair handrail cover plate.

Summary of Bridge Condition

	Bridge Component	No. of Compon.	% of **	Condition Rating*			Comments
				8 – 7 Good	6 – 5 Fair	4 – 3 Poor	
1	Concrete Deck	1	area	60%	20%	20%	Cracks, spalls, delaminations, and exposed rebar throughout.
2	Metal Railing	2	length	100%	0%	0%	See notes next page.
3	Steel Floorbeams	15	length	46%	46%	8%	Floor beam 1-1 has the most severe corrosion.
4	Steel Girders	2	length	85%	11%	4%	Girder at H2 LT and H6 RT has the most severe corrosion.
5	Suspension - Main Cable	2	length	100%	0%	0%	Minor loss of galvanizing.
6	Hanger Cables	26	length	90%	10%	0%	See notes next page.
7	Steel Pin	7	each	100%	0%	0%	
8	Concrete Tower	2	length	100%	0%	0%	
9	Cable Anchorage	3	each	100%	0%	0%	See notes next page.
10	Soffit (stay in place forms)	1	area	85%	0%	15%	See notes next page.
11	Vault	2	area	80%	0%	20%	See notes next page.
12							
13							

*See Page 2 for detailed descriptions **Condition rating percentages are based on the % of area, length, or each of the bridge components inspected.

GENERAL NOTES

Vault #1 at Pier 1; Vault #2 at Pier 2.

DESCRIPTION OF CONDITION OF BRIDGE COMPONENT		
Condition Value	**Material**	**Description**
8 – 7 Very good → Good 2 yr. insp. Cycle No repairs.	Steel	Like new, surface rust, minor pitting, no material loss. Connections are good. No damage.
	Concrete	No to minor/ insignificant defects includes: cracks, spalls, chips, consolidation, efflorescence.
	Timber	Beams: Minor splits, checks, or defects (one side), no decay or insects – sounds solid. Posts: Splits or cracks less than ⅜" (one side), no decay or insects – sounds solid.
	Paint	No defects, no sign of rust including no freckled rust, no peeling, no exposed steel.
	Scour / Erosion	None or minor.
6 – 5 Satisfactory → Fair 1 – 2 yr insp. cycle Monitor for repairs Paint: Max 10 year life estimate	Steel	Moderate corrosion, pitting, flaking, pack rust. Material loss is evident but barely measurable. Connections have up to moderate corrosion but remain fully functional. No cracks.
	Concrete	Some spalling but exposed rebar (if any) is insignificant or exhibits some surface rust; delamination is evident with or without evidence of rebar corrosion. Shear zone cracks are tight, barely measureable, and low density. Flexure zone cracks are measurable but less than .035 inch and low density. Concrete may exhibit: efflorescence (moderate to heavy), surface rust, heavy map cracking, very poor consolidation. Settlement cracks in foundations and wall are stable and less than ¼" wide.
	Timber	Beams: Less than ⅜" splits – two sides or greater than ⅜" on one side. Some decay (max 10% by volume), some softness but sounds solid – no insects. Posts: More than ½ "splits – two sides or greater than ¾" on one side. Decay is evident (greater than 20% by volume), timber may have extensive wetness and softness.
	Paint	Freckled rust, small areas of exposed steel, some peeling, oxidized.
	Scour / Erosion	Evidence of scour, exposed footing, no undermining. Banks are sloughing, protection, if any, needs repair.
4 – 3 Poor → Critical 3 mo – 1 yr. insp. cycle (as needed) Repairs needed. (ASAP or one year) Re - paint	Steel	Heavy to severe: corrosion, pitting, pack rust. Measurable material loss. Connections are heavily corroded, missing, and questionable functionality. Fatigue cracks.
	Concrete	Large spalls, deep w/ exposed and corroded rebar w/ material loss evident. Cracks are wider, closely spaced, clearly structural in nature both in shear and flexure zone. Concrete quality appears poor w/ heavy scaling, stagilites, efflorescence, map cracking, extensive surface rust and delamination, and very poor consolidation of concrete. Settlement cracks are significant.
	Timber	Beams: Greater than ⅜" on two sides. Moderate decay up to 20%, surface softness, do not sound solid – may have insects. Posts: Less than ½ "splits – two sides or greater than ½" on one side. Decay is evident (20%), wetness and soft.
	Paint	Extensive freckled rust, larger areas of exposed steel, heavily oxidized, extensive peeling.
	Scour / Erosion	Undermining or threatens undermining in a manner that could impact structure stability. Banks are heavily eroded, protection if any is non-functional.

Additional Comments by Component Number

Bridge Comp. No.	**Comments**
2	Handrail cover plate is missing screws near H9 LT, between H10 and H11 RT, and between H4 and H5 right. Concrete curb is cracked at suspender cable bolt connection.
6	Anchor bolts connecting hanger cable to girders are corroded, most severe corrosion is at H10.
9	Tree branches growing around south cable at anchorage. South anchorage block is buried. Northwest and South anchor plates only have one lock nut per anchor rod.
10	Stay in place deck form is heavily corroded and/or missing above the floor beams at the concrete deck construction joint location. The most extension deterioration is above floor beams near piers.
11	Stay in place deck forms are heavily corroded around manhole, column, and near bridge abutments. Steel angle support around column is heavily corroded. Beam at Vault #1 and angles at Vault #2 are heavily corroded.

Photo 1 –South Suspension Bridge Deck (Looking North)

Photo 2 – South Suspension Bridge Elevation (Looking West)

Photo 3 – Loose Cover Plate on Handrail

Photo 4 – Heavy Corrosion at Pier 1/Floorbeam 1-1

Photo 5 – Top Flange of Right Girder near H6, ~1/4” measured section loss

Photo 6 –Heavy Corrosion at H6 RT Suspender Cable Interior Hanger Connection

Photo 7 – Remove Tree Branches around South Cable Anchorage

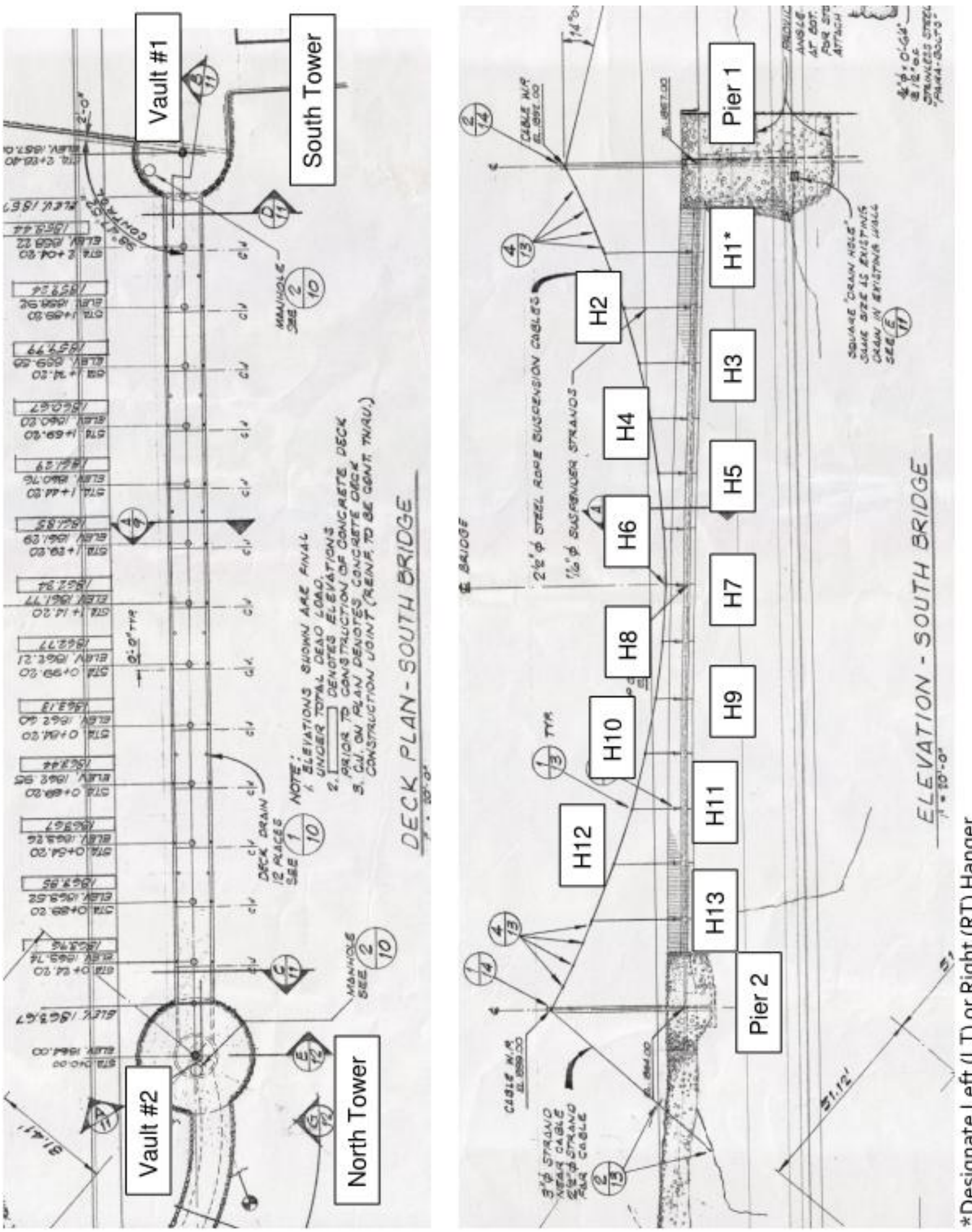
Photo 8 – Tack Weld Lock Nut at Northwest and South Cable Anchorage,
Remove Soil around South Anchorage block

Photo 9 – Corroded/Missing Stay-in-Place Formwork above Floorbeam (Typical)

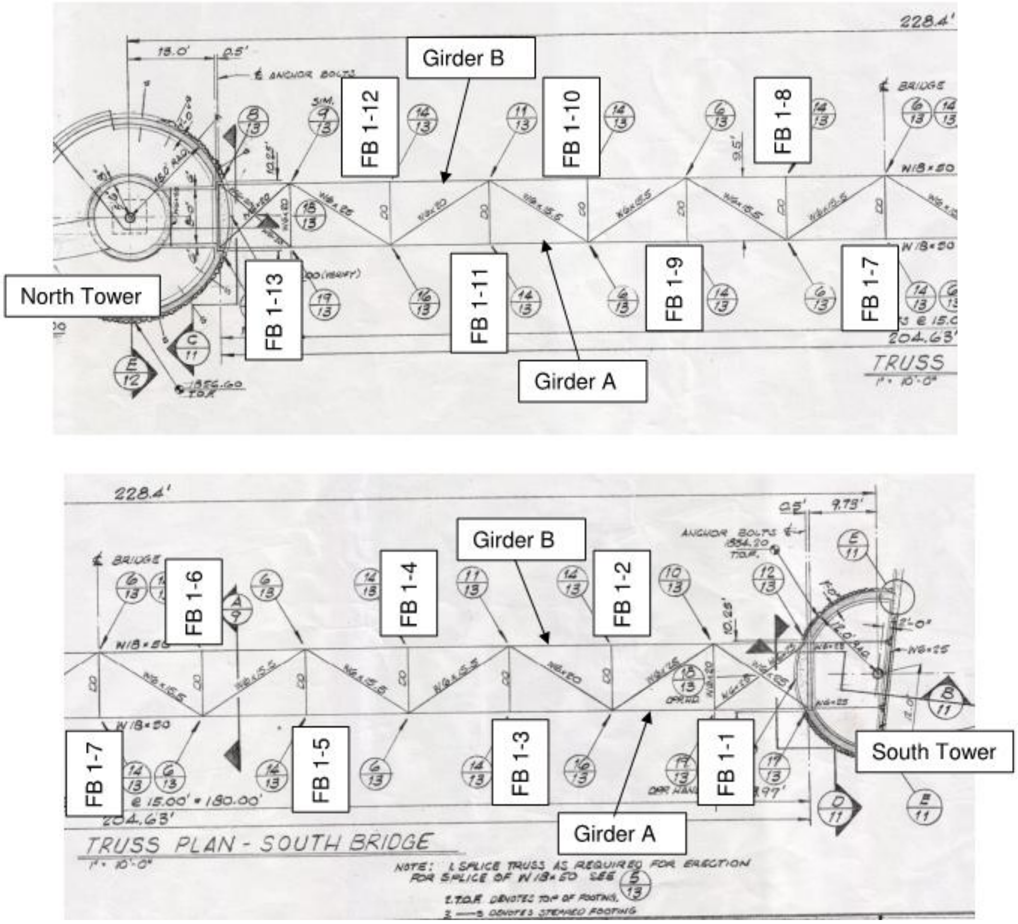
Photo 10 –Vault No. 1: Severely Corroded Beam

Photo 11 –Vault No. 1: Corroded Stay in Place Formwork around Manhole

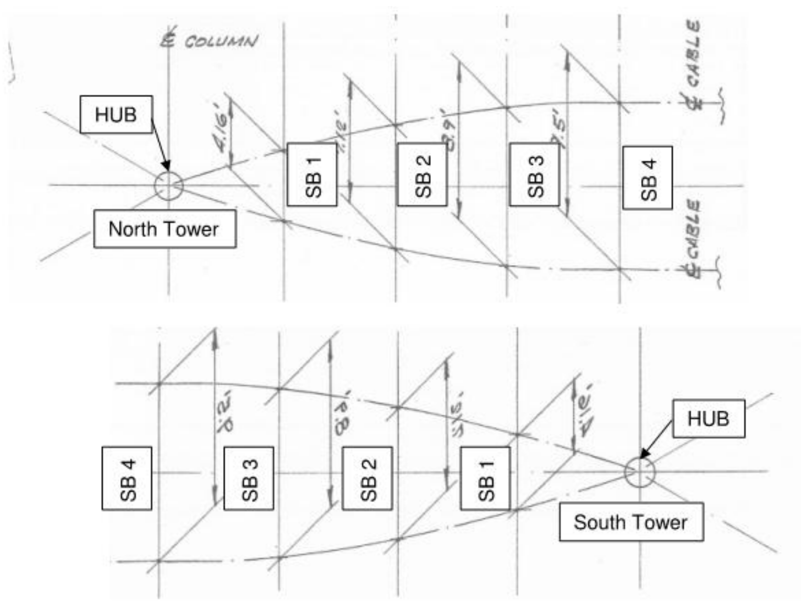
Photo 12 –Vault No. 2: Missing Stay in Place Formwork and Corroded Beam/Angle near Abutment



Bridge Component Labeling System: Suspender Cable / Panel Point



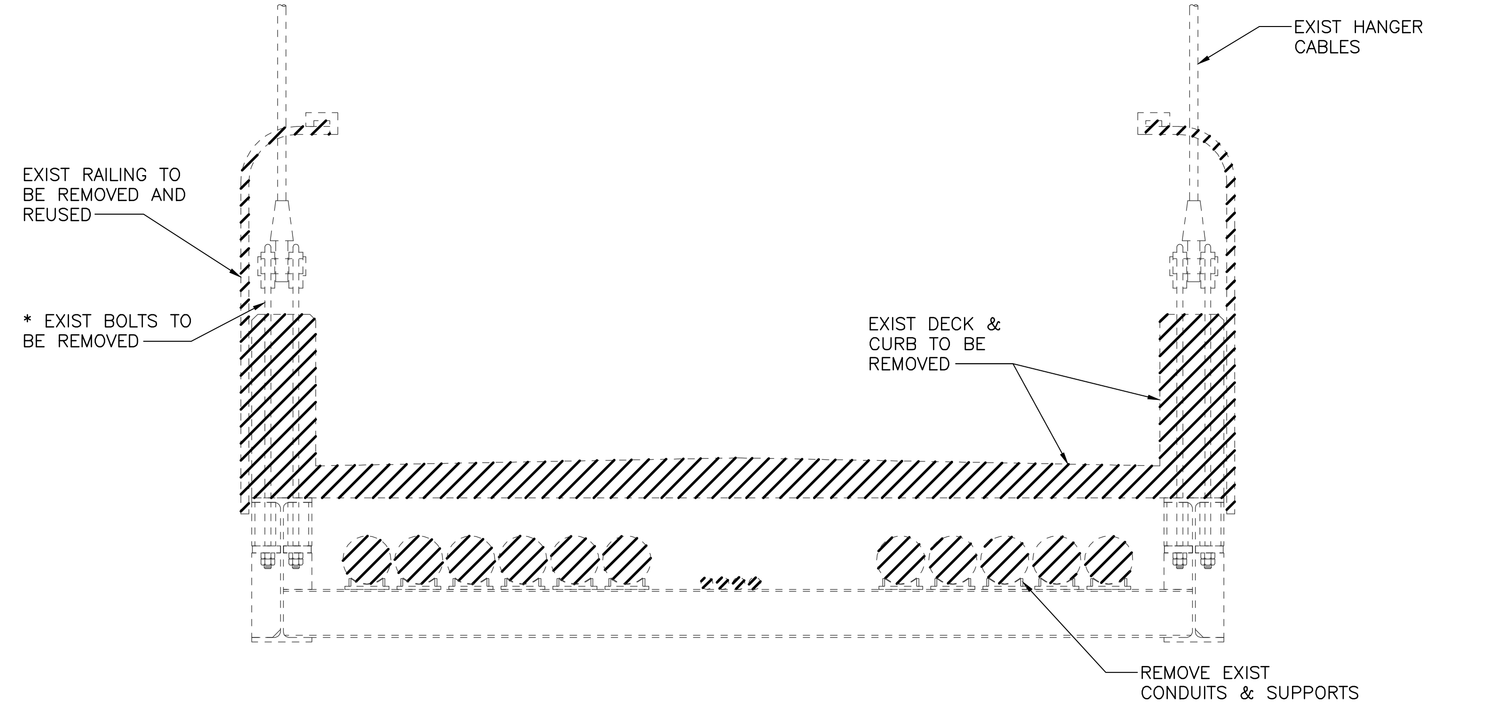
Bridge Component Labeling System: Floorbeams



