City of Tacoma

Questions and Answers

34TH STREET BRIDGE DECK REPAIR
RFQ Specification No. PW23-0141F

All interested parties had the opportunity to submit questions in writing by email to Brandon Snow, Senior Buyer, by date questions were due. The answers to the questions received are provided below and posted to the City's website at www.TacomaPurchasing.org: Navigate to *Current Contracting Opportunities* / *Services Solicitations*, and then click *Questions and Answers* for this Specification. This information IS NOT considered an addendum. Respondents should consider this information when submitting their proposals.

Question 1: Does this project have any plans?

Answer 1: The 2022 bridge inspection report, along with annotated 1935 plan drawings, a 2022 initial seismic and load rating deficiency evaluation, a 2022 WSBIS Local Agency Inventory Report, and photos of existing conditions, have been attached for reference.

The current annual bridge report is also available online: https://www.cityoftacoma.org/cms/One.aspx?portalId=169&pageId=206270 (Select 'Annual Bridge Inspection Report' drop-down menu. Then select link to 'Current Annual Bridge Report'. Navigate to Bridge No. 28 34thP-A)

BRIDGE INSPECTION REPORT

Status: Released | Printed On: 4/25/2022 | Agency: TACOMA

CD Guid: f439ffb4-0148-4e4a-9910-ed839b882bca | Release Date: 4/21/2022 | Program Mgr: Sonia L. Lowry

Br. No. 28 34thP-A **SID** 08512200 **Br. Name** EAST 34TH STREET

Carrying EAST 34TH STREET **Route On** 03234 **Mile Post** 10.00

Intersecting PACIFIC TO A ST **Route Under** **Mile Post**

Inspector's Signature SJC Cert # G0315 Cert Exp Date 4/15/2026 Co-Inspector's Signature CDN

Inspections Performed

Report Type	Inspection Type	Date	Freq	Hours	Inspector	Cert No	Co-Insp.
Routine		6/17/2020	24	2.5	SJC	G0315	CNS
Interim		4/4/2022	60	8.0	SJC	G0315	CDN
Informational		4/4/2022			SJC	G0315	CDN

8		Alignment	(1661)	36		Operating Tons	(1552)	0		Bridge Rails	(1684)
5	3	Deck Overall	(1663)	1.01		Op RF	(1553)	0		Transition	(1685)
5		Superstructure	(1671)	21		Inventory Tons	(1555)	0		Guardrails	(1686)
5		Substructure	(1676)	0.60		Inv RF	(1556)	0		Terminals	(1687)
9		Culvert	(1678)	5		Operating Level	(1660)	44.5		Bridge Rail Ht	(2612)
9		Chan/Protection	(1677)	P		Open/Closed	(1293)	8.50		Design Curb Ht	(2611)
N		Pier/Abut/Prot	(1679)	5		Structural Eval	(1657)				
9		Waterway	(1662)	2		Deck Geometry	(1658)				
N		Scour	(1680)	9		Underclearance	(1659)				

2		No Utilities	(2675)
0.50		Asphalt Depth	(2610)
1937		Year Built	(1332)
0		Year Rebuilt	(1336)

NBIS Risk Category
Routine: Low Risk
Underwater: No Risk Category

Inspection Flags

N		Soundings	(2693)			Measure Clearance	(2694)	N		Revise Rating	(2688)
P	D	Photos	(2691)			QA Flag	(2695)				

BMS Elements

Element	Element Description	Total	Units	CS 1	CS 2	CS 3	CS 4
12	Concrete Deck	11640	SF	10497	0	0	1143
35	Concrete Deck Soffit	11640	SF	10640	0	1000	0
110	Concrete Girder	1454	LF	1440	0	14	0
144	Concrete Arch	485	LF	485	0	0	0
150	Concrete Column on Spandrel Arch	28	EA	18	0	8	2
155	Concrete Floor Beam	648	LF	645	0	3	0
205	Concrete Pile/Column	20	EA	11	0	5	4
215	Concrete Abutment	160	LF	160	0	0	0
234	Concrete Pier Cap/Crossbeam	96	LF	96	0	0	0
266	Concrete Sidewalk & Supports	4850	SF	4517	0	333	0
310	Elastomeric Bearing	4	EA	0	0	4	0
311	Moveable Bearing (roller, sliding, etc)	4	EA	4	0	0	0
321	Concrete Roadway Approach Slab	768	SF	668	0	100	0
331	Concrete Bridge Railing	970	LF	950	20	0	0
370	Seismic - Longitudinal Restrainer	4	EA	4	0	0	0

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BMS Elements (Continued)

Element	Element Description	Total	Units	CS 1	CS 2	CS 3	CS 4
371	Seismic - Transverse Restrainer	8	EA	8	0	0	0
376	Concrete Deck Delamination Testing	11640	SF	10497	0	0	1143
402	Open Concrete Joint	48	LF	0	0	0	48
408	Steel Sliding Plate	96	LF	72	0	24	0
800	Asphaltic Concrete (AC) Overlay	11640	SF	7660	0	0	3980

Notes

0 The bridge orientation is west to east. The structure has 6 spans which are labeled 1 through 6. There are a total of 9 piers, which are labeled 1 through 9, from west to east.
Due to the complexity of the structure, it is advised to see the "2020 Inspector Layout Sheet" in the plans section of Bridgeworks.

Access to west abutment is through NW business parking area. There is a gate with a lock on it. Lock is currently frozen and should be replaced. Access to underside of bridge is south of 34th Street (12316 Pacific ave - Ahsleys Pipe Shop) via an access with a locked gate.

11 The bridge is posted for EV 3 vehicles and signs have been installed on the structure. The city has issued a permit for all impacted EV3 vehicles which allows those EV3's to still use the bridge if they adhere to the 10 MPH advisory speed limit.

12 The deck appears to be in poor condition. The caveat to this statement is most of the deck is covered in a failing chip seal and it is not visible to inspect. The chip seal is failing/failed on the deck. The deck is showing cracks, spalls, exposed reinforcing steel, and delaminations.