Bridge Component Labelling System: Spreader Bars

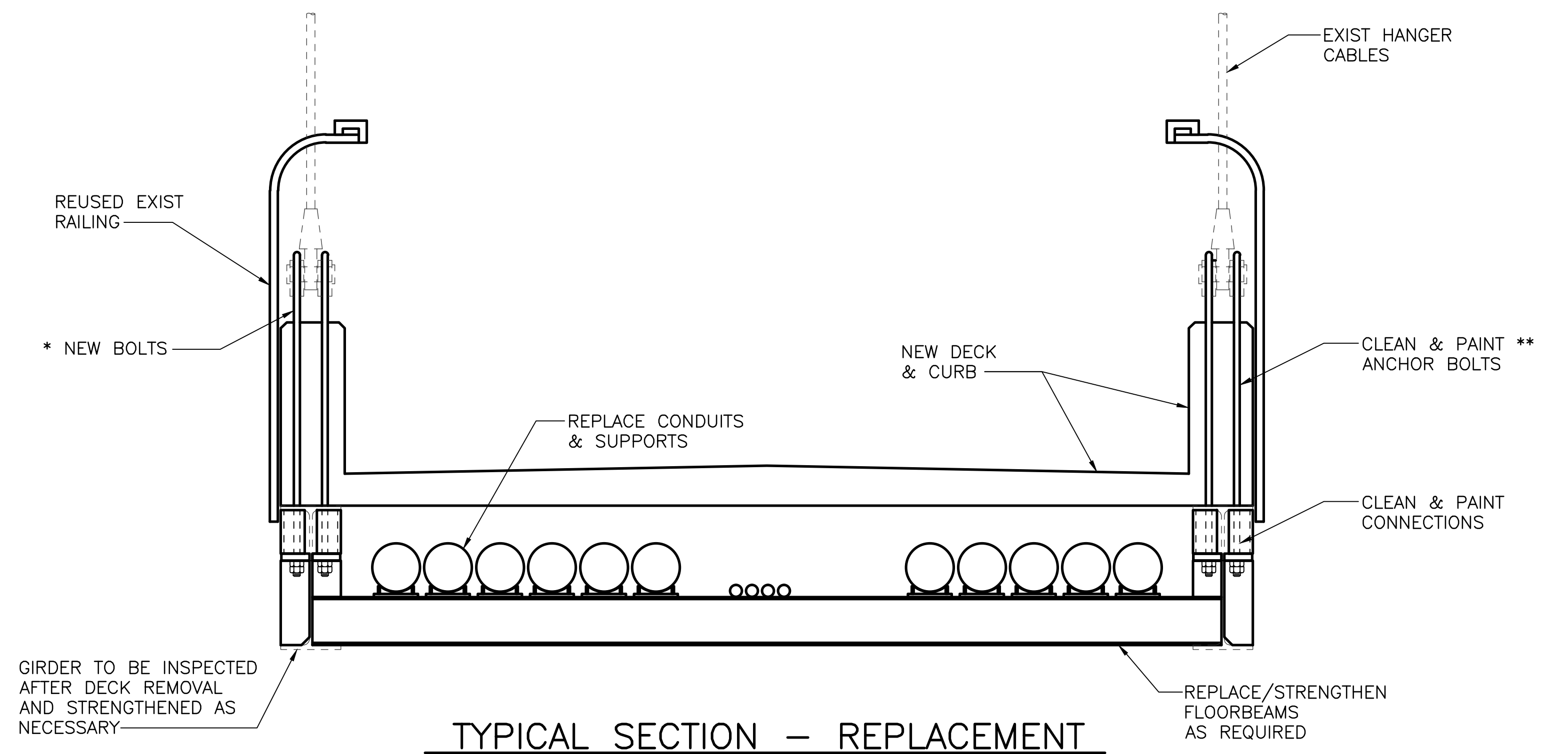
APPENDIX B

IMPROVEMENT DETAILS
COST ESTIMATES



TYPICAL SECTION – REMOVAL

SCALE: 1" = 1'-0"



TYPICAL SECTION – REPLACEMENT

SCALE: 1" = 1'-0"

* EXISTING ANCHOR BOLTS WITH MORE THAN 25% SECTION LOSS SHALL BE REPLACED.

** EXISTING ANCHOR BOLTS WITH EQUAL OR LESS THAN 25% SECTION LOSS SHALL BE CLEANED AND PAINTED.

Name: TaunieA Date: Nov 11, 2014-11:47:56am File: V:\114176 (Spokane River Front Bridges)\Suspension Bridge\Design\SB-S01.dwg

DATE	BY	PROJ.	DESCRIPTION
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REVISIONS

DATE	BY	PROJ.	E.P.N.	U.S.N.	FROM	TO	COUNCIL ACCEPT DATE

AS BUILT

FROM	TO	ORD. NO.	DATE	FILE NO.

GRADE ORDINANCE LIST

NAVD88 = (OLD CBM ELEV.) - (13.13)

AS OF JANUARY, 2000 USE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BENCH MARK LOCATION -
-

NAVD88 ELEV. -

CBM NO. -

NAVD88 DATUM

BAR IS ONE INCH ON ORIGINAL DRAWING.

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

HORIZONTAL PLAN&PROFILE AS SHOWN

VERTICAL PROFILE ONLY

SCALE

CURRENT C.O.S. DRAFTING STANDARDS ADOPTED FEB, 2007

	BY	DATES
DRAWN:	HT	11/14
REVISED:	MLF	11/14
CHECKED:	TW	11/14
APPROVED:	MLF	11/14

CITY OF SPOKANE, WASHINGTON

DEPARTMENT OF ENGINEERING SERVICES

808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6700

PROJECT NAME: RIVERFRONT PARK BRIDGES

BRIDGE NAME: NORTH & SOUTH SUSPENSION BRIDGES
DECK REPLACEMENT & REHAB

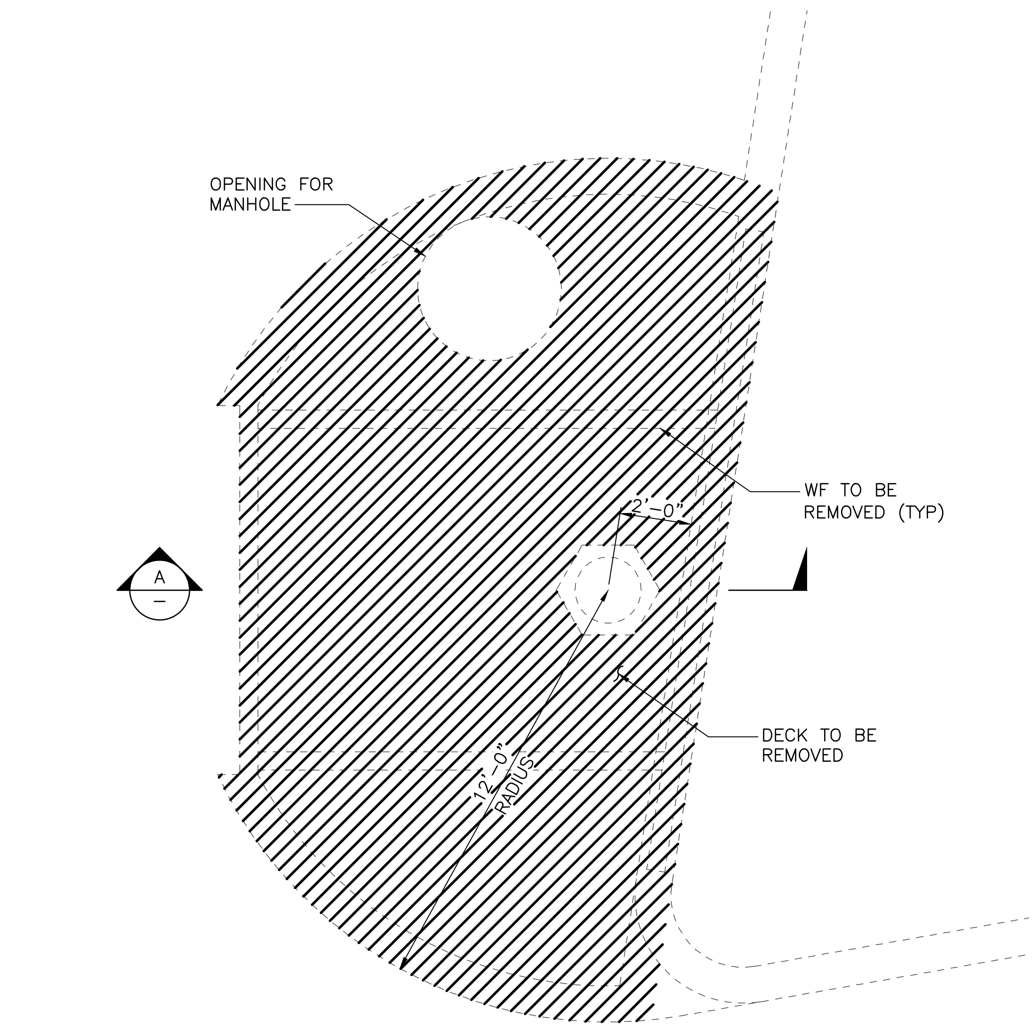
TYPICAL SECTION

TYPE OF IMPROVEMENT: BRIDGE

CITY PROJECT NUMBER	PLAN NUMBER
2013186	1 of 3
EFN: --	

CALL BEFORE YOU DIG 1-800-424-5555

REGION NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.
EASTERN	WASH.	---	



VAULT #1 – PLAN REMOVAL

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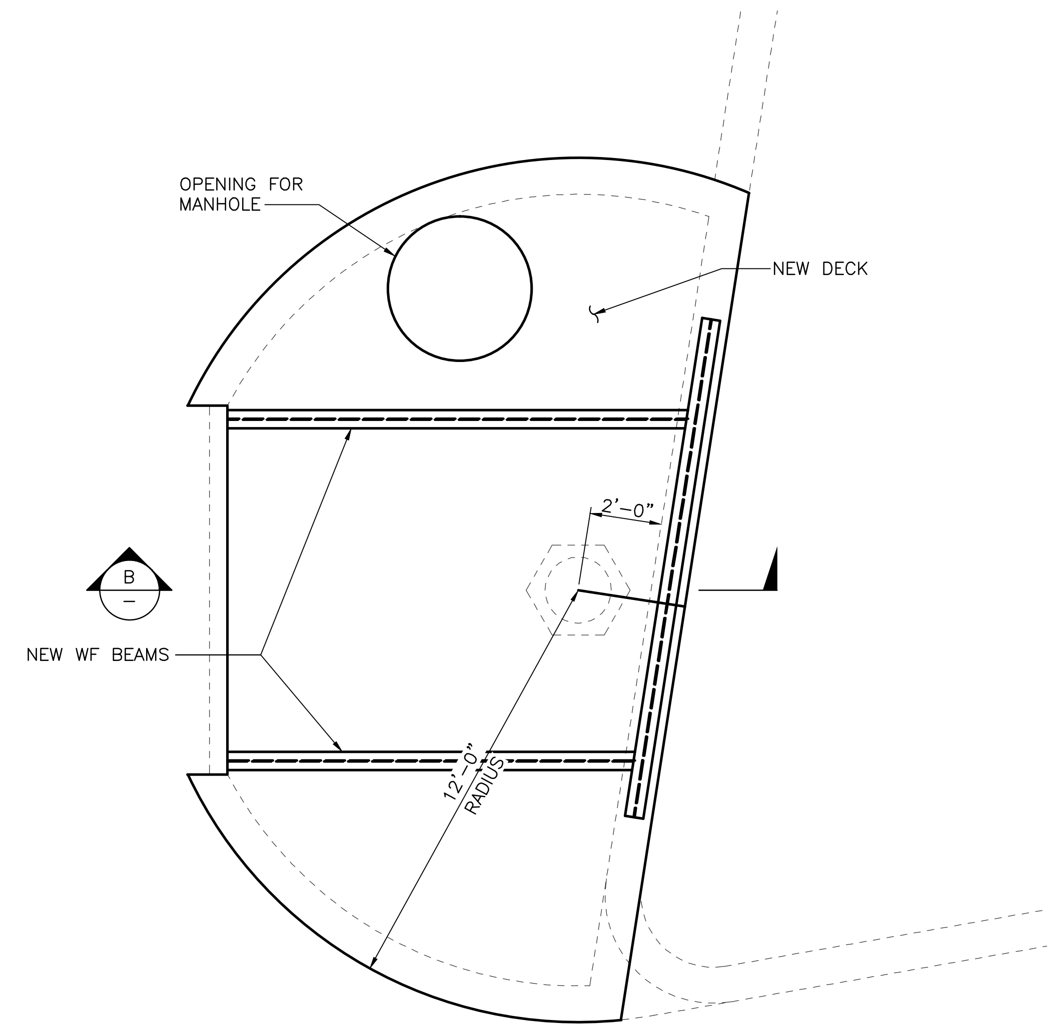

VAULT #1 – PLAN REPLACEMENT

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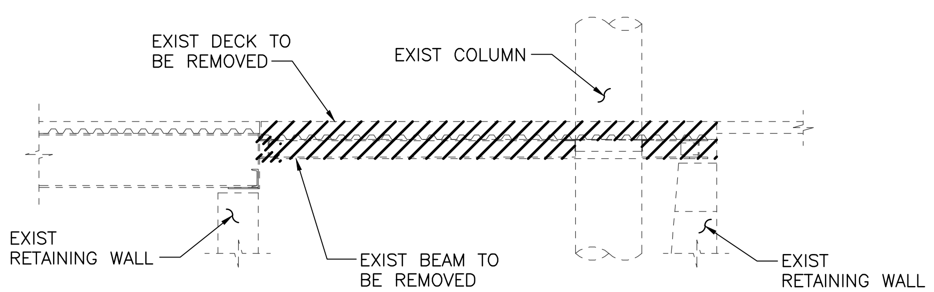

SECTION (A) REMOVAL

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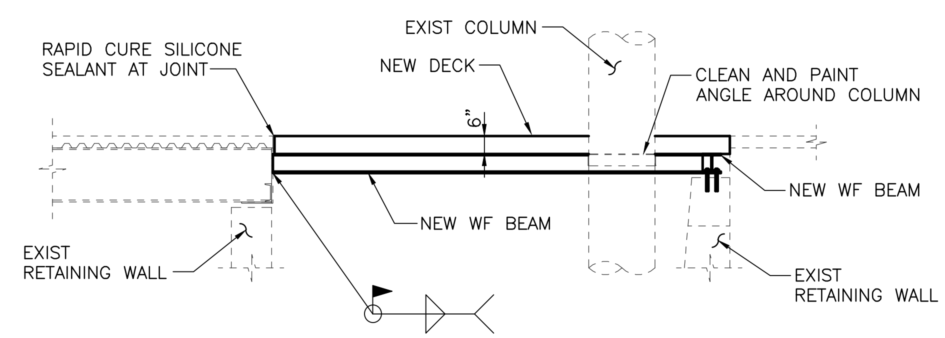


SECTION (B) REPLACEMENT

SCALE: 3/8"=1'-0"

REVISIONS | AS BUILT | GRADE ORDINANCE LIST

NAVD88 DATUM | SCALE: AS SHOWN

CURRENT C.O.S. DRAFTING STANDARDS ADOPTED FEB.2007

	BY	DATES
DRAWN:	HT	11/14
REVISED:	MLF	11/14
CHECKED:	TW	11/14
APPROVED:	MLF	11/14

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6700

PROJECT NAME: RIVERFRONT PARK BRIDGES

BRIDGE NAME: NORTH & SOUTH SUSPENSION BRIDGES

VAULT DECK REPLACEMENT

PLAN AND SECTION

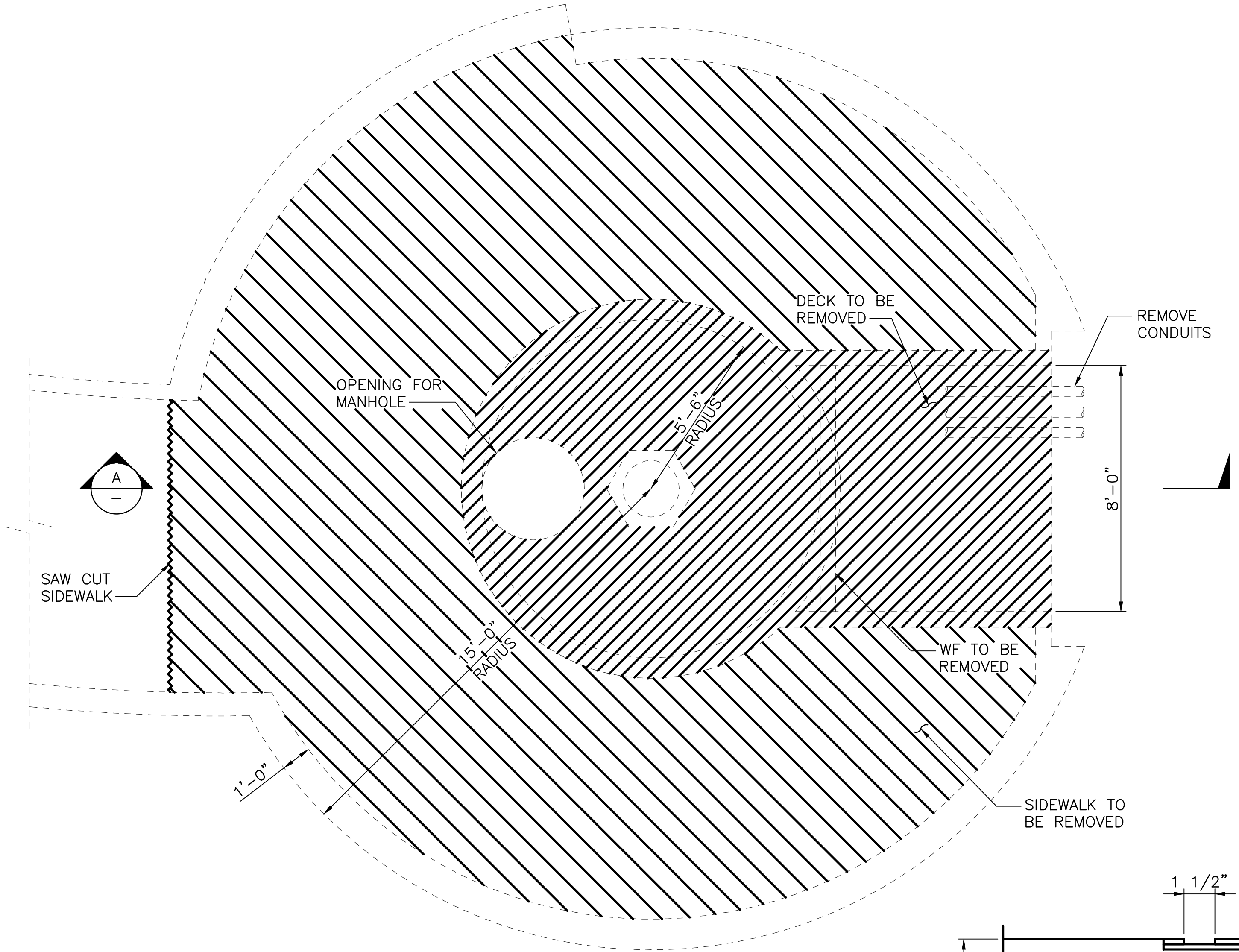
TYPE OF IMPROVEMENT: BRIDGE

CITY PROJECT NUMBER: 2013186

PLAN NUMBER: 2 of 3

CALL BEFORE YOU DIG 1-800-424-5555

REGION NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.
EASTERN	WASH.	---	



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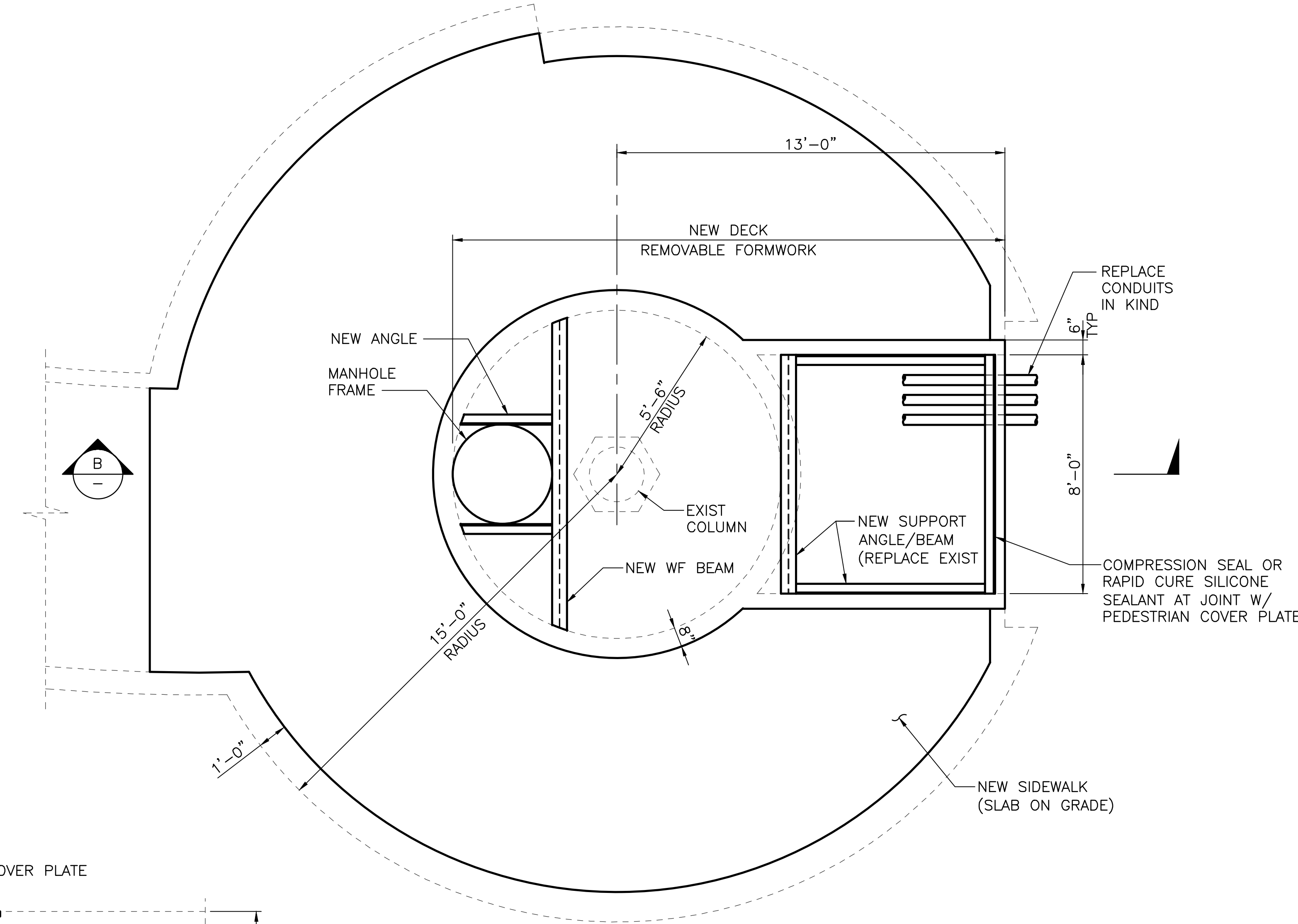

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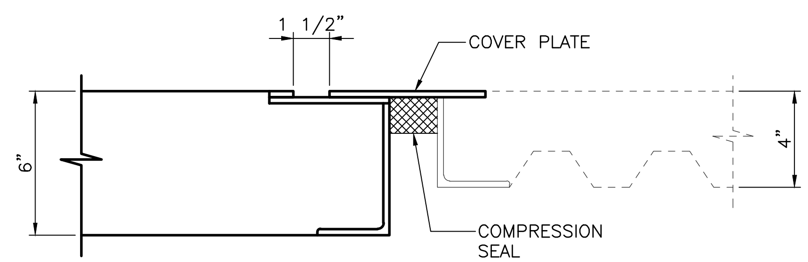

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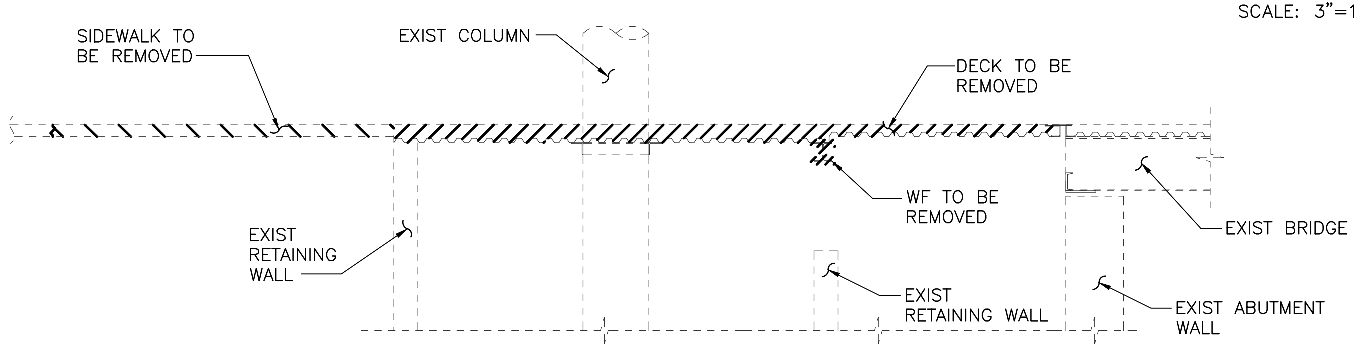

SECTION A REMOVAL
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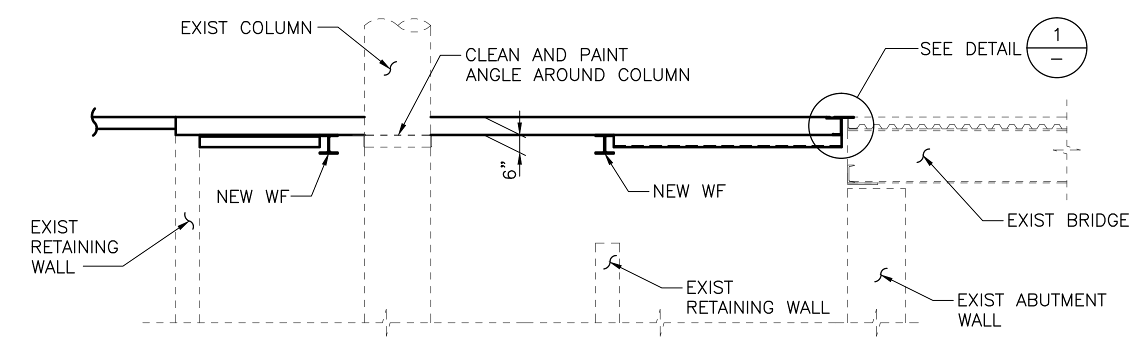


SECTION B REPLACEMENT
SCALE: 3/8"=1'-0"

DATE	BY	PROJ.	DESCRIPTION

REVISIONS

DATE	BY	PROJ.	E.P.N.	U.S.N.	FROM	TO	COUNCIL ACCEPT DATE

AS BUILT

FROM	TO	ORD. NO.	DATE	FILE NO.

GRADE ORDINANCE LIST

NAVD88 = (OLD CBM ELEV.) - (13.13)
AS OF JANUARY, 2000 USE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
BENCH MARK LOCATION -
NAVD88 ELEV. -
CBM NO. -
NAVD88 DATUM

BAR IS ONE INCH ON ORIGINAL DRAWING.
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

HORIZONTAL PLAN&PROFILE: AS SHOWN
VERTICAL PROFILE ONLY
SCALE

CURRENT C.O.S. DRAFTING STANDARDS ADOPTED FEB,2007

	BY	DATES
DRAWN:	HT	11/14
REVISED:	MLF	11/14
CHECKED:	TW	11/14
APPROVED:	MLF	11/14

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6700

PROJECT NAME: RIVERFRONT PARK BRIDGES
BRIDGE NAME: NORTH & SOUTH SUSPENSION BRIDGES
VAULT DECK REPLACEMENT
PLAN AND SECTION
TYPE OF IMPROVEMENT: BRIDGE
CITY PROJECT NUMBER: 2013186
EFN: --
PLAN NUMBER: 3 of 3

CALL BEFORE YOU DIG 1-800-424-5555

City of Spokane Pedestrian Bridges Nov-14

Cost Estimates for Bridge Improvements Based on the 2014 KPFF Inspection and Analysis Recommendations

Bridge Name: Two Suspension Bridges (North and South) and Vault decks.

Combined Bridge Length and Width (feet) 474 10

Recommendations for Improvements - Include: Deck Replacement, Structural Steel Improvments, Valult Rehabilitation

Item no	Item Description	Cost Unit	Quantity	Unit Cost	Item Cost
1	Existing Rail Remove and Re-install	LF	474	90	$ 42,660
2	Replace Existing Anchor Bolts	EA	25	1250	$ 31,000
3	Clean and Paint In-situ Anchor Bolts	EA	223	450	$ 100,440
4	Remove Existing Deck and Curb	SF	4740	45	$ 213,300
5	New Deck and Curb	SF	4740	65	$ 308,100
6	Replace Floorbeams	EA	9	4500	$ 38,925
7	Clean, Strengthen, & Paint in-situ Floorbeams	EA	26	1500	$ 39,525
8	Replace Conduits and Supports	LF	7110	12	$ 85,320
9	Edge Girder Repair and Painting	LF	948	250	$ 237,000
10	Repair/Replace Vault Deck and Adj. Sidewalk	EA	4	25000	$ 100,000
12	Misc and Constructibility Access	LS	2	100000	$ 200,000
	Total				$ 1,396,270
13	Mobilization	12%			$ 167,552
14	Design, Permits, Survey	30%			$ 418,881
15	Construction Management	13%			$ 174,534
16	Taxes	8%			$ 111,702
17	Contingency	30%			$ 418,881
18	Excalation (1 year)	3%			$ 41,888
19	Agency Project Development & Mngmt.	5%			$ 69,814
	Total				$ 1,403,251
	Total Project Cost (2015)				**$ 2,799,521**
	Square Foot Cost - includes Vault Area ($/SF)				$ 545

Note: Total project cost is for both north and south suspension bridges and all four vault repairs.

APPENDIX C

LOAD RATING RESULTS AND CALCULATIONS

Structural Analysis –
Load Rating Summary

LRFR Bridge Rating Summary

Strength I – Rating Factors (RF):

	Pedestrian		Vehicle	
	Inventory	**Operating**	**Inventory**	**Operating**
Deck (Stress) RF	**0.51**	**0.66**	*N/A*	*N/A*
Controlling Point	Center of Deck		*N/A*	
Steel (Moment) RF	2.76	3.58	**1.59**	**2.06**
Controlling Point	Girders at Hanger Connections		Girders at Hanger Connections	
Cable (Axial) RF	1.56	2.02	9.97	12.9
Controlling Point	Backstay Cables		Backstay Cables	
Pylon (M+A) RF	1.87	2.43	10.1	13.0
Controlling Point	Base of Pylon		Base of Pylon	

<u>Maximum Pedestrian Live Load</u>

Inventory = 0.51*90 psf = 46 psf
Operating = 0.66*90 psf = 59 psf

Pedestrian = 90 psf uniform distributed load

Vehicle = Bridge Inspection Vehicles
(12,150 lb. front axle, 4,050 lb. rear axle, 6'-7" axle spacing)
(15,895 lb. front axle, 5,300 lb. rear axle, 8'-3" axle spacing)
Weights provided by City of Spokane Engineering Department

Figures C3.1-1 and C3.1-2 from the *LRFD Guide Specifications for the Design of Pedestrain Bridges* (December 2009) give a visual representation of the uniform pedestrian live load.

Figure C3.1-1—Live Load of 50 psf

Figure C3.1-2—Live Load of 100 psf

Structural Analysis - Load Rating

Design Parameters:

Concrete
f'c = 4,000 psi @ 28 days
Rebar – fy = 60,000 psi

Steel
Yield Stress, fy = 50 ksi
Modulus of Elasticity, E = 29,000 ksi

Cables
Yield Stress, fy = 160 ksi
Tensile Stress, fu = 200 ksi
Modulus of Elasticity, E = 20,000 ksi

Dead Loads
Superstructure self weight
Curb and railing
Conduits
(CSiBridge Load – Sched3-ZERO, step 31)

Live Loads
Pedestrian Uniform Load = 90 psf
(CSiBridge Load – Pedestrian)
Vehicle Load = 16,200 lb inspection vehicles
(CSiBridge Load – Truck 1)
Vehicle Load = 21,190 lb inspection vehicles
(CSiBridge Load – Truck 2)
Impact is not included
Pedestrian and Vehicle Loads do not act concurrently

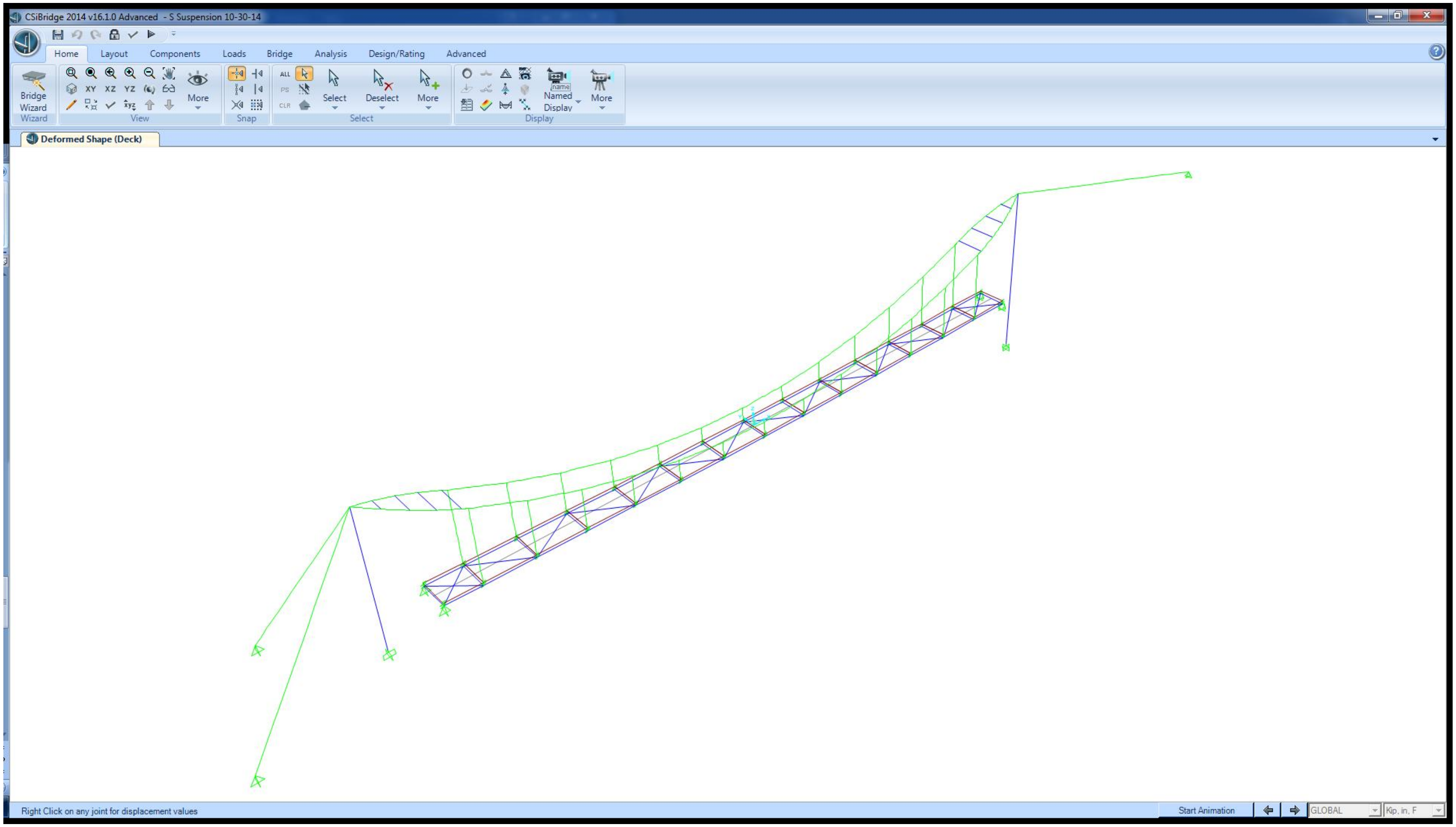
Analysis Methods:

The bridge geometry, section properties, and cables were modeled in CSiBridge based on the "As Built" drawings. The force in the cables was not specified so they were set to values that resulted in zero dead load deflection. The moment, shear, and axial demands due to dead loads and live loads were exported from CSiBridge to Excel. The moment, shear, and axial capacities were calculated in Excel. The Strength I rating factors were calculated in Excel using the peak demands in each element type.