Specific deficienies noted in the files tab along with mapping of locations and noted in BMS element 376.

35 The concrete deck soffit in span 1, 3, 5, and 6, appear to be in good condition. There are some minor cracking with leacheate.

The concrete deck soffit in span 2 appears to be in fair to good condition. There is a 1/2" crack in several locations with leacheate and rust staining as noted in the 2018 inspection.

The concrete deck soffit in span 4 appears to be in fair condition. The "spans" between spandrel columns 3 to 13 show evidience of transverse and longitudinal cracking. There is leaching and effloresceance show through these locations.

110 General girder deficiency note: All of the girders within the arch appear to have hairline leaching cracks with efflorescence. Some of the cracks appear to be near midspan of the girder. Many of these spalls and cracks have not appeared to have changed since previous inspections. Many of these deficiencies appear to be minor.

Span 1:
Girder 1, near pier 2 has a 6”x6” spall.
Girder 2, near pier 2 has 2 spall with exposed reinforcing steel on the bottom surface. Approximate size is 1’x1’ each.
Girder 4, near pier 1 has a 5” long crack on the south face, approximately 1/8” wide.

Span 2:
Girder 4, near pier 2, has a 6”x6” spall.

Span 7:
Girder 1, north face, has an 8” spall the full height of the girder with 22” of exposed reinforcing steel.
Girder 3, north face, has 3 short sections of exposed reinforcing steel near midspan. There is also an exposed reinforcing steel near pier 8.

Span 8:
Girder 4, there is an exposed reinforcing steel 24” long, near pier 8.

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Carrying EAST 34TH STREET **Route On** 03234 **Mile Post** 10.00

Intersecting PACIFIC TO A ST **Route Under** **Mile Post**

Notes (Continued)

144 Overall, the concrete arches appear to be in good condition.

There are a couple of minor deficiencies to note:
Arch 1 has a vertical leaching crack at the cold joint on the insdie face near spandrel column 2. There are also hairline diagonal cracks, 12" on center for approx. 10 feet, on the top of the arch between spandrel column 7 and 8.

150 Overall, the spandrel arch columns appear to be in fair condition. The spandrel columns appear to have areas of poor concrete consolidation, leaving many rock pockets. When the rock pockets spall, they leave exposed reinforcing steel.

Many of the spandrel columns have a crack all around the column at the top, where it connects to the girder.

SC1A is spalled at the bottom of the south face, and 24" high on the SEC. Three of the corners at the bottom of the column have spalls. There is a 12" spall in the
NWC near the arch and a 10" x 6" spall, NWC, with exposed bar.

SC1B is spalled on the SWC, 32" high x 6" wide x 4" deep. There is 21" of exposed reinforcing steel.

SC2A has four spalls on the NW corner, with a total of 12" of exposed reinforcing steel. The lower 10 ft. of the NWC is all spalled.

SC2B has a crack in NEC at mid-height of column. This crack is forming into a spall.

SC3A SEC near the Arch has a 12” x 8” spall.

SC3B is spalled on the SEC (16" high x 3" wide x 2" deep) which has 12" of exposed reinforcing steel.

SC4A at the SWC support, there is 18” of exposed reinforcing steel.

SC8B, there is an 8” spall on the SWC with 4" of exposed reinforcing steel. The north face has cracking on the bottom half.

SC12A is spalled on the SEC. It has 18" of exposed reinforcing steel at the base, and 12" of exposed reinforcing near the lower third point of the column. This spall is approx. 12’ high on the NEC. There are two reinforcing bars exposed at the base and 8’ of exposed vertical reinforcing.

SC12B is spalled on the NW edge at the bottom at Arch B. There is a 6" spall at the base of the column.

SC13A has rock pockets near mid-height and a 14" x 4" x 2" deep spall with 11" of exposed reinforcing at the NEC. The spall on the SE C has 8" of exposed reinforcing at the base and 8" of exposed reinforcing near the one quarter height. There is also a spall on the SW edge and a spall and delamination on the NW edge at the construction joint. There is a crack at NW corner at mid-height. The crack is fully across the column face horizontally.

SC13B is spalled on the NW and SW corners, with 30" of exposed reinforcing.

SC14A is spalled on the SEC, 26" high x 4" wide x 2" deep, just above the mid-height strut. It has 18" of exposed reinforcing. There is approx. 10 ft. of rock pockets on this column. The NE and NW corners are spalled, with approx. 8’ of exposed reinforcing at each.

155 Overall, the concrete floor beams are in good condition. Several of the floorbeams are exhibiting leaching cracks with efflorescense.
Specific Deficiencies are: There are two exposed reinforcing steel, approx. 10" and 20" in length, in the west face of the Pier 6 floorbeam

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Notes (Continued)

205 There are four columns each, at Piers 2, 3, and 8, and two columns each at Piers 4, 5, 6, and 7. The concrete pile/columns appear to be in fair, to good, condition. Specific deficiencies are:

Column 3B, has a 5" spall with exposed reinforcing on the west face, just above the strut. On the east face, there is a 2 ft. x 1 ft. spall
Column 4A has three pieces of exposed reinforcing steel on the west face and three pieces on the south face, near midheight. There are 4 spalls on south face at bottom 10 ft. of the column. There is a 12" x12" spall with exposed reinfocing steel in the section. Column 4B has a 12" spall with exposed reinforcing on the west face, near the top. Column 5A, SE edge, has an 11" x 5" x 2" deep spall with exposed vertical reinforcing. It is located in the construction joint, at the strut, between Columns 5A and 5B. Column 5b has 18" of exposed vertical reinforcing on the north face at mid-height.

Column 7A has a crack at the sidwalk support.

215 The concrete abutments appear to be in good condition. There are small, minor blemishes evident on the faces of the abutments.

234 The crossbeams appear to be in good condition. There are some minor deficiencies at the top of the columns at Piers 4, 5, 6 and 7 which have vertical leaching cracks.

266 The concrete sidewalk supports appear to be in good condition. The sidewalk surface appears to be in fair to poor condition. There are signs of deficiencies in several locations.

Specific deficienies noted in the files tab along with mapping.

A complete list of size and locations for spalls, delaminations, and cracking can be found in the Files Tab along with mapping of the locations. This was from chain dragging which occured in March 2022 to document all of the deck and sidewalk deficiencies.

310 The elements we are noting as "elastomeric bearings" are reall more like heavy asphalt material which may allow movement similar to a elastomeric bearing. This item is the most logical place for these elements.

The elastomeric bearings appear to be in fair to poor condition as noted in the 2018 inspection. Some of the material is deteriorated to a state which it can be easily broken off and removed from the wearing interface between the colum and crossbeam. Due to this, all bearings are being put into CS3.

311 The moveable bearings appear to be in good condition and show no signs of deficiencies.

There are movable bearings are at Pier 4 and Pier 7 at the top of the columns. These are sliding plates which appear to be in good condition and show no signs of deficiencies.

321 The concrete approach slabs are note visible during this inspection due to a chip seal overlay installed on the top of them. The portions which are visible show signs of surface war, exposed aggregate, and small surface defects and spalls. The approach slab with this wear is accounted for in CS3.

The chip seal overlay appears to be in poor condition and has failed. This amount of poor/failed chip seal is accounted for in element #800.

331 The concrete bridge rails appear to be in good condition and show no signs of deficiencies. Note, a 20 ft. segment near midspan, south side was removed and replaced due to a car accident. This accounts for the amount of rail in CS2.

370 The longitudinal restrainers appear to be in good condition and show no signs of deficiencies.

371 The transverse restrainers appear to be in good condition and show no signs of deficiencies.

376 Specific deficienies noted in the files tab along with mapping.

A complete list of size and locations for spalls, delaminations, and cracking can be found in the Files Tab along with mapping of the locations. This was from chain dragging which occured in March 2022 to document all of the deck and sidewalk deficiencies.

402 The open concrete joints in the bridge deck have all failed and no longer function.

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Notes (Continued)

408 The steel plates are working loose and make a loud noise when a vehicle passes. These plates have been repaired several times by Tacoma crews, but need futher attention. 2018, The sliding plate on pier 5 has been removed. The westbound lane header is spalling from impact loads.

800 The chip seal over the roadway is in poor condition. It has worn away in the wheel paths. Note, 100 SF of failed AC overlay comes from the chip seal on the concrete approach raodway slabs on either end as noted in element ID 321.

1663 In April 2022, the city performed a delamination check of the deck and sidewalks. Due to the amount of delamination found (9.4% deck) BMS element 1663 was changed from a 5 to a 3. This was a change also recommended by WSDOT.

Repairs

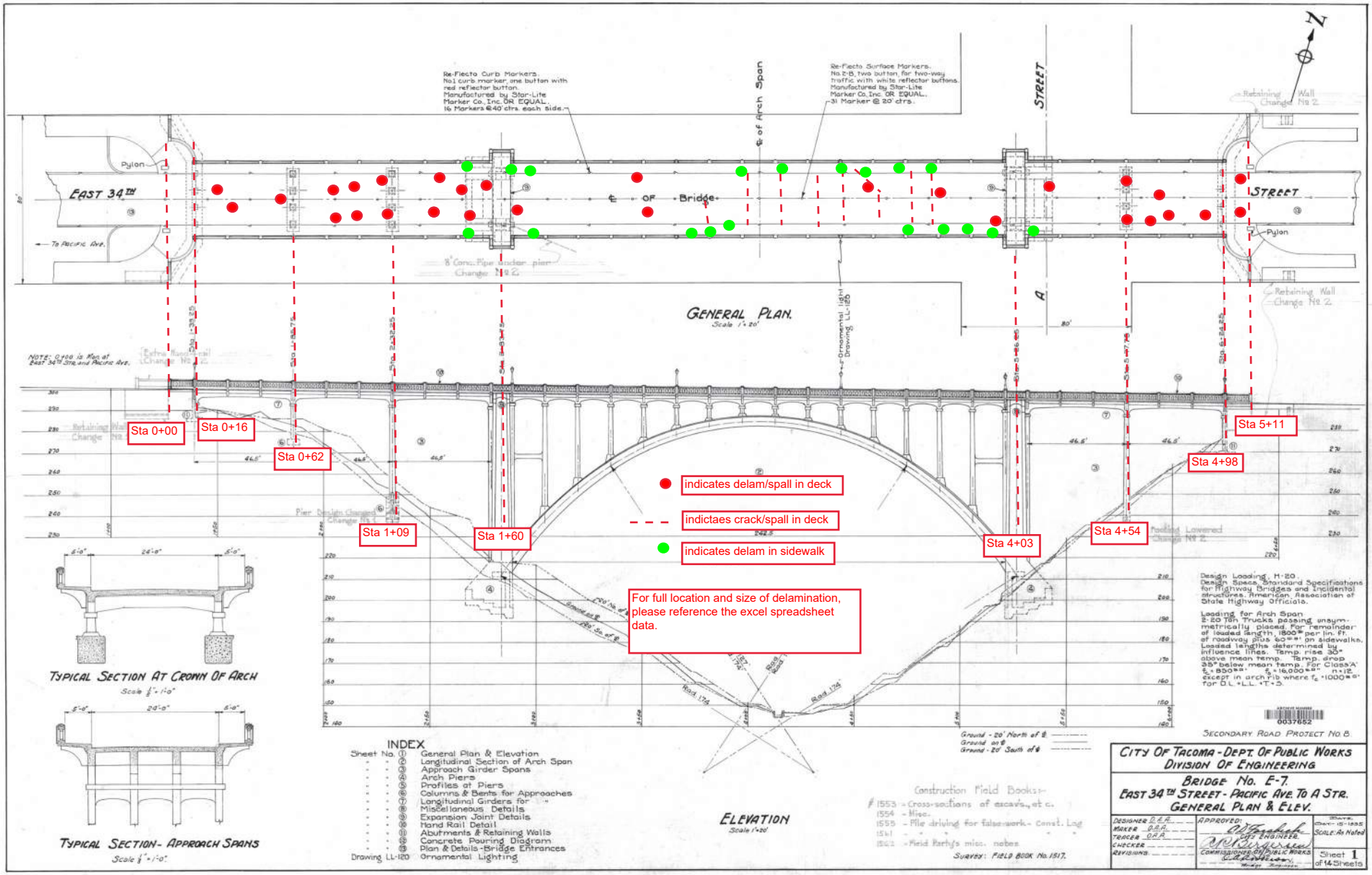
Repair No	Pr	R	Repair Descriptions	BMS	Noted	Maint	Verified
10005	M	B	resurface concrete deck with a concrete overlay	12	6/17/2020		
10006	M	B	patch all spalls and exposed reinforcing steel of the superstructure	110, 150, 155, 205	6/17/2020		
10007	M	B	repair or replace all bearings	310, 311	6/17/2020		
10008	M	B	replace concrete approach slabs	321	6/17/2020		
10009	3	B	remove vegetation from under the bridge, in the gulch for easier access prior to next inspection.	0	6/17/2020		
10010	3	B	replace lock on west side abutment access next to business. The existing lock is frozen.	0	6/17/2020		
10011	M	B	repair sidewalk spalls and exposed reinforcing steel	266	6/17/2020		
10012	M	B	repair/replace failed expansion joints	408	6/17/2020		