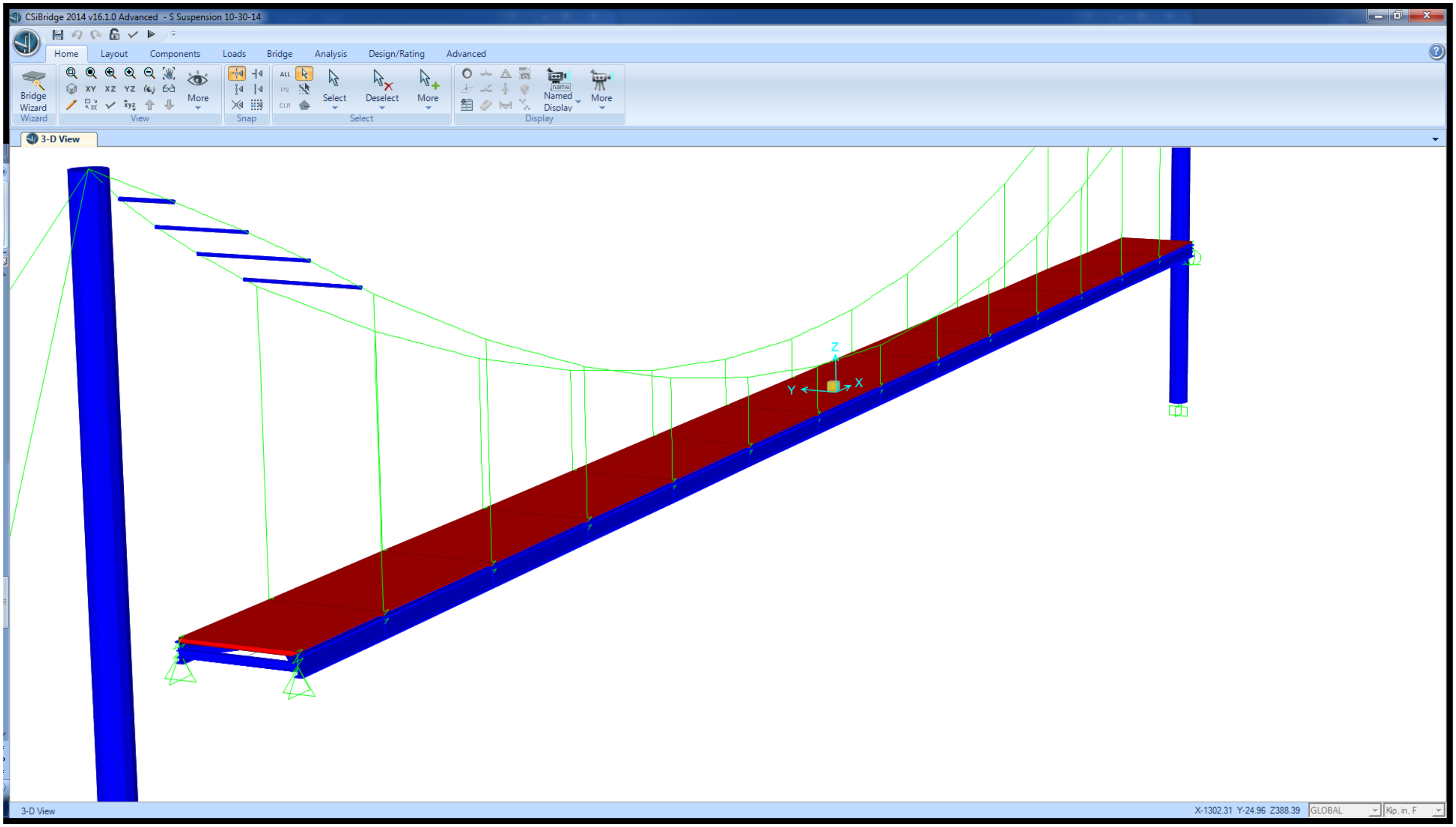
The visual bridge inspection completed on September 5, 2014 found the deck to be in poor condition, and the floor beams to be in fair condition. All other superstructure components were shown to be in good condition. The condition rating factor, φ_c, is equal to 1.0 for good members, 0.95 for fair members, and 0.85 for poor members. The system rating factor, φ_s is equal to 1.0 for redundant members such as the deck, floorbeams, crossbracing, and spreader bars, and 0.85 for all other non redundant members.

The Strength I Load Rating checks flexure, shear, and axial capacities, as well as combined concurrent moment and axial capacity. Each member was checked individually and compared to the demands given in the CSiBridge model. The deck was not load rated for vehicles as it is in poor condition and is being recommended for replacement. No vehicles shall be allowed on the existing deck.

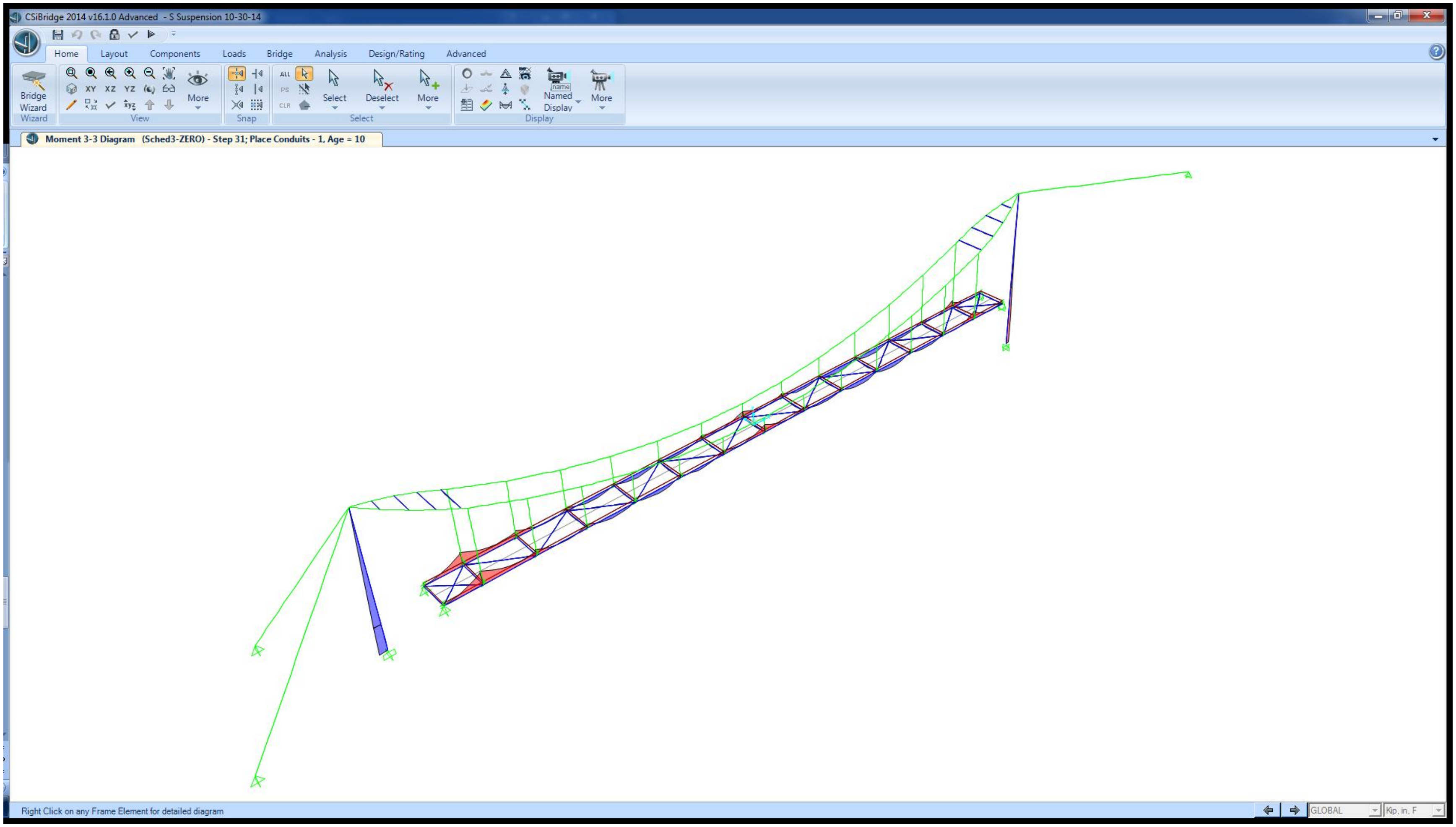
South Suspension Bridge Undeformed



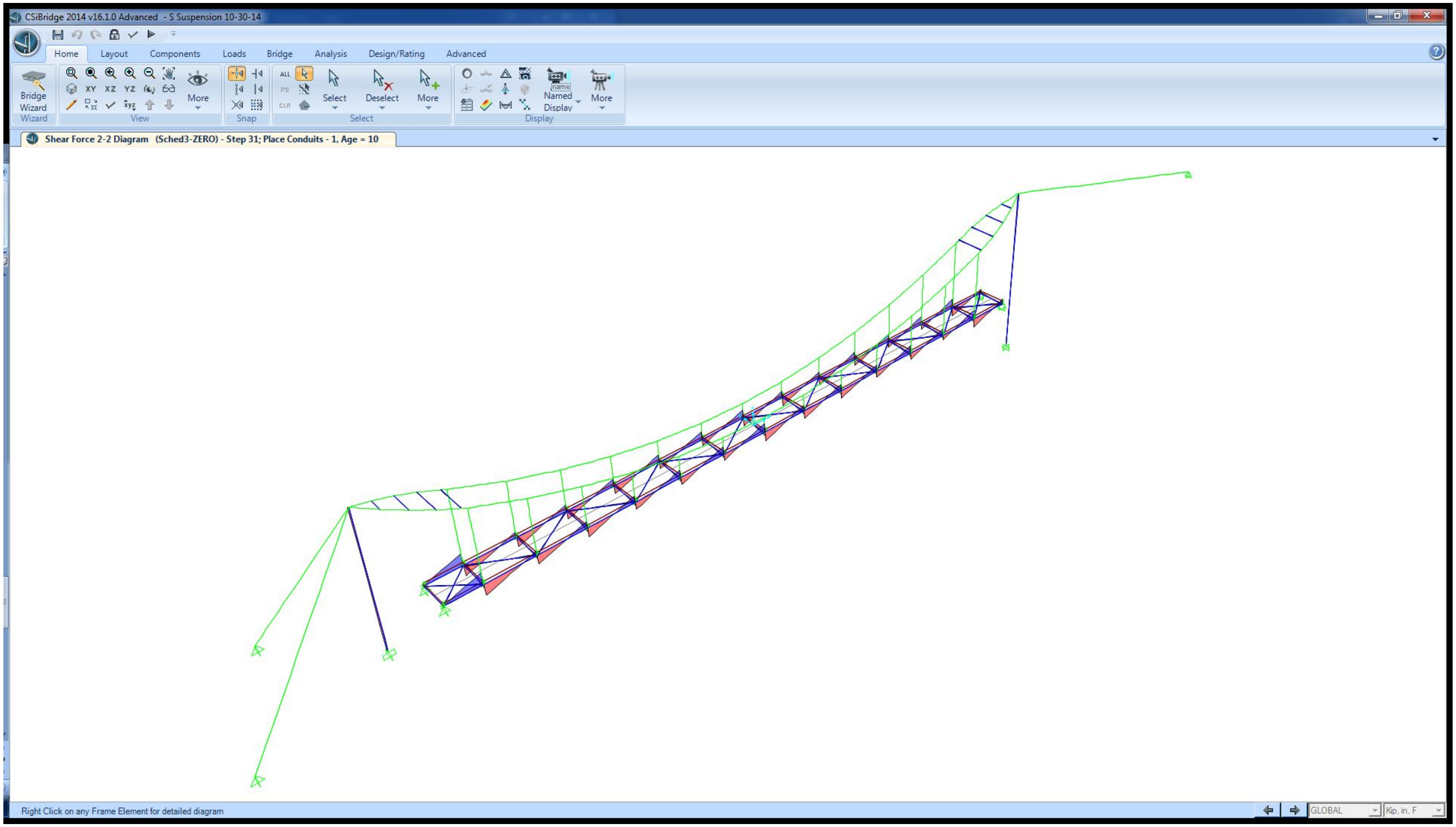
South Suspension Bridge Extruded View



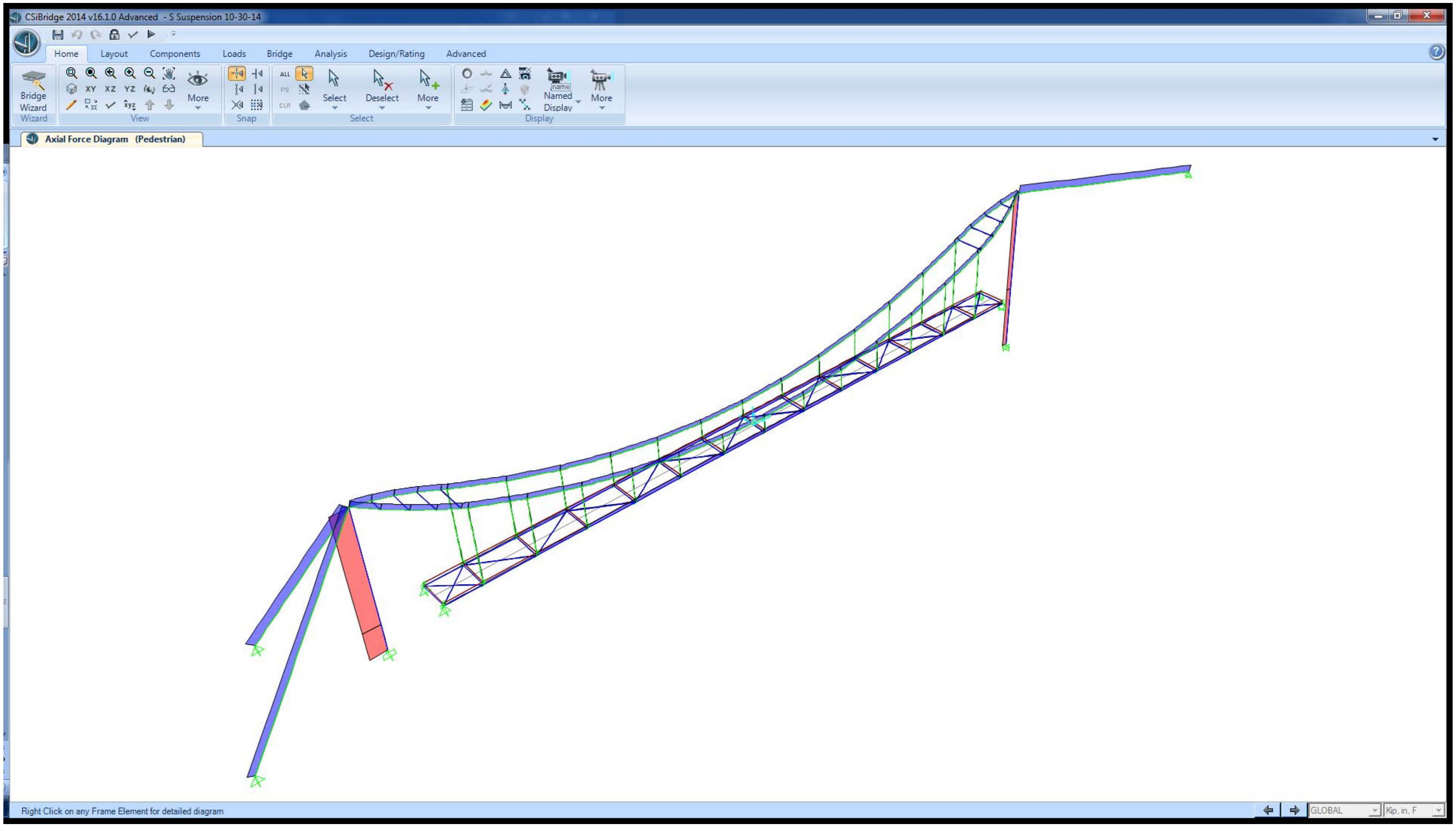
South Suspension Bridge Dead Load Moment



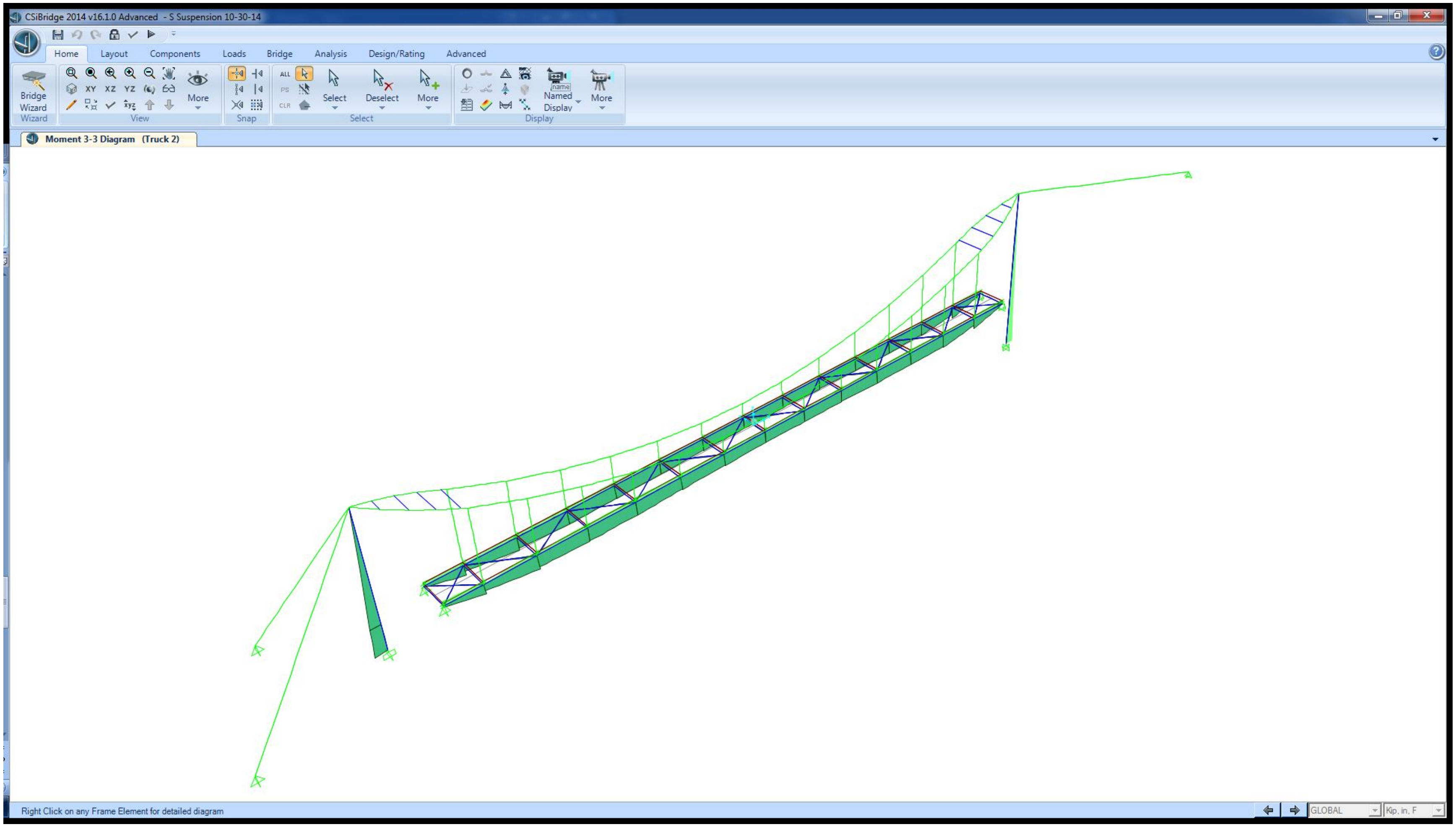
South Suspension Bridge Dead Load Shear



South Suspension Bridge Pedestrian Axial Force



South Suspension Bridge Vehicular Moment



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South Suspension Bridge Load Rating (LRFR Method)

Concrete Deck

**Conservatively neglect corregated metal formwork and strength of concrete in corregation. Since the transverse steel is so high up in the section, check the bending stress in the bottom of the slab at the middle instead of the moment. The deck is assumed to be between fixed-fixed and pinned-pinned at the curbs. Curbs not checked.*

t_{middle}	5	*in*
t_{edges}	4	*in*
$h_{corregation}$	1.5	*in*
$t_{average}$	3.75	*in*
clear cov.	1.5	*in*
$d_{trans.\ bars}$	1.75	*in*
A_{bars}	0.2	*in^2*
s_{bars}	9	*in*
f_y	60	*ksi*
b_{deck}	8.79	*ft*
S	28.1	*in^3/ft*
f'_c	4	*ksi*
γ_c	0.16	*kcf*
β_1	0.85	

Dead Loads Self Weight of deck is only dead load

Weight	$W_{deck} = t_{average} * \gamma_c * 1\ ft$ =	50.0	*lb/ft*
Moment	$M_{deck\ fixed} = W_{deck} * b_{deck}^2/24$ =	161	*lb-ft/ft*
	$M_{deck\ pinned} = W_{deck} * b_{deck}^2/8$ =	483	*lb-ft/ft*
Bot. Stress	$\sigma_{deck} = M_{deck\ avg.}/S$ =	137	*psi*
Shear	$V_{deck} = W_{deck} * b_{deck}/2$ =	220	*lb/ft*

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* AASHTO LRFD Ped Bridge 3.1

Weight	$W_{PL} = PL * 1\ ft$ =	90	*lb/ft*
Moment	$M_{deck\ fixed} = W_{PL} * b_{deck}^2/24$ =	290	*lb-ft/ft*
	$M_{deck\ pinned} = W_{PL} * b_{deck}^2/8$ =	870	*lb-ft/ft*
Bot. Stress	$\sigma_{PL} = M_{PL\ avg.}/S$ =	247	*psi*
Shear	$V_{PL} = W_{PL} * b_{deck}/2$ =	396	*lb/ft*

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Moment	M_{LL} =	*N/A*	*lb-ft/ft*
Shear	V_{LL} =	*N/A*	*lb/ft*

Vehicular demands not checked as vehicles are not allowed on bridge.