Inspections Performed and Resources Required

Report Type	Date	Freq	Hrs	Insp	CertNo	Coinsp	Note
Routine	6/17/2020	24	2.5	SJC	G0315	CNS	2020 routine inspection

Resources	Hours	Min	Pref	Max	Freq	Date	Need Date	Override	Notes
UBIT	3.00	30	60	60					SDOT UBIT was used for 2016 inspection
UBIT	8.00	30	60	60					SDOT UBIT was used for 2010 inspection.
UBIT	3.50	30	60	60					UB60 used for 2008 inspection. The UB50 and UB30 will require deployment off both sides.
Flagging	4.00	LA	LA	LA					Contact Steve Carstens at 253.591.5263 to arrange for flagging.

Interim	4/4/2022	60	8.0	SJC	G0315	CDN	interim inspection performed to verify amount of delamination in deck and sidewalks.
Informational	4/4/2022			SJC	G0315	CDN	informational to insert new deck delamination information.


GENERAL PLAN.
Scale 1" = 20'
EAST 34TH
STREET
Pylon
℄ OF Bridge
℄ of Arch Span
Re-Flecto Curb Markers. No1 curb marker, one button with red reflector button. Manufactured by Star-Lite Marker Co., Inc. OR EQUAL. 16 Markers @ 40' ctrs. each side.
Re-Flecto Surface Markers. No.2-B, two button, for two-way traffic with white reflector buttons. Manufactured by Star-Lite Marker Co., Inc. OR EQUAL. 31 Marker @ 20' ctrs.
Retaining Wall Change No 2
Sta 0+00
Sta 0+16
Sta 0+62
Sta 1+09
Sta 1+60
Sta 4+03
Sta 4+54
Sta 4+98
Sta 5+11
indicates delam/spall in deck
indictaes crack/spall in deck
indicates delam in sidewalk
For full location and size of delamination, please reference the excel spreadsheet data.
TYPICAL SECTION AT CROWN OF ARCH
Scale 1/2" = 1'-0"
TYPICAL SECTION - APPROACH SPANS
Scale 1/2" = 1'-0"
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Sheet No. 1 General Plan & Elevation
2 Longitudinal Section of Arch Span
3 Approach Girder Spans
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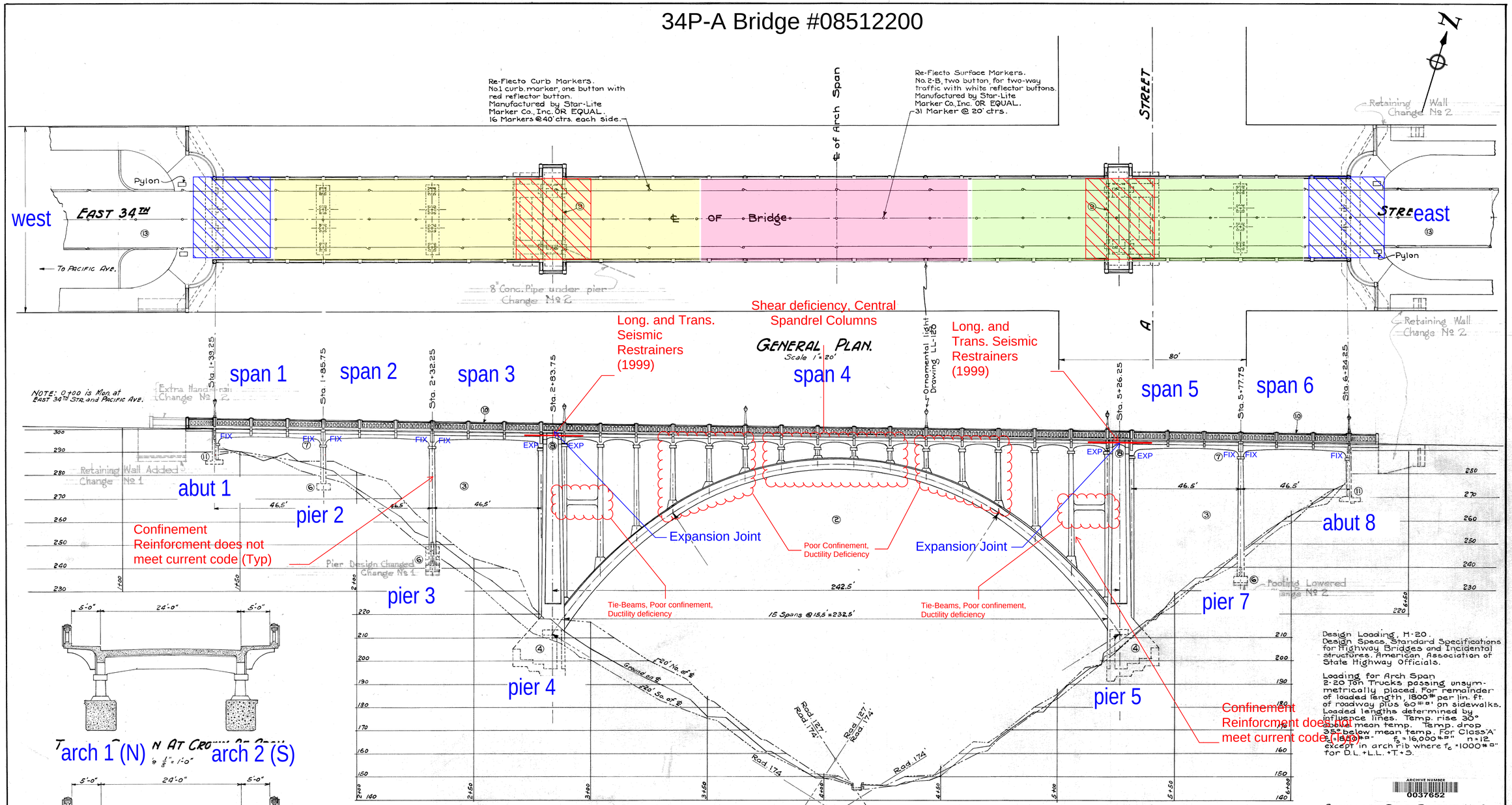
6 Columns & Bents for Approaches
7 Longitudinal Girders for "
8 Miscellaneous Details
9 Expansion Joint Details
10 Hand Rail Detail
11 Abutments & Retaining Walls
12 Concrete Pouring Diagram
13 Plan & Details - Bridge Entrances
Drawing LL-120 Ornamental Lighting
ELEVATION
Scale 1" = 20'
Construction Field Books:-
1553 - Cross-sections of excav., etc.
1554 - Misc.
1555 - Pile driving for false-work - Const. Log