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Capacity

Shear

$V_n = V_c + V_s$ AASHTO 5.8.3.3-1

Φ	0.9		AASHTO 5.5.4.2
$V_c = 0.0316*\beta*sqrt(f'_c)*b_v d_v$			AASHTO 5.8.3.3-3
β	2		AASHTO 5.8.3.4.1
b_v	12 *in*	(Unit width)	
$d_v = M_n/(A_s f_y) < \min(0.9d, 0.72h)$			AASHTO 5.8.2.9
$d_v =$	1.80 *in*		
$V_c =$	2730 *lb/ft*		
$V_s = 0$		(Conservative assumption)	

$\Phi V_n =$ 2730 *lb/ft*

Direct Concrete Tensile Strength

$f_r = 0.23*\sqrt{f'_c} =$ 0.46 *ksi* AASHTO C5.4.2.7

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c\Phi_s\Phi_n R_n$		AASHTO MBE 6A.4.2.1-2
$\Phi_c\Phi_s \geq 0.85$		AASHTO MBE 6A.4.2.1-3
Φ_s	1	AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Bottom Stress

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [psi]	460	437	391
$RF_{pedestrian\ inventory}$	**0.67**	**0.61**	**0.51**
$RF_{pedestrian\ operating}$	**0.86**	**0.79**	**0.66**
$RF_{vehicle\ inventory}$	**N/A**	**N/A**	**N/A**
$RF_{vehicle\ operating}$	**N/A**	**N/A**	**N/A**

Shear

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [lb/ft]	2730	2594	2321
$RF_{pedestrian\ inventory}$	**3.55**	**3.35**	**2.96**
$RF_{pedestrian\ operating}$	**4.60**	**4.34**	**3.83**
$RF_{vehicle\ inventory}$	**N/A**	**N/A**	**N/A**
$RF_{vehicle\ operating}$	**N/A**	**N/A**	**N/A**

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South Suspension Bridge Load Rating (LRFR Method)

Girders

L		204.6	*ft*			
Spacing		9.5	*ft*			
Crossbeam Spacing		15	*ft*			
Size	W18x50					
	b_f	7.50	*in*	F_{yc}	50	*ksi*
	t_f	0.570	*in*	F_{yw}	50	*ksi*
	r_t	1.98	*in*	$F_{yr} = 0.7F_{yc}$	35	*ksi*
	d	18	*in*	E	29000	*ksi*
	D	16.9	*in*			
	t_w	0.355	*in*			
	S_x	88.9	*in^3*			

Dead Loads

Moment	M_{max}	(+)	60.5	*k-in*	
	M_{min}	(-)	186	*k-in*	(from CSiBridge Model)
Shear	V_{max}		2.34	*k*	

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* — AASHTO LRFD Ped Bridge 3.1

Weight $W_{PL} = PL*w_{trib.} =$ 427.5 *plf*

Moment	M_{max}	(+)	537.0	*k-in*	
	M_{min}	(-)	0.0	*k-in*	(from CSiBridge Model)
Shear	V_{max}		2.29	*k*	

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Moment	M_{max}	(+)	961	*k-in*	(from CSiBridge Model, Truck 2 controls)
	M_{min}	(-)	286	*k-in*	
Shear	V_{max}		7.46	*k*	

Capacity

Local Buckling Resistance			AASHTO 6.10.8.2.2
$\lambda_f = b_{fc}/2t_{fc}$ =	6.58		AASHTO 6.10.8.2.2-3
$\lambda_{pf} = 0.38*\sqrt{(E/F_{yc})}$ =	9.15		AASHTO 6.10.8.2.2-4
$\lambda_{rf} = 0.56*\sqrt{(E/F_{yr})}$ =	13.49		AASHTO 6.10.8.2.2-5

$\lambda_f < \lambda_{pf} \rightarrow$ $F_{nc} = R_b*R_h*F_{yc}$ AASHTO 6.10.8.2.2-1

R_b	1	AASHTO 6.10.1.10.2
R_h	1	AASHTO 6.10.1.10.1 (constructability is not checked)

F_{nc} = 50 *ksi*

Lateral Torsional Buckling			AASHTO 6.10.8.2.3
L_b	15	*ft*	
$L_p = r_t*\sqrt{(E/F_{yc})}$ =	3.97	*ft*	AASHTO 6.10.8.2.3-4
$L_r = \pi*r_t*\sqrt{(E/F_{yr})}$ =	14.92	*ft*	AASHTO 6.10.8.2.3-5

$L_b > L_r \rightarrow$ $F_{nc} = F_{cr} \le R_b*R_h*F_{yc}$

$$F_{cr} = \frac{C_b*R_b*\pi^2*E}{(L_b/r_t)^2}$$ AASHTO 6.10.8.2.3-9

$C_b = 1.75 - 1.05(M_1/M_2) + 0.3(M_1/M_2)^2 \le 2.3$ AASHTO 6.10.8.2.3-7

	(-M)	(+M)		
$M_{2\,(veh.)}$ =	286	961	*k-in*	largest moment at end of braced length
$M_{mid\,(veh.)}$=	236	858	*k-in*	moment at middle of braced length
$M_{0\,(veh.)}$ =	186	755	*k-in*	smallest moment at end of braced length
$M_{1\,(veh.)} = M_{0\,(veh.)}$ =				AASTHO A6.3.3-12
	186.4	755	*k-in*	
$C_{b\,(vehicle)}$ =	1.19	1.11		

	(-M)	(+M)		
$M_{2\,(ped.)}$ =	0.0	537.0	*k-in*	largest moment at end of braced length
$M_{mid\,(ped.)}$=	0.0	514.4	*k-in*	moment at middle of braced length
$M_{0\,(ped.)}$ =	0.0	491.8	*k-in*	smallest moment at end of braced length
$M_{1\,(ped.)} = M_{0\,(ped.)}$ =				AASTHO A6.3.3-12
	0.0	491.8	*k-in*	
$C_{b\,(ped.)}$ =	1.75	1.02		

	(-M)	(+M)	
$F_{cr\,(vehicle)}$ =	41.3	38.4	*ksi*
$F_{cr\,(ped.)}$ =	60.6	35.3	*ksi*

$F_{nc\text{ veh. \& -ped}}$ = 38.4 *ksi*

$F_{nc\,+ped}$ = 35.3 *ksi*

Tension Flange Flexural Resistance

$F_{nt} = R_h*F_{yt} =$ 50 *ksi* AASHTO 6.10.8.3-1

Minimum Flexural Resistance

$\Phi M_{n\ 33} = \Phi_f*S_x*\min(F_{nc},F_{nt})$

Φ_f 1 AASHTO 6.5.4.2

$\Phi M_{n\ veh.\ \&\ -ped}=$ 3418 *k-in*

$\Phi M_{n\ +ped}=$ 3142 *k-in*

Unstiffened Web Shear Resistance AASHTO 6.10.9.2

$\Phi V_n = \Phi_v V_{cr} = \Phi_v C V_p$

Φ_v 1 AASHTO 6.5.4.2

$V_p = 0.58*F_{yw}*D*t_w =$ 173.6 *k* AASHTO 6.10.9.2-2

D/t_w	47.5
k	5
$1.12*\sqrt{(E*k/F_{yw})} =$	60.3
if $D/t_w < 1.12*\sqrt{(E*k/F_{yw})} \rightarrow C=1$	
C	1

$\Phi V_n =$ 173.6 *k*

Rating Factors

$$RF_{general} = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$

AASHTO MBE 6A.4.2.1-1
(Impact for vehicles only)

$C_{Str-I} = \Phi_c\Phi_s\Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c\Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 0.85 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Flexure

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k-in]	2670	2670	2670
$RF_{pedestrian\ inventory}$	**2.76**	**2.76**	**2.76**
$RF_{pedestrian\ operating}$	**3.58**	**3.58**	**3.58**
C [k-in]	2905	2905	2905
$RF_{vehicle\ inventory}$	**1.59**	**1.59**	**1.59**
$RF_{vehicle\ operating}$	**2.06**	**2.06**	**2.06**

Shear

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	148	148	148
$RF_{pedestrian\ inventory}$	**36.1**	**36.1**	**36.1**
$RF_{pedestrian\ operating}$	**46.8**	**46.8**	**46.8**
$RF_{vehicle\ inventory}$	**11.1**	**11.1**	**11.1**
$RF_{vehicle\ operating}$	**14.4**	**14.4**	**14.4**

South Suspension Bridge Load Rating (LRFR Method)

Floorbeams

L		9.5 *ft*			
Spacing		15 *ft*			
Size	W6x20				
	b_f	6.08 *in*		F_{yc}	50 *ksi*
	t_f	0.37 *in*		F_{yw}	50 *ksi*
	r_t	1.70 *in*		$F_{yr} = 0.7F_{yc}$	35 *ksi*
	d	6.2 *in*		E	29000 *ksi*
	D	5.47 *in*			
	t_w	0.26 *in*			
	S_x	13.4 in^3			

Dead Loads

Moment	M_{max}	12.65 *k-in*	(from CSiBridge Model)
Shear	V_{max}	0.83 *k*	

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian:		PL	90 *psf*	AASHTO LRFD Ped Bridge 3.1
	Weight	$P_{PL} = PL*A_{trib.} =$	12.8 *k*	(two point loads of this mag.)
	Moment	M_{max}	6.43 *k-in*	(from CSiBridge Model)
	Shear	V_{max}	0.00 *k*	

			Truck 1	Truck 2
Vehicular:		LL	Truck 1	Truck 2
		Total	16.2	21.19 *k*
	Weight	Axle 1 Wheels	6.08	7.95 *k*
		Axle 2 Wheels	2.03	2.65 *k*
		wheel spacing	6	6 *ft*
		axle spacing	6.58	8.25 *ft*

Moment	M_{max}	4.57 *k-in*	(From CSiBridge Model, Truck 2 controls)
Shear	V_{max}	0.08 *k*	

Capacity

Local Buckling Resistance		AASHTO 6.10.8.2.2
$\lambda_f = b_{fc}/2t_{fc} =$	8.33	AASHTO 6.10.8.2.2-3
$\lambda_{pf} = 0.38*\sqrt{(E/F_{yc})} =$	9.15	AASHTO 6.10.8.2.2-4
$\lambda_{rf} = 0.56*\sqrt{(E/F_{yr})} =$	13.49	AASHTO 6.10.8.2.2-5

$\lambda_f < \lambda_{pf} \rightarrow$	$F_{nc} = R_b*R_h*F_{yc}$		AASHTO 6.10.8.2.2-1
	R_b	1	AASHTO 6.10.1.10.2
	R_h	1	AASHTO 6.10.1.10.1 (constructability is not checked)
	F_{nc} =	50 *ksi*	

Lateral Torsional Buckling — AASHTO 6.10.8.2.3

L_b	9.5 *ft*	
$L_p = r_t*\sqrt{(E/F_{yc})}$ =	3.41 *ft*	AASHTO 6.10.8.2.3-4
$L_r = \pi*r_t*\sqrt{(E/F_{yr})}$ =	12.81 *ft*	AASHTO 6.10.8.2.3-5

$L_p < L_b < L_r \rightarrow F_{nc} = C_b[1-(1-F_{yr}/(R_hF_{yc}))((L_b-L_p)/(L_r-L_p))]R_bR_hF_{yc} < R_bR_hF_{yc}$

$C_b = 1.75 - 1.05(M_1/M_2) + 0.3(M_1/M_2)^2 \leq 2.3$ — AASHTO 6.10.8.2.3-7

$M_{2\,(veh.)}$ =	4.6 *k-in*		largest moment at end of braced length
$M_{mid\,(veh.)}$=	4.5 *k-in*		moment at middle of braced length
$M_{0\,(veh.)}$ =	4.5 *k-in*		smallest moment at end of braced length
$M_{1\,(veh.)} = M_{0\,(veh.)}$ =		4.5 *k-in*	AASTHO A6.3.3-12
$C_{b\,(vehicle)}$ =	1.01		
$M_{2\,(ped.)}$ =	6.4 *k-in*		largest moment at end of braced length
$M_{mid\,(ped.)}$=	6.1 *k-in*		moment at middle of braced length
$M_{0\,(ped.)}$ =	5.7 *k-in*		smallest moment at end of braced length
$M_{1\,(ped.)} = M_{0\,(ped.)}$ =		5.7 *k-in*	AASTHO A6.3.3-12
$C_{b\,(ped.)}$ =	1.03		
$F_{nc\,(veh.)}$ =	40.6 *ksi*		
$F_{nc\,(ped.)}$ =	41.4 *ksi*		

Tension Flange Flexural Resistance

$F_{nt} = R_h*F_{yt}$ = 50 *ksi* — AASHTO 6.10.8.3-1

Minimum Flexural Resistance

$\Phi M_n = \Phi_f*S_x*\min(F_{nc},F_{nt})$

Φ_f	1	AASHTO 6.5.4.2
ΦM_n =	543 *k-in*	

Unstiffened Web Shear Resistance — AASHTO 6.10.9.2

$\Phi V_n = \Phi_v V_{cr} = \Phi_v C V_p$

Φ_v	1	AASHTO 6.5.4.2

$V_p = 0.58*F_{yw}*D*t_w =$ 41.2 *k* AASHTO 6.10.9.2-2

D/t_w	21.0
k	5
$1.12*\sqrt{(E*k/F_{yw})} =$	60.3
if $D/t_w < 1.12*\sqrt{(E*k/F_{yw})} \rightarrow C=1$	
C	1

$\Phi V_n =$ 41.2 *k*

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c\Phi_s\Phi_n R_n$			AASHTO MBE 6A.4.2.1-2
	$\Phi_c\Phi_s \geq 0.85$		AASHTO MBE 6A.4.2.1-3
	Φ_s	1	AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Flexure

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k-in]	543	516	462
$RF_{pedestrian\ inventory}$	**46.9**	**44.5**	**39.6**
$RF_{pedestrian\ operating}$	**60.8**	**57.6**	**51.4**
$RF_{vehicle\ inventory}$	**66.0**	**62.6**	**55.8**
$RF_{vehicle\ operating}$	**85.6**	**81.2**	**72.4**

Shear

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	41.2	39.2	35.1
$RF_{pedestrian\ inventory}$	**1000**	**1000**	**1000**
$RF_{pedestrian\ operating}$	**1000**	**1000**	**1000**
$RF_{vehicle\ inventory}$	**287**	**272**	**243**
$RF_{vehicle\ operating}$	**372**	**353**	**315**

South Suspension Bridge Load Rating (LRFR Method)

Crossbracing

L	17.75 *ft*				
Size	W6x15				
	b_f	5.99 *in*		F_{yc}	50 *ksi*
	t_f	0.26 *in*		F_{yw}	50 *ksi*
	r_t	1.66 *in*		$F_{yr} = 0.7F_{yc}$	35 *ksi*
	d	5.99 *in*		E	29000 *ksi*
	D	5.47 *in*			
	t_w	0.23 *in*			
	S_x	29.1 in^3			

Dead Loads

Moment	M_{max}	11.2 *k-in*	(from CSiBridge Model)
Shear	V_{max}	0.25 *k*	

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* AASHTO LRFD Ped Bridge 3.1

Moment	M_{max}	17.0 *k-in*	(from CSiBridge Model)
Shear	V_{max}	0.09 *k*	

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Moment	M_{max}	44.0 *k-in*	(From CSiBridge Model, Truck 2 controls)
Shear	V_{max}	0.24 *k*	

Capacity

Local Buckling Resistance AASHTO 6.10.8.2.2

$\lambda_f = b_{fc}/2t_{fc}$ =	11.52	AASHTO 6.10.8.2.2-3
$\lambda_{pf} = 0.38*\sqrt{(E/F_{yc})}$ =	9.15	AASHTO 6.10.8.2.2-4
$\lambda_{rf} = 0.56*\sqrt{(E/F_{yr})}$ =	13.49	AASHTO 6.10.8.2.2-5

$\lambda_{pf} < \lambda_f < \lambda_{rf} \rightarrow F_{nc} = [1-(1-F_{yr}/R_hF_y)((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_bR_hF_{yc}$ AASHTO 6.10.8.2.2-1

R_b 1 AASHTO 6.10.1.10.2

R_h 1 AASHTO 6.10.1.10.1 (constructability is not checked)

F_{nc} = 41.8 *ksi*

Lateral Torsional Buckling AASHTO 6.10.8.2.3

L_b 17.75 *ft*

$L_p = r_t*\sqrt{(E/F_{yc})}$ = 3.33 *ft* AASHTO 6.10.8.2.3-4

$L_r = \pi*r_t*\sqrt{(E/F_{yr})}$ = 12.51 *ft* AASHTO 6.10.8.2.3-5

$L_b > L_r \rightarrow F_{nc} = F_{cr} < R_bR_hF_{yc}$

$F_{cr} = C_bR_b\pi^2E/(L_b/r_t)^2$

C_b = 1

F_{cr} = 17.4 *ksi*

F_{nc} = 17.4 *ksi*

Tension Flange Flexural Resistance

$F_{nt} = R_h*F_{yt}$ = 50 *ksi* AASHTO 6.10.8.3-1

Minimum Flexural Resistance

$\Phi M_n = \Phi_f*S_x*\min(F_{nc},F_{nt})$

Φ_f 1 AASHTO 6.5.4.2

ΦM_n = 506 *k-in*

Unstiffened Web Shear Resistance AASHTO 6.10.9.2

$\Phi V_n = \Phi_vV_{cr} = \Phi_vCV_p$

Φ_v 1 AASHTO 6.5.4.2

$V_p = 0.58*F_{yw}*D*t_w$ = 36.5 *k* AASHTO 6.10.9.2-2

D/t_w 23.8

k 5

$1.12*\sqrt{(E*k/F_{yw})}$ = 60.3

if $D/t_w < 1.12*\sqrt{(E*k/F_{yw})} \rightarrow C=1$

C 1

ΦV_n = 36.5 *k*

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str-I} = \Phi_c \Phi_s \Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c \Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 1 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Flexure