1561 - " " " " "
1562 - Field Party's misc. notes
Survey: FIELD BOOK No. 1517.
Ground - 20' North of ℄
Ground on ℄
Ground - 20' South of ℄
Design Loading, H-20.
Design Specs. Standard Specifications for Highway Bridges and Incidental structures. American Association of State Highway Officials.
Loading for Arch Span 2-20 Ton Trucks passing unsymmetrically placed. For remainder of loaded length, 1800# per lin. ft. of roadway plus 60#/# on sidewalks. Loaded lengths determined by influence lines. Temp. rise 30° above mean temp. Temp. drop 35° below mean temp. For Class 'A' f_c = 850#/□" f_s = 16,000#/□" n = 12 except in arch rib where f_c = 1000#/□" for D.L. + L.L. + T + S.
0037652
SECONDARY ROAD PROJECT No. 8.
CITY OF TACOMA - DEPT. OF PUBLIC WORKS
DIVISION OF ENGINEERING
BRIDGE No. E-7.
EAST 34TH STREET - PACIFIC AVE. TO A STR.
GENERAL PLAN & ELEV.
DESIGNER D.A.A.
MAKER D.A.A.
TRACER D.A.A.
CHECKER
REVISIONS
APPROVED:
CITY ENGINEER
COMMISSIONER OF PUBLIC WORKS
DATE: Oct. 15-1935
SCALE: As Noted
Sheet 1 of 14 Sheets

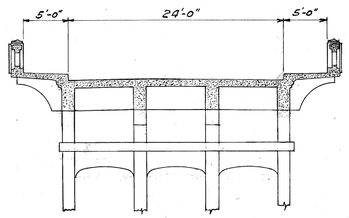
34TH Street P-A Deck Delaminations

	Sta	Offset	R/L	L	W	SF
Approach slab	511	3	L	9	12	108
Approach slab	511	6	R	2	11	22
Deck/Spall	500	4	R	2	4	8
Deck/Spall	485	4	R	9	12	108
Deck/Spall	475	4	R	2	3	6
Deck/Spall	465	11	R	2	3	6
Deck/Spall	450	5	L	2	3	6
Deck/Spall	450	5	R	1	4	4
Deck/Spall	420	4	L	1	3	3
Deck/Spall	380	12	R	3	3	9
Deck/Spall	350	3	L	5	8	40
Deck/CRACK	340	NA	NA	1	24	24
Deck/CRACK	330	NA	NA	1	24	24
Deck/CRACK	317	NA	NA	1	24	24
Deck/Spall	290-310	5	L	4	20	80
Deck/CRACK	290	NA	NA	1	24	24
Deck/CRACK	275	NA	NA	1	24	24
Deck/CRACK	260	NA	NA	1	24	24
Deck/CRACK	250	NA	NA	1	24	24
Deck/CRACK	230	NA	NA	1	11	11
Deck/Spall	210	7	R	2	3	6
Deck/Spall	190-234	7	L	2	44	88
Deck/Spall	190	2	R	10	10	100
Deck/Spall	170	4	R	1	2	2
Deck/Spall	150	4	L	5	7	35
Deck/Spall	130	4	L	2	3	6
Deck/Spall	120-142	2	R	3	22	66
Deck/Spall	125	4	R	2	3	6
Deck/Spall	125	10	R	2	2	4
Deck/Spall	115	7	L	1	1	1
Deck/Spall	100	5	R	4	2	8
Deck/Spall	100	3	L	2	6	12
Deck/Spall	85	4	L	11	2	22
Deck/Spall	85	3	R	2	3	6
Deck/Spall	75	2	L	2	2	4
Deck/Spall	75	4	R	1	9	9
Deck/Spall	50	0	NA	9	9	81
Deck/Spall	15	1	R	3	10	30
Approach slab	5	1	L	2	3	6
				Total (SF)		1071