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k-in]	506	481	430
$RF_{pedestrian\ inventory}$	**16.6**	**15.7**	**14.0**
$RF_{pedestrian\ operating}$	**21.5**	**20.4**	**18.2**
$RF_{vehicle\ inventory}$	**6.38**	**6.06**	**5.40**
$RF_{vehicle\ operating}$	**8.28**	**7.85**	**7.00**

Shear

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	36.5	34.7	31.0
$RF_{pedestrian\ inventory}$	**230**	**218**	**195**
$RF_{pedestrian\ operating}$	**298**	**283**	**253**
$RF_{vehicle\ inventory}$	**85.8**	**81.5**	**72.8**
$RF_{vehicle\ operating}$	**111**	**106**	**94.4**

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South Suspension Bridge Load Rating (LRFR Method)

Hanger Cables

Size	$^{11}/_{16}$"			(Structural Steel Strand ASTM - A586, Class A Coating)
	A_g	0.284	*in^2*	
	Breaking Force	58	*k*	(from Bethlehem Wire Rope catalog)
	E	24000	*ksi*	

Dead Loads

Axial	P_{max}	8.66	*k*	(from CSiBridge Model)

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian:	PL	90	*psf*	AASHTO LRFD Ped Bridge 3.1
Axial	P_{max}	6.51	*k*	(from CSiBridge Model)

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Axial P_{max} 1.64 *k* (From CSiBridge Model, Truck 2 controls)

Capacity

Tensile Reistance

$\Phi P_n = \Phi_u F_y A_n R_p U$ AASHTO 6.8.2.1-2

Φ_u	0.8	AASHTO 6.5.4.2
$F_y A_n$ = Breaking Force		
R_p	1.0	
U	1.0	

$\Phi P_n =$ 46.4 *k*

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c \Phi_s \Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c \Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 0.85 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Axial

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	39.4	39.4	39.4
RF$_{pedestrian\ inventory}$	**2.51**	**2.51**	**2.51**
RF$_{pedestrian\ operating}$	**3.26**	**3.26**	**3.26**
RF$_{vehicle\ inventory}$	**9.97**	**9.97**	**9.97**
RF$_{vehicle\ operating}$	**12.9**	**12.9**	**12.9**

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South Suspension Bridge Load Rating (LRFR Method)

Main Cables

Size	$2\ ^1/_2$"			(Structural Steel Rope - ASTM A603, Class A Coating)
	A_g	2.97 *in²*		
	Nominal Strength	576	*k*	(from Bethlehem Wire Rope catalog)
	E	20000 *ksi*		

Dead Loads

Axial	P_{max}	131.0 *k*	(from CSiBridge Model)

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian:		PL	90 *psf*		AASHTO LRFD Ped Bridge 3.1
	Axial	P_{max}	94.8 *k*		(from CSiBridge Model)

Vehicular:		LL	Truck 1	Truck 2	
		Total	16.2	21.19	*k*
	Weight	Axle 1 Wheels	6.08	7.95	*k*
		Axle 2 Wheels	2.03	2.65	*k*
		wheel spacing	6	6	*ft*
		axle spacing	6.58	8.25	*ft*

Axial	P_{max}	18.0 *k*	(From CSiBridge Model, Truck 2 controls)

Capacity

Tensile Reistance

$\Phi P_n = \Phi_u F_y A_n R_p U$ — AASHTO 6.8.2.1-2

Φ_u	0.8	AASHTO 6.5.4.2
$F_y A_n$ = Breaking Force		
R_p	1.0	
U	1.0	

$\Phi P_n =$ 576 *k*

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c \Phi_s \Phi_n R_n$ — AASHTO MBE 6A.4.2.1-2

$\Phi_c \Phi_s \geq 0.85$ — AASHTO MBE 6A.4.2.1-3

Φ_s 0.85 — AASHTO MBE 6A.4.2.4

γ_{DC}	1.25		
$\gamma_{LL\ inv.}$	1.75		
$\gamma_{LL\ op.}$	1.35		
IM	0		AASHTO LRFD Ped. Bridge Manual 3.2

Axial

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	490	490	490
$RF_{pedestrian\ inventory}$	**1.96**	**1.96**	**1.96**
$RF_{pedestrian\ operating}$	**2.55**	**2.55**	**2.55**
$RF_{vehicle\ inventory}$	**10.4**	**10.4**	**10.4**
$RF_{vehicle\ operating}$	**13.4**	**13.4**	**13.4**

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South Suspension Bridge Load Rating (LRFR Method)

Backstay Cables

Size d = 2 $^{7}/_{8}$" (Structural Steel Strand ASTM - A586, Class A Coating)

A_g	4.94	in^2	
Nominal Strength	988	*k*	(from Bethlehem Wire Rope catalog)
E	23000	*ksi*	

Size d = 3" (Structural Steel Strand ASTM - A586, Class A Coating)

A_g	5.38	in^2	
Nominal Strength	1076	*k*	(from Bethlehem Wire Rope catalog)
E	23000	*ksi*	

Dead Loads

		2 $^{7}/_{8}$"	3"		
Axial	P_{max}	232.1	185.2	*k*	(from CSiBridge Model)

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* AASHTO LRFD Ped Bridge 3.1

		2 $^{7}/_{8}$"	3"		
Axial	P_{max}	161.9	126.8	*k*	(from CSiBridge Model)

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

		2 $^{7}/_{8}$"	3"		
Axial	P_{max}	30.4	23.9	*k*	(from CSiBridge Model, Truck 2)

Capacity

Tensile Reistance

$\Phi P_n = \Phi_u F_y A_n R_p U$

Φ_u	0.8
$F_y A_n$ = Breaking Force	
R_p	1.0
U	1.0

	2 $^{7}/_{8}$"	3"	
ΦP_n =	790	861	*k*

Rating Factors

RF = $\dfrac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$ AASHTO MBE 6A.4.2.1-1

$C_{Str-I} = \Phi_c\Phi_s\Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c\Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 0.85 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25
$\gamma_{LL\ inv.}$	1.75
$\gamma_{LL\ op.}$	1.35
IM	0

AASHTO LRFD Ped. Bridge Manual 3.2

Axial

	2 $^7/_8$"			3"		
Condition	Good	Fair	Poor	Good	Fair	Poor
Φ_c	1	0.95	0.85	1	0.95	0.85
C [k]	672	672	672	732	732	732
$RF_{pedestrian\ inventory}$	**1.35**	**1.35**	**1.35**	**1.56**	**1.56**	**1.56**
$RF_{pedestrian\ operating}$	**1.75**	**1.75**	**1.75**	**2.02**	**2.02**	**2.02**
$RF_{vehicle\ inventory}$	**7.17**	**7.17**	**7.17**	**8.29**	**8.29**	**8.29**
$RF_{vehicle\ operating}$	**9.29**	**9.29**	**9.29**	**10.7**	**10.7**	**10.7**

South Suspension Bridge Load Rating (LRFR Method)

Spreader Bars

Size d = 3"

A_g	2.08	*in* ^{2}
L	9.5	*ft*
$D_{outside}$	3.5	*in* ^{2}
d_{inside}	3.07	*in* ^{2}
t	2.16	*in*
r_s	1.17	*in*
F_y	50	*ksi*
E	29000	*ksi*

Dead Loads

Axial P_{max} 11.9 *k* (from CSiBridge Model)

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* AASHTO LRFD Ped Bridge 3.1

Axial P_{max} 8.60 *k* (from CSiBridge Model)

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Axial P_{max} 1.61 *k* (From CSiBridge Model, Truck 2 controls)

Capacity

Compression Resistance AASHTO 6.9.4.1.1

K 0.65 AASHTO 4.6.2.5

Φ_c 0.9 AASHTO 6.5.4.2

$$P_e = \frac{\pi^2 E * A_g}{(K * l / r_s)^2}$$ AASHTO 6.9.4.1.2-1

$P_o = QF_yA_g$ AASHTO 6.9.4.1.1

D	3.5	*in*
t	2.160	*in*
D/t	1.6	→ Nonslender
$0.11*E/F_y$	63.8	
Q	1.0	AASHTO 6.9.4.2

P_e	148 *k*	AASHTO 6.9.4.1.2-1
P_o	104 *k*	AASHTO 6.9.4.1.1
P_e/P_o =	1.43	
$P_e/P_o > 0.44 \rightarrow$		AASHTO 6.9.4.1.1-1

$P_n = (0.658^{(P_o/P_e)})P_e$

P_n = 77.6 *k*

ΦP_n = 69.8 *k*

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c\Phi_s\Phi_n R_n$		AASHTO MBE 6A.4.2.1-2
$\Phi_c\Phi_s \geq 0.85$		AASHTO MBE 6A.4.2.1-3
Φ_s	1	AASHTO MBE 6A.4.2.4
γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Axial

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	69.8	66.3	59.3
$RF_{pedestrian\ inventory}$	**3.65**	**3.42**	**2.95**
$RF_{pedestrian\ operating}$	**4.73**	**4.43**	**3.83**
$RF_{vehicle\ inventory}$	**19.5**	**18.3**	**15.8**
$RF_{vehicle\ operating}$	**25.3**	**23.7**	**20.5**

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South Suspension Bridge Load Rating (LRFR Method)

Hanger Bolts

d	0.75	*in*	
d_{actual}	0.50	*in*	(Accounts for corrosion)
$d_{threads}$	0.65	*in*	(Based on equation AASTHO 6.13.2.10.2-1)
A_b	0.44	in^2	
$A_{b\ actual}$	0.20	in^2	
F_{ub}	120	*ksi*	(A325 Bolts)
E	29000	*ksi*	

Dead Loads Force in hanger bolts = hanger strand force divided by four (number of bolts/hanger)

Axial P_{max} 2.16 *k* (from CSiBridge Model)

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian: PL 90 *psf* AASHTO LRFD Ped Bridge 3.1

Axial P_{max} 1.63 *k* (from CSiBridge Model)

Vehicular:

	LL	Truck 1	Truck 2	
	Total	16.2	21.19	*k*
Weight	Axle 1 Wheels	6.08	7.95	*k*
	Axle 2 Wheels	2.03	2.65	*k*
	wheel spacing	6	6	*ft*
	axle spacing	6.58	8.25	*ft*

Axial P_{max} 0.41 *k* (From CSiBridge Model, Truck 2 controls)

Capacity

Tensile Reistance

If $d_{threads} < d_{actual}$:

$\Phi T_n = \Phi_t 0.76 A_b F_{ub}$ AASHTO 6.13.2.10.2-1

If $d_{threads} > d_{actual}$:

$\Phi T_n = \Phi_t A_{b\ actual} F_{ub}$ AASHTO 6.13.2.10.2-1

Φ_t 0.8 AASHTO 6.5.4.2

$\Phi T_n =$ 18.8 *k*

Rating Factors

RF = $\dfrac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c\Phi_s\Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c\Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 1 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Axial

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	18.8	17.9	16.0
$RF_{pedestrian\ inventory}$	**5.67**	**5.34**	**4.68**
$RF_{pedestrian\ operating}$	**7.35**	**6.92**	**6.06**
$RF_{vehicle\ inventory}$	**22.5**	**21.2**	**18.6**
$RF_{vehicle\ operating}$	**29.2**	**27.5**	**24.1**

South Suspension Bridge Load Rating (LRFR Method)

Concrete Pylons

d	30	*in*
A_g	707	*in* ^{2}
A_{bars}	1.56	*in* ^{2}
N_{bars}	22	*in*
$A_{spiral\ bars}$	0.11	*in* ^{2}
$p_{spiral\ bars}$	1.75	*in*
f_y	60	*ksi*
clear cov.	1.5	
f'_c	5	*ksi*
γ_c	0.16	*kcf*
β_1	0.85	
L_{max}	57.25	*ft*

Dead Loads Self Weight of deck is only dead load

Weight	W_{DL} =	45.0	*k*	
Moment	M_{DL} =	84.5	*k-in*	(From CSiBridge Model)
Axial	P_{DL} =	411	*k*	

Live Loads Pedestrian and Vehicular loads act seperately

Pedestrian:		PL	90	*psf*	AASHTO LRFD Ped Bridge 3.1
	Weight	W_{PL} =	115	*k/pylon*	
	Moment	M_{PL} =	3400	*k-in*	(From CSiBridge Model)
	Axial	P_{PL} =	265	*k*	

Vehicular:		LL	Truck 1	Truck 2	
		Total	16.2	21.19	*k*
	Weight	Axle 1 Wheels	6.08	7.95	*k*
		Axle 2 Wheels	2.03	2.65	*k*
		wheel spacing	6	6	*ft*
		axle spacing	6.58	8.25	*ft*

Moment	M_{LL} =	639	*k-in*	(From CSiBridge Model, Truck 2 controls)
Axial	P_{LL} =	49.5	*k*	

Capacity

<u>*Compression + Flexure*</u> AASHTO MBE Appendix G6A

$e_1 = M_{LL}/P_{LL}$

$e_{1\ ped.}$ = 12.8 *in*

$e_{1\ vehicle}$ = 12.9 *in*

$e_2 = M_{DL}/P_{DL}$

e_2 = 0.21 *in*

$\Phi M_{n\ ped.}$ = 14700 *k-in*

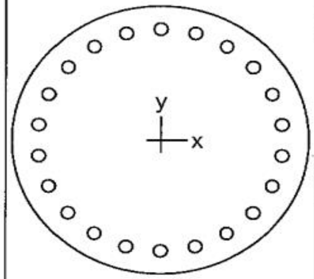
$\Phi M_{n\ veh.}$ = 14640 *k-in*

$\Phi P_{n\ ped.}$ = 1625 *k*

$\Phi P_{n\ veh.}$ = 1630 *k*

(From SpColumn)

**The capacity for concrete elements in compression and bending is determined from a P-M interaction diagram. The axial and bending capacities are assumed to be the values at the edge of the interaction diagram along the line that connects the factored dead and the factored live plus dead combined loading responses. Rating factors are calculated for both the max axial and bending conditions.*



30 in diam.

Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

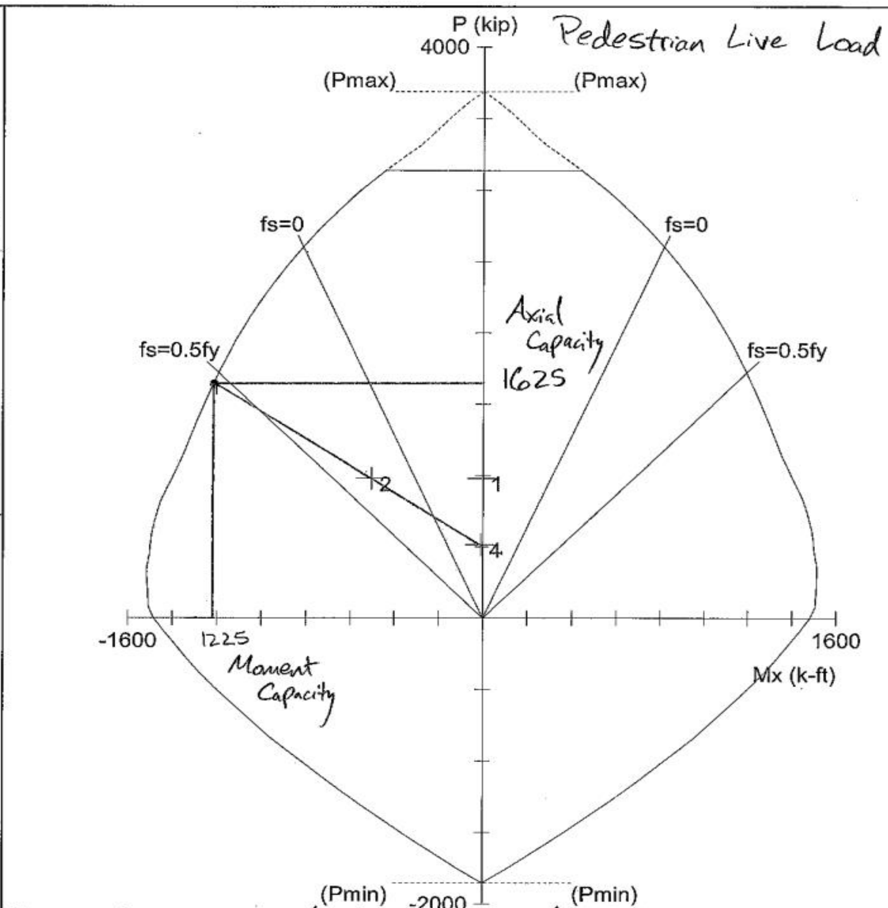
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 11/05/14

Time: 15:20:56



Point 4 is factored dead load demand.
Point 2 is factored dead plus live load demand.

spColumn v4.60. Licensed to: KPFF Consulting Engineers. License ID: 57305-1023324-4-1BE6D-26367

File: F:\Project Files\114176 (Spokane Riverfront Park Inspection and Analysis)\15 Load Ratin...\s susp pylons Ped.col

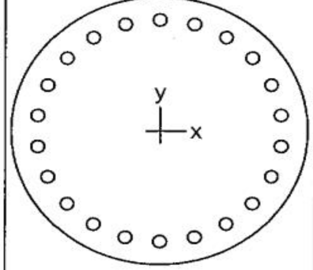
Project:

Column:		Engineer:	
f'c = 5 ksi	fy = 60 ksi	Ag = 706.858 in^2	22 #11 bars
Ec = 4031 ksi	Es = 29000 ksi	As = 34.32 in^2	rho = 4.86%
fc = 4.25 ksi		Xo = 0.00 in	Ix = 39760.8 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 39760.8 in^4
Beta1 = 0.8		Min clear spacing = 2.13 in	Clear cover = 1.88 in

Confinement: Spiral

phi(a) = 0.85, phi(b) = 0.9, phi(c) = 0.75

kpff Consulting Engineers



30 in diam.

Code: ACI 318-08

Units: English

Run axis: About X-axis

Run option: Investigation

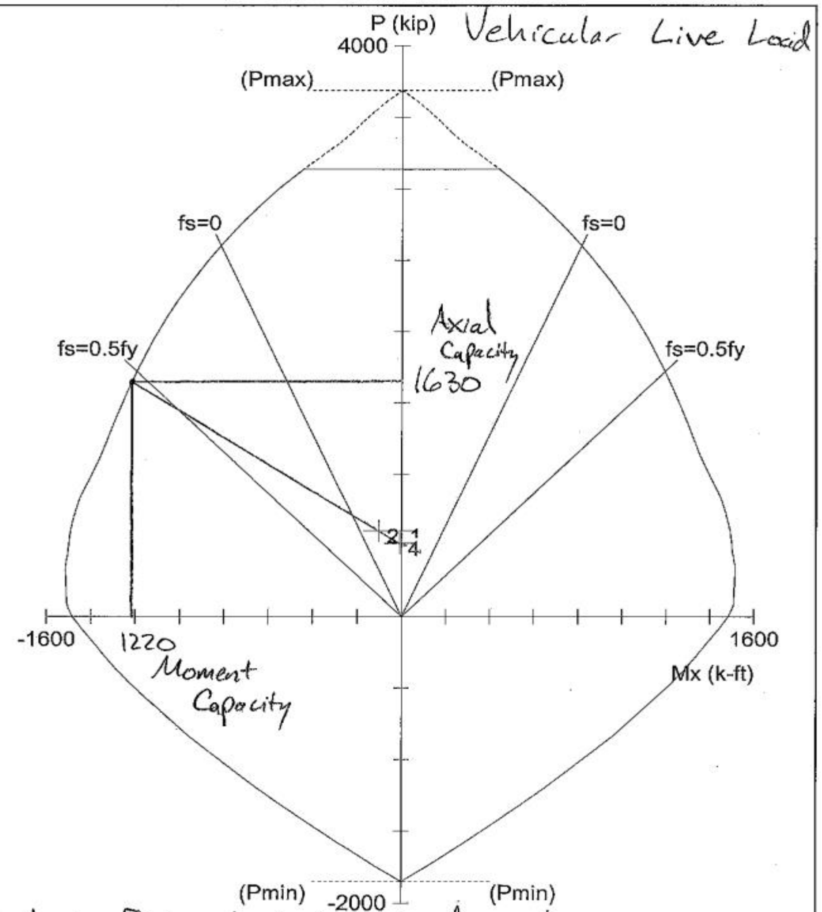
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 11/05/14

Time: 15:22:15



Point 4 is factored dead load demand.
Point 2 is factored dead plus live load demand.

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File: F:\Project Files\114176 (Spokane Riverfront Park Inspection and Analysis)\15 Load Ratin...\s susp pylons Veh.col

Project:

Column:		Engineer:	
f'c = 5 ksi	fy = 60 ksi	Ag = 706.858 in^2	22 #11 bars
Ec = 4031 ksi	Es = 29000 ksi	As = 34.32 in^2	rho = 4.86%
fc = 4.25 ksi		Xo = 0.00 in	Ix = 39760.8 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 39760.8 in^4
Beta1 = 0.8		Min clear spacing = 2.13 in	Clear cover = 1.88 in
Confinement: Spiral			
phi(a) = 0.85, phi(b) = 0.9, phi(c) = 0.75			

Rating Factors

$$RF = \frac{(C - \gamma_{DC}DC - \gamma_{DW}DW +/- \gamma_P P)}{\gamma_{LL}LL(1+IM)}$$ AASHTO MBE 6A.4.2.1-1

$C_{Str\text{-}I} = \Phi_c\Phi_s\Phi_n R_n$ AASHTO MBE 6A.4.2.1-2

$\Phi_c\Phi_s \geq 0.85$ AASHTO MBE 6A.4.2.1-3

Φ_s 0.85 AASHTO MBE 6A.4.2.4

γ_{DC}	1.25	
$\gamma_{LL\ inv.}$	1.75	
$\gamma_{LL\ op.}$	1.35	
IM	0	AASHTO LRFD Ped. Bridge Manual 3.2

Flexure

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k-in]	12495	12495	12495
$RF_{pedestrian\ inventory}$	**2.08**	**2.08**	**2.08**
$RF_{pedestrian\ operating}$	**2.70**	**2.70**	**2.70**
C [k-in]	12444	12444	12444
$RF_{vehicle\ inventory}$	**11.0**	**11.0**	**11.0**
$RF_{vehicle\ operating}$	**14.3**	**14.3**	**14.3**

Axial

Condition	Good	Fair	Poor
Φ_c	1	0.95	0.85
C [k]	1381	1381	1381
$RF_{pedestrian\ inventory}$	**1.87**	**1.87**	**1.87**
$RF_{pedestrian\ operating}$	**2.43**	**2.43**	**2.43**
C [k]	1386	1386	1386
$RF_{vehicle\ inventory}$	**10.1**	**10.1**	**10.1**
$RF_{vehicle\ operating}$	**13.0**	**13.0**	**13.0**

South Suspension Bridge Load Rating (LRFR Method)

Summary

*Floorbeams are in fair condition (Φ_c =0.95) and Deck is in poor condition (Φ_c =0.85)

*All other members are in good condition (Φ_c =1)

Controlling Rating Factor & Failure Force	Pedestrian			Vehicle		
	Force	**Inventory**	**Operating**	**Force**	**Inventory**	**Operating**
Deck	**Flexure**	**0.51**	**0.66**	*N/A*	*N/A*	*N/A*
Girders	Flexure	2.76	3.58	Flexure	**1.59**	**2.06**
Floorbeams	Flexure	44.5	57.6	Flexure	62.6	81.2
Crossbracing	Flexure	16.6	21.5	Flexure	6.38	8.28
Hanger Cables	Axial	2.51	3.26	Axial	9.97	12.9
Main Cables	Axial	1.96	2.55	Axial	10.4	13.4
Backstay Cables	Axial	1.56	2.02	Axial	8.29	10.7
Spreader Bars	Axial	3.65	4.73	Axial	19.5	25.3
Hanger Bolts	Axial	4.68	6.06	Axial	18.6	24.1
Pylons	Axial	1.87	2.43	Axial	10.1	13.0

APPENDIX D

PHOTOGRAPH LOG

PHOTOGRAPH CONTACT SHEET

kpff Consulting Engineers
1601 Fifth Avenue, Suite 1600 Seattle, WA 98101
(206) 622-5822 fax (206) 622-8130

Project	Riverfront Park Bridges Inspection	By	M. Frymoyer	Sheet No.
Location	Spokane	Date	9/26/2014	1 OF8
Client	City of Spokane			Job No.
Inspection Photo Log				114176.12

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
A	195	Btwn Pier 1 /H1	Spall in deck	JPG
A	196	H1 left curb	Typical condition of curb at hanger - cracks/spalls	JPG
A	197	H1-H2 right curb	Chipped concrete in curb	JPG
A	198	H2-H3 left curb	Typical curb conditon	JPG
A	200	H3-H4 deck	Minor deck chipping, major delamination, typical	JPG
A	201	H4-H5 deck	Rusting coming through deck, delamination, typical	JPG
A	202	H5-H6 deck	Typical transverse crack, delamination	JPG
A	203	H7-H8 deck	Major delamination and crack	JPG
A	204	H9-H10 curb	Major spalling, exposed rebar, material loss	JPG
A	205	H9-H10 curb	Major spalling, exposed rebar, material loss	JPG
A	206	H9-H10 curb	Typical curb cracking, spalling	JPG
A	207	H12 curb	Typical curb erosion at hanger	JPG
A	208	H12-H13 curb	Major spalling, exposed rebar, material loss	JPG
A	209	H13 curb	Typical crack at hanger	JPG
A	210	North end	Large crack at end of deck	JPG
A	212	South end right curb	Major spalling, exposed rebar, material loss and hole in the deck	JPG
A	213	H6-H7 curb	Exposed rebar at light	JPG
A	214	H12-H13 curb	Spalling, exposed rebar at light fixture	JPG
A	215	H1 RT	Spalling on underside of deck	PG
A	216	H1 RT	Typical floorbeam corrosion/flaking	PG
A	217	Pier 1	General view of abutment	PG
A	218	Pier 1	General view of abutment	PG
A	219	Pier 1	General view of abutment	PG
A	220	H1 RT	Flaking and pitting of bottom flange	PG
A	221	H1	Lateral bracing	PG
A	222	H1	Floorbeam, SIP forms	PG
A	223	H1 RT	Flaking and pitting of bottom flange	PG
A	224	H1 RT	Flaking and pitting of bottom flange	PG
A	225	H2 RT	Hanger rods on inside showing minor corrosion	PG
A	226	H2 RT	Hanger rods on inside showing minor corrosion	PG
A	227	H2 RT	Hanger rods on inside showing minor corrosion	PG
A	228	H2 RT	Soffit deterioration - exposed concrete	PG
A	229	H2 RT	Soffit deterioration - exposed concrete	PG
A	230	H2 RT	Soffit deterioration - exposed concrete	PG
A	231	H2 RT	Soffit deterioration - exposed concrete	PG
A	232	H2 LT	Debris (bird's next) at panel point	PG
A	233	H3 RT	1/16" section loss at bottom flange	PG
A	234	H3 RT	Bottom flange	PG
A	236	H3 RT	Cable hanger rods on inside moderate corrosion	PG
A	237	H3 RT	Cable hanger rods on inside moderate corrosion	PG
A	238	H3 RT	Cable hanger rods on inside moderate corrosion	PG
A	239	H3	Soffit deterioration - exposed concrete	PG
A	240	H3	Soffit deterioration - exposed concrete	PG
A	241	H3 RT	Bottom flange	PG
A	251	H8 LT	Girder splice pack rust at web plate	PG

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Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
A	252	H8 LT	Inside hanger bolt connection	PG
A	253	H8 LT	Inside hanger bolt connection	PG
A	254	H8 LT	Girder bottom flange is flaking	PG
A	255	H8 LT	Girder bottom flange is flaking	PG
A	256	H8 LT	SIP deck form is corroded	PG
A	257	H8 LT	SIP deck form is corroded	PG
A	261	H10 LT	SIP deck form is corroded, spall	PG
A	298	H11 RT	Girder splice, good condition	JPG
A	300	H11 RT	Girder splice, good condition	JPG
A	301	H11 RT	Floorbeam - flaking, corrosion	JPG
A	302	H11 RT	SIP deck corroded with missing/exposed deck concrete	JPG
A	303	H11 RT	SIP deck corroded with missing/exposed deck concrete	JPG
A	304	H12 RT	Cable hanger rods on inside moderate corrosion	JPG
A	305	H12 RT	SIP deck corroded	JPG
A	307	H13 RT	Debris built up in hanger connection	JPG
A	310	H13 RT	SIP deck corroded	JPG
A	312	H13 RT	Right girder - bearing and brace connection	JPG
A	313	H13 RT	Right girder - bearing and brace connection	JPG
A	314	H13 RT	Right girder - bearing and brace connection	JPG
A	315	H13 RT	Floorbeam and conduit rollers are corroded	JPG
A	316	H13 RT	Floorbeam and conduit rollers are corroded	JPG
A	432	Pier 1	Abutment seat	MLF
A	433	Pier 1	Abutment seat	MLF
A	434	Pier 1	Abutment seat/bearing	MLF
A	435	Pier 1	Lateral bracing	MLF
A	436	General	Floor system, looking north	MLF
A	437	Pier 1	Abutment seat/bearing	MLF
A	438	Pier 1	Abutment seat/bearing	MLF
A	439	Pier 1	Abutment seat/bearing	MLF
A	440	Pier 1	Abutment seat/bearing	MLF
C	2248	H5 LT	1/8" pack rust at splice	MLF
C	2249	H5 LT	1/8" pack rust at splice	MLF
C	2250	H5 RT	Corrision at connection	MLF
C	2251	H5 RT	Corrision at connection	MLF
C	2252	H6 RT	Girder web flaking	MLF
C	2253	H6 RT	Girder web flaking	MLF
C	2254	H6 RT	Girder web flaking	MLF
C	2255	H6 RT	Girder web flaking	MLF
C	2257	H6 LT	Girder top flange corrosion/flaking	MLF
C	2258	H7 RT	Corrosion at connection	MLF
C	2259	H7 LT	Minor corrosion at girder splice	MLF
C	2260	H7 LT	Inside of girder web flaking	MLF
C	2322	H11 LT	Deck soffit, typical	PG

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Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
C	2323	H11 LT	Deck soffit, typical	PG
C	2324	H12 LT	Outside hanger bolt connection	PG
C	2325	H12 LT	Outside of girder	PG
C	2326	H12 LT	Outside of girder	PG
C	2327	H12 LT	Diagonal bracing, looking north	PG
C	2328	H12 LT	Floorbeam	PG
C	2329	H12 LT	Diagonal bracing, looking south	PG
C	2330	H12 LT	Deck soffit, typical	PG
C	2331	H12 LT	Inside hanger bolt connection	PG
C	2332	H12 LT	Inside hanger bolt connection	PG
C	2333	H13 LT	Outside hanger bolt connection	PG
C	2334	H13 LT	Outside of girder	PG
C	2335	H13 LT	Outside of girder	PG
C	2336	H13 LT	Inside of girder	PG
C	2338	H13 LT	Inside of girder	PG
C	2339	H13	Floorbeam	PG
C	2340	H13	Floorbeam	PG
C	2341	H13	Floorbeam	PG
C	2342	H13	Floorbeam	
2	4	H13 RT	Anchor bolts	TW
2	7	H13 LT	Left inside hanager bolt connection	TW
2	9	H13 LT	Left inside hanager bolt connection	TW
2	10	General	SIP deck form corrosion	TW
2	11	General	SIP deck form corrosion	TW
2	12	General	Steel framing plan	TW
2	13	Abutment 1	Vault/Power House	TW
2	19	H13 RT	Lateral brace connection	TW
2	20	FB 1-13	Corroded floorbeam and conduit supports	TW
2	21	FB 1-13	Corroded floorbeam and conduit supports	TW
2	22	H13 LT	Lateral brace connection	TW
2	23	FB 1-13	SIP deck form corrosion	TW
2	25	H13 LT	Lateral brace connection	TW
2	26	H13 LT	Lateral brace connection	TW
2	27	H13 LT	Anchor bolts	TW
2	28	Abutment 2	Crack in rock wall	TW
2	29	FB 1-13	Corroded floorbeam and conduit supports	TW
2	32	General	View of exterior girder	TW
2	33	H12 LT	Outside hanger bolt connection	TW
2	34	H13 RT	Outside hanger bolt connection	TW
2	35	H13 RT	Outside hanger bolt connection	TW
2	36	H13 RT	Outside hanger bolt connection	TW
2	37	H13 RT	Outside hanger bolt connection	TW
2	38	General	View of exterior girder	TW
2	39	Abutment 2	Retaining wall, right side of bridge	TW
2	40	Abutment 2	Retaining wall/fence right side of bridge	TW

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
7	5170	H1 LT	Corrosion at SW lower hanger at curb, 1/16" section loss of rod	PG
7	5171	H4 LT	Typical surface corrosion on lower hangers	PG
7	5172	H5 RT	Corrosion at SE lower hnager bar at curb, 1/16" section loss (necking)	PG
7	5173	H6 RT	Spalls on curb at railing embedment plate	PG
7	5174	H6 RT	Weld btw. Rail post and embedment plate appears to have failed, but	PG
7	5175	H9 LT	8 ft. of handrail is mising bolts just north of H9 LT	PG
7	5176	H10 - H11 RT	Missing handrail bolts between H10 and H11	PG
7	5177	H4 - H5 RT	Missing handrail bolts between H4 and H5	PG
7	5181	H1-H2 LT	Significant flaking (no section loss)	JPG
7	5182	FB 1-1	Floorbeam flaking	JPG
7	5184	South of FB 1-1	SIP forms corrosion/have holes	JPG
7	5185	H2	Rollers for conduits are rusting	JPG
7	5186	Pier 1	South abutment	JPG
7	5187	FB 1-2	Corroded tie-rods	JPG
7	5188	South of FB 1-2	SIP forms corrosion/have holes	JPG
7	5190	South of FB 1-2	SIP forms corrosion/have holes	JPG
7	5192	H2 LT	Debris at girder connection	JPG
7	5197	H3 LT	Typical hanger bolt corrosion	JPG
7	5199	H3 - H4 LT	Typical girder splice	JPG
7	5200	H3 - H4 LT	Girder top of web flaking at splice	JPG
7	5205	H3	Corroded SIP forms, missing concrete	JPG
7	5206	H3 North	Typical deck soffit looking north	JPG
7	5207	H3 South	Typical deck soffit looking south	JPG
7	5208	H4 RT	Outside hanger bolt connection	BK
7	5209	H4 RT	Outside hanger bolt connection	BK
7	5210	H4 RT	SIP deck corrosion	BK
7	5211	H4 RT	Inside hanger bolt connection corrosion	BK
7	5212	H4 RT	Inside of gider web flaking	BK
7	5213	H4 RT	Inside hanger bolt connection corrosion	BK
7	5214	H4 RT	General framing looking south towards Pier 1	BK
7	5217	H4 RT	Loss of SIP formwork	BK
7	5218	H5 RT	Girder splice in good condition	BK
7	5219	H5 RT	Outside hanger bolt connection	BK
7	5220	H5 RT	Lateral bracing connection	BK
7	5221	H5 RT	Girder splice in good condition	BK
7	5222	H5 RT	Floorbeam bottom flange corrosion	BK
7	5223	H5 RT	Lateral bracing connection corrosion	BK
7	5224	H5 RT	Lateral bracing connection corrosion	BK
7	5225	H5 RT	~1/2" section loss in lateral brace	BK
7	5226	H5 RT	General view of soffit	BK
7	5228	H6 RT	Outside hanger bolt connection	BK
7	5229	H6 RT	Corrosion at floorbeam to girder connection	BK
7	5230	H6 RT	Corrosion at connection	BK
7	5231	H6 RT	Inside hanger bolt connection corrosion	BK
7	5232	H6 RT	Inside hanger bolt connection corrosion	BK
7	5233	H6 RT	5/16" section loss girder top flange (measured w/ D-meter)	BK

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
7	5234	H6 RT	Corrosion at floorbeam to girder connection	BK
7	5235	H6 RT	Corrosion at top of floorbeam and SIP deck	BK
7	5236	H6 RT	Corrosion at floorbeam to girder connection	BK
7	5237	H6 RT	General view of bottom of girder	BK
7	5238	H6 RT	Corrosion SIP deck	BK
7	5239	H7 RT	Girder splice in good condition	BK
7	5240	H7 RT	Section loss/piting of bottom flange lateral brace	BK
7	5241	H7 RT	Corrosion at lateral brace connection	BK
7	5242	H7 RT	Corrosion at lateral brace connection	BK
7	5243	H7 RT	Corrosion at lateral brace connection	BK
7	5244	H7 RT	Corrosion at lateral brace connection	BK
7	5245	H7 RT	Corrosion at lateral brace connection	BK
7	5246	H7 RT	Corrosion at lateral brace connection	BK
7	5247	H7 RT	Corrosion at lateral brace connection	BK
7	5249	H8 RT	SIP deck, conduits	BK
7	5252	H9 RT	Inside hanger bolt connection corrosion	JPG
7	5254	H9 RT	SIP deck corrosion	JPG
7	5255	H9 RT	Girder splice	JPG
7	5256	H9 RT	Floorbeam, SIP deck corrosion	JPG
7	5257	H9 RT	Girder splice	JPG
7	5261	H10 RT	Hanger connection moderate corrosion	JPG
7	5262	H10 RT	Formwork corrosion, typical	JPG
7	5263	H10 RT	Floorbeam flaking, typical	JPG
7	5428	Pier 1	Abutment seat	PG
7	5429	Pier 1	Abutment seat	PG
7	5430	Pier 1	Corroded bearing	PG
7	5431	Pier 1	Abutment seat	PG