34P-A Bridge #08512200



Typical Section at Cross-Beam
arch 1 (N) arch 2 (S)
Scale 1/8" = 1'-0"



TYPICAL SECTION - APPROACH SPANS
Scale 1/8" = 1'-0"

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" " 2 Longitudinal Section of Arch Span
" " 3 Approach Girder Spans
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" " 7 Longitudinal Girders for "
" " 8 Miscellaneous Details
" " 9 Expansion Joint Details
" " 10 Hand Rail Detail
" " 11 Abutments & Retaining Walls
" " 12 Concrete Pouring Diagram
" " 13 Plan & Details - Bridge Entrances
Drawing LL-120 Ornamental Lighting

Construction Field Books:-
#1553 - Cross-sections of excav's., etc.
1554 - Misc.
1555 - Pile driving for false-work - Const. Log
1561 - " " " "
1562 - Field Party's misc. notes

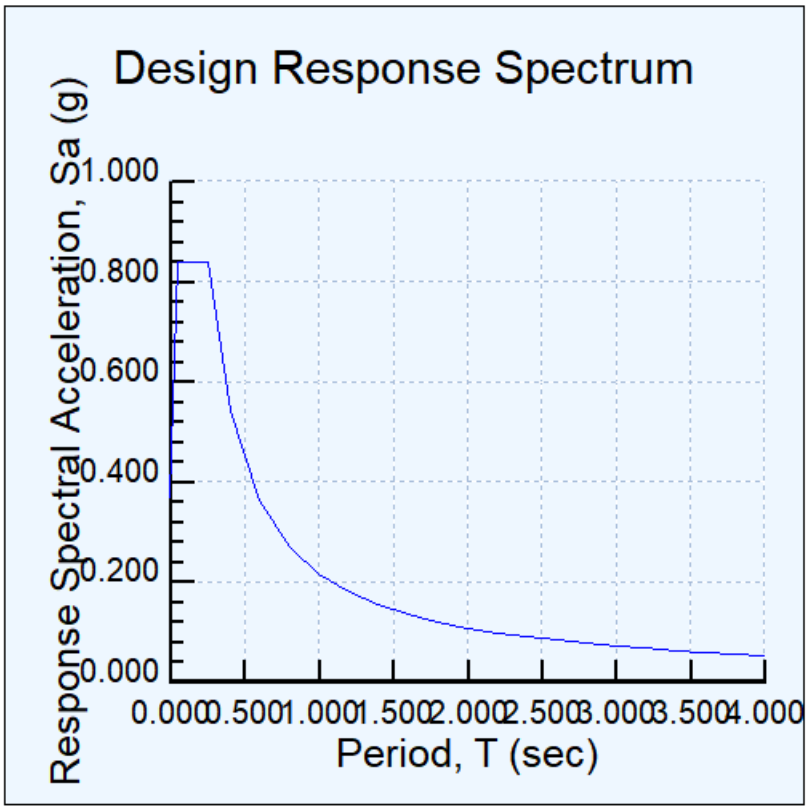
SURVEY: FIELD BOOK No. 1517.

Seismic parameters

Based on the bridge coordination and site class B, the design response spectrum is:

Seismic Design Category (SDC) = B

Period, T (sec)	Sa (g)	
0.000	0.370	
0.052	0.840	T_0
0.200	0.840	
0.258	0.840	T_s
0.400	0.542	
0.600	0.361	
0.800	0.271	
1.000	0.217	
1.200	0.181	
1.400	0.155	
1.600	0.135	
1.800	0.120	
2.000	0.108	
2.200	0.099	
2.400	0.090	
2.600	0.083	
2.800	0.077	
3.000	0.072	
3.200	0.068	
3.400	0.064	
3.600	0.060	
3.800	0.057	
4.000	0.054	



$Csm := 0.84$

We assume that expansion joints have been connected using a link-slab system. In this case, spandrel columns are more vulnerable in the transverse direction. Using a simplified approach and considering the mass based on the tributary area, the seismic moment and shear are calculated as follows:

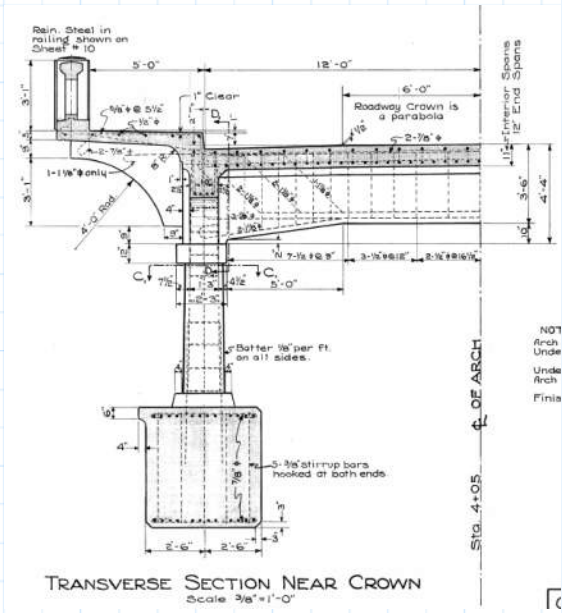
FRP layers to enhance confinement at top and bottom of the columns

$W\_Deck := 9.35\ \frac{kip}{ft}$

Column 3:

$C3\_A := (1\ ft + 8\ in)^2 = 400\ in^2$

$HCol\_3 := 25\ ft + 8\ in$



$$EQ\_3 := Csm \cdot \left(\frac{W\_Deck}{2} \cdot 15.5\ ft + C3\_A \cdot HCol\_3 \cdot 0.155\ \frac{kip}{ft^3} \cdot 0.5 \right) = 65.51\ kip$$

$$M\_C3 := \frac{EQ\_3 \cdot HCol\_3}{2} = 840.71\ kip \cdot ft$$

$As := 3 \cdot 0.79\ in^2$ 3-#8

$Fy := 40\ ksi$

$ds := 1\ ft + 8\ in - 2\ in$

$f'c := 4\ ksi$

$b := 1\ ft + 8\ in$

$$Mp := 1.10 \cdot \left(As \cdot Fy \cdot \left(ds - 0.5 \cdot \frac{As \cdot Fy}{0.85 \cdot f'c \cdot b} \right) \right) = 150.363\ kip \cdot ft$$

$$\frac{M\_C3}{Mp} = 5.591$$

The ratio of elastic demand to plastic capacity is more than 5.0. It means a significant plastic curvature is expected at the top and bottom of the spandrel columns. Good confinement is needed to avoid concrete degradation and buckling of the longitudinal/vertical bars. Currently, ties are provided at 12-inch spacing. This spacing does not meet the code minimum requirement for tie spacing. Therefore, 4-6 layers of FRP are expected to achieve desirable confinement at this location.

Column 2:

$$C2\_A := (1\ ft + 8\ in)^2 = 400\ in^2$$

$$HCol\_2 := 36\ ft$$

$$EQ\_2 := Csm \cdot \left(\frac{W\_Deck}{2} \cdot 15.5\ ft + C2\_A \cdot HCol\_2 \cdot 0.155\ \frac{kip}{ft^3} \cdot 0.5 \right) = 67.379\ kip$$

$$M\_C2 := \frac{EQ\_2 \cdot HCol\_2}{2} = 1213\ kip \cdot ft$$

$$\frac{M\_C2}{Mp} = 8.066$$

Significant confinement enhancemnet using FRP is needed.

Column 6:

$$C6\_A := (1\ ft + 8\ in)^2 = 400\ in^2$$

$$HCol\_6 := 7.5\ ft$$

$$EQ\_6 := Csm \cdot \left(\frac{W\_Deck}{2} \cdot 15.5\ ft + C6\_A \cdot HCol\_6 \cdot 0.155\ \frac{kip}{ft^3} \cdot 0.5 \right) = 62.225\ kip$$

$$M\_C6 := \frac{EQ\_6 \cdot HCol\_6}{2} = 233\ kip \cdot ft$$

$$\frac{M\_C6}{Mp} = 1.552$$

Minimum confinement enhancement is expected for shorter columns

Columns at approch spans

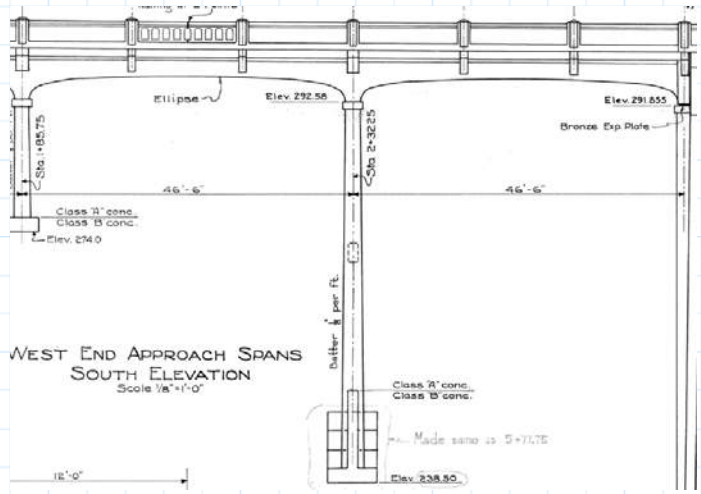
Rocking in the longitudinal direction is expected considering the width of the bent footing. However, columns can experience a significant moment at the top and bottom in the transverse direction. Here, the behavior of the bent in the transverse direction is considered.

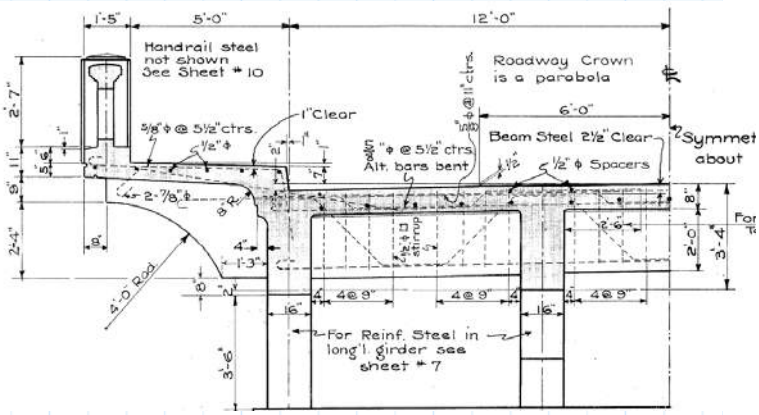
$Ha := 48\ ft$

$b\_top := 2\ ft$

$b\_bot := 2.5\ ft$

$W := 1.5\ ft$



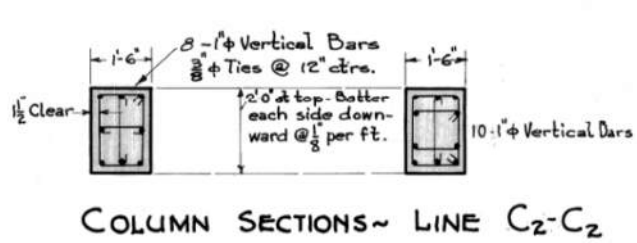


$$W\_App := 393\ kip + 4 \cdot W \cdot \left(\frac{b\_top + b\_bot}{2}\right) \cdot \frac{Ha}{2} \cdot 0.155\ \frac{kip}{ft^3} + 2.5\ ft \cdot 1.5\ ft \cdot 6.5\ ft \cdot 0.155\ \frac{kip}{ft^3} \cdot \frac{3}{2}$$