A	441	NW Anchor	General, anchor block	MLF
A	442	NW Anchor	Anchor block	MLF
A	443	NW Anchor	General, anchor block	MLF
A	444	NW Anchor	Nuts, plate	MLF
A	445	NW Anchor	General, anchor block	MLF
A	446	NW Anchor	General, anchor block	MLF
A	447	NW Anchor	Threaded rods	MLF
A	448	NW Anchor	Threaded rods	MLF
A	449	NW Anchor	Underside of plate	MLF
A	450	NE Anchor	General, anchor block	MLF
A	451	NE Anchor	General, anchor block	MLF
A	452	NE Anchor	Cable, nuts, plate	MLF
A	453	NE Anchor	Anchor block, threaded rod, plate	MLF
A	454	South Anchor	Tree growth around cable, anchorage	MLF
A	455	South Anchor	Anchor block is buried in soil, debris	MLF
A	456	South Anchor	Cable, nuts, plate	MLF
A	457	South Anchor	Threaded rod	MLF

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Project	Riverfront Park Bridges Inspection	By	M. Frymoyer	Sheet No.
Location	Spokane	Date	9/26/2014	6 OF8
Client	City of Spokane			Job No.
Inspection Photo Log				114176.12

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
7	5264	SB3 RT south	General connectiond detail	BK
7	5265	SB4 RT south	General connectiond detail	BK
7	5266	SB4 RT south	General connectiond detail	BK
7	5267	H1 RT	General connectiond detail	BK
7	5268	SB3 RT south	General connectiond detail	BK
7	5269	SB3 RT south	General connectiond detail	BK
7	5270	SB4 RT south	General connectiond detail	BK
7	5271	H1 RT	General connectiond detail	BK
7	5272	H1 RT	General connectiond detail	BK
7	5273	H1 RT	General connectiond detail	BK
7	5274	H1 RT	General connectiond detail	BK
7	5275	H1 LT	General connectiond detail	BK
7	5276	H1 LT	General connectiond detail	BK
7	5277	H1 LT	General connectiond detail	BK
7	5278	General	General connectiond detail	BK
7	5279	H1 LT	General connectiond detail	BK
7	5280	H1 LT south	General connectiond detail	BK
7	5281	H1 LT	General connectiond detail	BK
7	5282	H1 LT	General connectiond detail	BK
7	5283	SB4 LT south	General connectiond detail	BK
7	5284	SB3 LT south	General connectiond detail	BK
7	5285	South Tower	Rigging set up to access upper connections	BK
7	5286	SB2 LT south	General connectiond detail	BK
7	5287	SB1 LT south	General connectiond detail	BK
7	5288	SB1 LT south	General connectiond detail	BK
7	5289	SB1 LT south	General connectiond detail	BK
7	5291	SB3 to SB4 LT south	Main suspension cable	BK
7	5293	SB2 RT south	General connectiond detail	BK
7	5294	SB1 RT south	General connectiond detail	BK
7	5295	SB1 RT south	General connectiond detail	BK
7	5296	South HUB	North side of south tower pin connection	BK
7	5297	South HUB	North side of south tower pin connection	BK
7	5298	South HUB	North side of south tower pin connection	BK
7	5299	South HUB	North side of south tower pin connection	BK
7	5300	South HUB	North side of south tower pin connection	BK
7	5301	South HUB	North side of south tower pin connection	BK
7	5302	South HUB	Main suspension cable connection	BK
7	5303	South HUB	Main suspension cable connection	BK
7	5304	South HUB	Main suspension cable connection	BK
7	5306	South HUB	North side of south tower pin connection	BK
7	5307	H13 LT	General connectiond detail	BK
7	5308	H13 LT	General connectiond detail	BK
7	5309	H13 LT	General connectiond detail	BK
7	5310	SB4 LT north	General connectiond detail	BK
7	5311	General		BK
7	5312	H13 RT	General connectiond detail	BK

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
7	5313	H13 RT	General connectiond detail	BK
7	5314	H13 RT	General connectiond detail	BK
7	5315	SB4 RT north	General connectiond detail	BK
7	5316	General		BK
7	5317	SB1 LT north	General connectiond detail	BK
7	5318	SB1 RT north	General connectiond detail	BK
7	5319	North HUB	Main suspension cable connection	BK
7	5320	North HUB	Main suspension cable connection	BK
7	5321	North HUB	South side of north tower pin connection	BK
7	5322	North HUB	South side of north tower pin connection	BK
7	5323	North HUB	South side of north tower pin connection	BK
7	5324	North HUB	South side of north tower pin connection	BK
7	5325	North HUB	South side of north tower plates	BK
7	5326	North HUB	South side of north tower plates	BK
7	5327	North HUB	South side of north tower plates	BK
7	5328	North HUB	North side of north tower (looking down)	BK
7	5329	North HUB	North side of north tower (looking down)	BK
7	5330	North HUB	North side of north tower (looking down)	BK
7	5331	North HUB	North side of north tower (looking down)	BK
7	5332	North HUB		BK
7	5432	H12 LT	Top hanger to cable connection	PG
7	5433	H12 LT	Top hanger to cable connection	PG
7	5434	H12 LT	Top hanger to cable connection	PG
7	5435	H12 LT	Top hanger to cable connection	PG
7	5436	H12 RT	Top hanger to cable connection	PG
7	5437	H12 RT	Top hanger to cable connection	PG
7	5438	H12 RT	Top hanger to cable connection	PG
7	5439	H11 RT	Top hanger to cable connection	PG
7	5440	H11 RT	Top hanger to cable connection	PG
7	5441	H11 RT	Top hanger to cable connection	PG
7	5442	H11 LT	Top hanger to cable connection	PG
7	5443	H11 LT	Top hanger to cable connection	PG
7	5444	H11 LT	Top hanger to cable connection	PG
7	5445	H3 LT	Top hanger to cable connection	PG
7	5446	H3 LT	Top hanger to cable connection	PG
7	5447	H3 LT	Top hanger to cable connection	PG
7	5448	H3 RT	Top hanger to cable connection	PG
7	5449	H3 RT	Top hanger to cable connection	PG
7	5450	H3 RT	Top hanger to cable connection	PG
7	5451	H2 RT	Top hanger to cable connection	PG
7	5452	H2 RT	Top hanger to cable connection	PG
7	5453	H2 RT	Top hanger to cable connection	PG
7	5454	H2 LT	Top hanger to cable connection	PG
7	5455	H2 LT	Top hanger to cable connection	PG
7	5456	H2 LT	Top hanger to cable connection	PG
7	5457	H2 LT	Top hanger to cable connection	PG

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Project	Riverfront Park Bridges Inspection	By	M. Frymoyer	Sheet No.
Location	Spokane	Date	9/26/2014	8 OF8
Client	City of Spokane			Job No.
Inspection Photo Log				114176.12

Bridge Name: South Suspension Bridge

Date of Inspection: 9/2/14-9/5/14

Camera No.	Photo No.	Location	Notes	By
7	5458	H4 RT	Top hanger to cable connection	PG
7	5459	H4 RT	Top hanger to cable connection	PG
7	5460	H4 RT	Top hanger to cable connection	PG
7	5461	H4 LT	Top hanger to cable connection	PG
7	5462	H4 LT	Top hanger to cable connection	PG
7	5463	H4 LT	Top hanger to cable connection	PG
7	5466	H10 RT	Top hanger to cable connection	PG
7	5468	H10 RT	Top hanger to cable connection	PG
7	5469	H10 RT	Top hanger to cable connection	PG
7	5470	H10 RT	Top hanger to cable connection	PG
7	5471	H10 LT	Top hanger to cable connection	PG
7	5472	H10 LT	Top hanger to cable connection	PG
7	5473	H10 LT	Top hanger to cable connection	PG
7	5475	H10 LT	Top hanger to cable connection	PG
7	5476	H9 LT	Top hanger to cable connection	PG
7	5477	H9 LT	Top hanger to cable connection	PG
7	5478	H9 LT	Top hanger to cable connection	PG
7	5479	H9 LT	Top hanger to cable connection	PG
7	5480	H9 RT	Top hanger to cable connection	PG
7	5481	H9 RT	Top hanger to cable connection	PG
7	5482	H9 RT	Top hanger to cable connection	PG
7	5483	H8 RT	Top hanger to cable connection	PG
7	5484	H8 RT	Top hanger to cable connection	PG
7	5485	H8 RT	Top hanger to cable connection	PG
7	5486	H8 LT	Top hanger to cable connection	PG
7	5487	H8 LT	Top hanger to cable connection	PG
7	5488	H8 LT	Top hanger to cable connection	PG
7	5489	H7 LT	Top hanger to cable connection	PG
7	5490	H7 LT	Top hanger to cable connection	PG
7	5491	H7 LT	Top hanger to cable connection	PG
7	5492	H7 RT	Top hanger to cable connection	PG
7	5493	H7 RT	Top hanger to cable connection	PG
7	5494	H7 RT	Top hanger to cable connection	PG
7	5495	H6 RT	Top hanger to cable connection	PG
7	5496	H6 RT	Top hanger to cable connection	PG
7	5497	H6 RT	Top hanger to cable connection	PG
7	5498	H6 LT	Top hanger to cable connection	PG
7	5499	H6 LT	Top hanger to cable connection	PG
7	5500	H6 LT	Top hanger to cable connection	PG
7	5501	H5 LT	Top hanger to cable connection	PG
7	5502	H5 LT	Top hanger to cable connection	PG
7	5503	H5 LT	Top hanger to cable connection	PG
7	5504	H5 RT	Top hanger to cable connection	PG
7	5505	H5 RT	Top hanger to cable connection	PG
7	5507	H5 RT	Top hanger to cable connection	PG

South Suspension Bridge - Camera A Photos


IMG_0440.JPG


IMG_0195.JPG


IMG_0196.JPG


IMG_0197.JPG


IMG_0198.JPG


IMG_0200.JPG


IMG_0201.JPG


IMG_0202.JPG


IMG_0203.JPG


IMG_0204.JPG


IMG_0205.JPG


IMG_0206.JPG


IMG_0207.JPG


IMG_0208.JPG


IMG_0209.JPG


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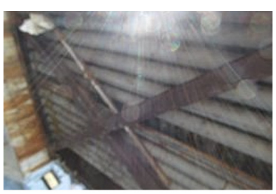
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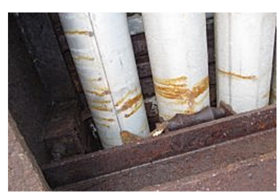
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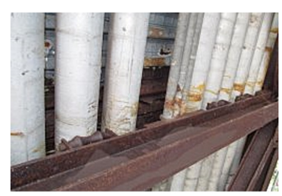
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South Suspension Bridge - Camera A Photos


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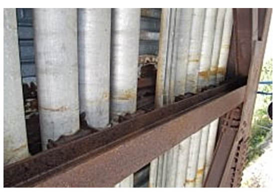
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IMG_0305.JPG


IMG_0307.JPG


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IMG_0314.JPG


IMG_0315.JPG


IMG_0316.JPG


IMG_0432.JPG


IMG_0433.JPG


IMG_0434.JPG

South Suspension Bridge - Camera A Photos


IMG_0435.JPG


IMG_0436.JPG


IMG_0437.JPG


IMG_0438.JPG


IMG_0439.JPG

South Suspension Bridge - Camera C Photos


IMG_2342.JPG


IMG_2248.JPG


IMG_2249.JPG


IMG_2250.JPG


IMG_2251.JPG


IMG_2252.JPG


IMG_2253.JPG


IMG_2254.JPG


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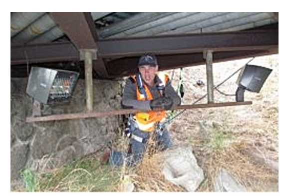
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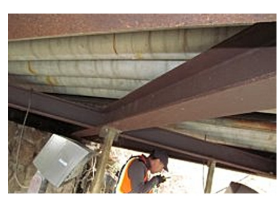
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South Suspension Bridge - Camera 2 Photos


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IMG_0011.JPG


IMG_0012.JPG


IMG_0013.JPG


IMG_0019.JPG


IMG_0020.JPG


IMG_0021.JPG


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IMG_0034.JPG


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IMG_0039.JPG

South Suspension Bridge - Camera 7 Photos


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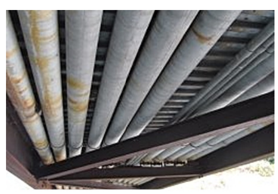
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South Suspension Bridge - Camera 7 Photos


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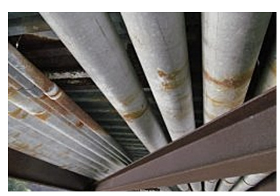
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South Suspension Bridge - Camera 7 Photos


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IMG_5430.JPG

South Suspension Bridge - Camera A Photos Anchors


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South Suspension Bridge - Camera 7 Photos Cables


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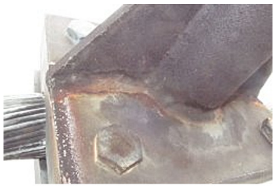
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South Suspension Bridge - Camera 7 Photos Cables


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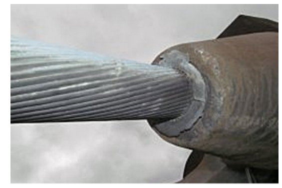
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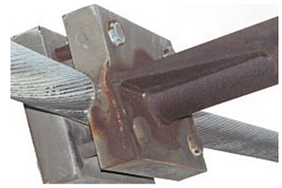
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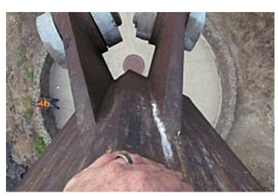
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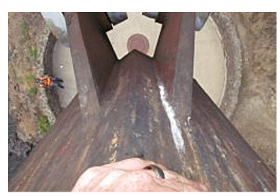
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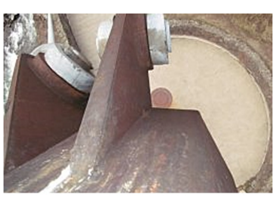
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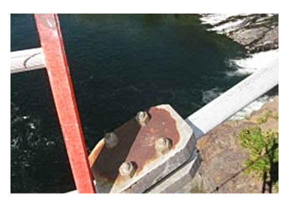
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South Suspension Bridge - Camera 7 Photos Cables


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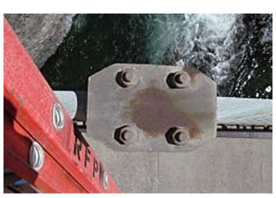
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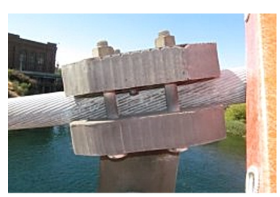
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South Suspension Bridge - Camera 7 Photos Cables


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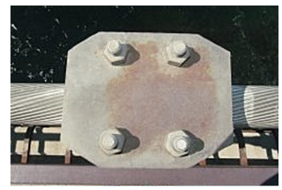
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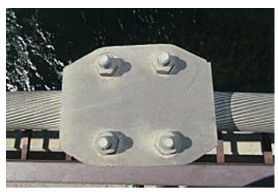
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IMG_5500.JPG


IMG_5501.JPG


IMG_5502.JPG


IMG_5503.JPG


IMG_5504.JPG


IMG_5505.JPG

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Project	Riverfront Park Bridges Inspection	By	M. Frymoyer	Sheet No.
Location	Spokane	Date	9/26/2014	1 OF1
Client	City of Spokane			Job No.
Inspection Photo Log				114176.12

Bridge Name: South Suspension Bridge Vaults

Date of Inspection: 9/2/14-9/5/14

Photo No.	Location	Notes	By
264	Vault 1	Severely corroded beam at manhole	MLF
265	Vault 1	Severely corroded beam at manhole	MLF
267	Vault 2	Corroded stay in place formwork near manhole	MLF
268	Vault 2	Corroded stay in place formwork near manhole	MLF
269	Vault 2	Corroded stay in place formwork and support angle at column/tower	MLF
270	Vault 2	Corroded stay in place formwork and support angle at column/tower	MLF
271	Vault 2	Corroded stay in place formwork near bridge abutment	MLF
272	Vault 2	Corroded stay in place formwork near bridge abutment	MLF
273	Vault 2	Corroded stay in place formwork near bridge abutment	MLF
274	Vault 2	Corroded stay in place formwork near bridge abutment	MLF
275	Vault 2	Corroded stay in place formwork near manhole & column/tower	MLF
276	Vault 2	Corroded stay in place formwork and support angle at column/tower	MLF
2265	Vault 1	Severely corroded beam at manhole	BK
2266	Vault 1	Severely corroded beam at manhole	BK
2267	Vault 1	Severely corroded beam at manhole	BK
2268	Vault 1	Severely corroded beam at manhole	BK
2269	Vault 1	Column/Tower lateral support connection	BK
2270	Vault 1	Column/Tower lateral support connection	BK
2271	Vault 1	Column/Tower lateral support connection	BK
2272	Vault 1	Column/Tower lateral support connection	BK
2273	Vault 1	Column/Tower lateral support connection	BK
2274	Vault 1	Column/Tower lateral support connection	BK
2275	Vault 1	Column/Tower lateral support connection	BK
2276	Vault 1	Corroded stay in place formwork near manhole	BK
2277	Vault 1	Corroded stay in place formwork near manhole	BK
2278	Vault 1	Conduits	BK
2279	Vault 1	Conduits	BK
2280	Vault 1	Retaining wall at bottom of vault	BK
2281	Vault 1	Column/Tower anchor plate and bolt	BK
2282	Vault 1	Vault wall in good condition	BK
2283	Vault 1	Retaining wall at bottom of vault	BK
2284	Vault 1	Exposed rebar in vault wall	BK
2285	Vault 1	Vault wall	BK
2286	Vault 1	Upper column brace	BK
2287	Vault 1	Exposed rebar in vault wall	BK
2288	Vault 1	Stay in place formwork and conduits	BK
2289	Vault 1	Lifting anchorage on column/tower	BK
2290	Vault 1	Column/Tower lateral support connection	BK
2291	Vault 1	Column/Tower lateral support connection	BK
2292	Vault 1	Column/Tower lateral support connection	BK
2293	Vault 1	Column/Tower lateral support connection	BK
2294	Vault 1	Corroded stay in place formwork near column/tower	BK
2295	Vault 1	Upper column brace and corroded conduit	BK
2296	Vault 1	Upper column brace and corroded conduit	BK

South Suspension Bridge Vaults - Photos


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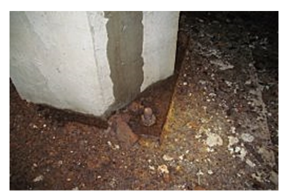
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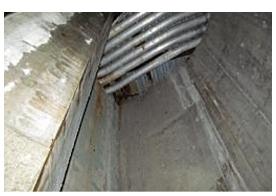
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South Suspension Bridge Vaults - Photos


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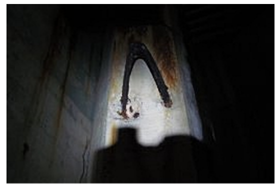
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