$$W\_App = 449\ kip$$

$$EQ\_a := Csm \cdot W\_App = 377\ kip$$

$$M\_Ca := \frac{\frac{EQ\_a}{4} \cdot Ha}{2} \cdot 0.75 = 1697\ kip \cdot ft$$



$Ase := 3 \cdot 0.79\ in^2$ 3-#8

$Asi := 4 \cdot 0.79\ in^2$ 4-#8

$Fy := 40\ ksi$

$ds := W - 2\ in = 16\ in$
$f'c := 4\ ksi$

$$Mp_{TE} := 1.10 \cdot \left(Ase \cdot Fy \cdot \left(ds - 0.5 \cdot \frac{Ase \cdot Fy}{0.85 \cdot f'c \cdot b\_top}\right)\right) = 133.992\ kip \cdot ft$$

$$Mp_{BE} := 1.10 \cdot \left(Ase \cdot Fy \cdot \left(ds - 0.5 \cdot \frac{Ase \cdot Fy}{0.85 \cdot f'c \cdot b\_bot}\right)\right) = 135.002\ kip \cdot ft$$

$$Mp_{TI} := 1.10 \cdot \left(Asi \cdot Fy \cdot \left(ds - 0.5 \cdot \frac{Asi \cdot Fy}{0.85 \cdot f'c \cdot b\_top}\right)\right) = 176.413\ kip \cdot ft$$

$$Mp_{BI} := 1.10 \cdot \left(Asi \cdot Fy \cdot \left(ds - 0.5 \cdot \frac{Asi \cdot Fy}{0.85 \cdot f'c \cdot b\_bot}\right)\right) = 178.207\ kip \cdot ft$$

Comparing elastic moment demands with plastic capacities of interior and exterior columns shows that a plastic hinge is expected at the top and bottom of the columns in the transverse direction. So, an FRP strengthening to increase the ductility capacity of the columns is needed.

Link-Slab preliminary design

$H\_T := 2 \cdot (2 \cdot 293)\ ft = 1172\ ft$ total length of columns

$$W\_T := \left(W\_Deck \cdot (15.5\ ft \cdot 7.5 + 10\ ft) \cdot 2 + C3\_A \cdot H\_T \cdot 0.155\ \frac{kip}{ft^3} \cdot 0.5\right)$$

$W\_T = 2613.2\ kip$ Effective engaged weight

$V\_LS := Csm \cdot W\_T \cdot 0.5 = 1097.5\ kip$ shear demand at link-slab in transverse direction

$As2 := 0.44\ in^2$ #6 @ 6 inch spacing at shear interface

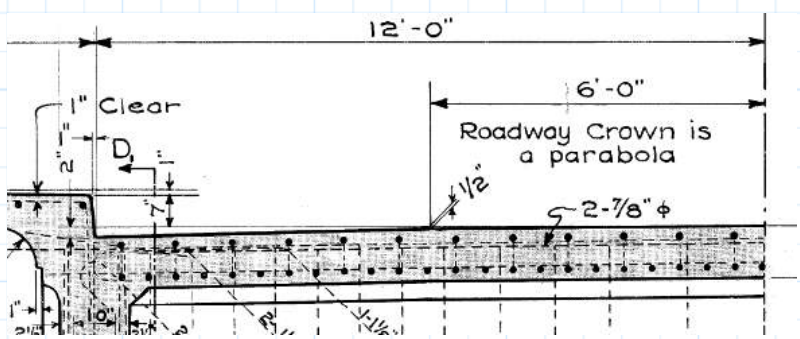
$Fy2 := 60\ ksi$

$W\_ls := 24\ ft$ effective link slab width

$$Vni := 1.0 \left(As2 \cdot \frac{W\_ls}{6\ in}\right) \cdot Fy2$$

$Vni = 1267.2\ kip$

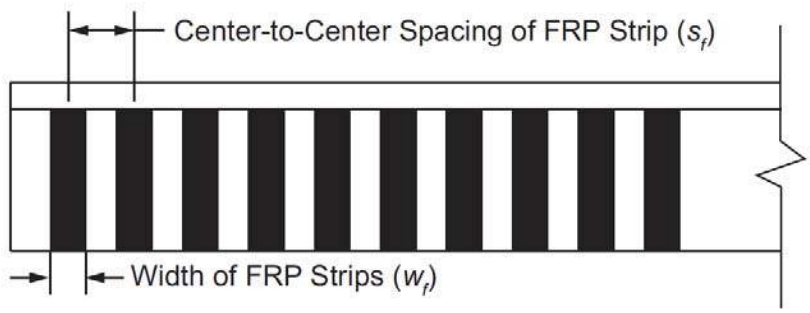
$\frac{Vni}{V\_LS} = 1.155$ > 1.0, OK



FRP Strengthening of girders to eliminate load posting on the bridge

The current load rating report shows that the **E 34th Street Bridge** has been reduced to 31 tons. The load rating shows that approach T-beam girders have rating factors of 0.79 and 0.74 for OL2 and EV3, respectively. The lowest rating factors are due to a shear deficiency at 0.6L of approach span.

FRP Properties:



$\phi_{frp} := 0.85$ FRP Resistance factor CL. 4.3.1

$t_f := 0.04\ in$ FRP Reinf. thickness/Nominal Laminate thickness

$w_f := 12 \cdot in$ Width of the FRP strip.

$S_f := 18\ in$ Spacing of the FRP strips (set to wf for continuous reinforcement)

$n_f := 2$ Number of fiber plies, each side

$\alpha_f := 90 \cdot deg$ Orientation of the primary fibers with respect to the longitudinal beam axis

$b_v := 16\ in$ width of girder web

$d_f := 3\ ft + 4\ in - 8\ in$ Web height strengthended by FRP

Tyfo SCH-41 Composite Properties:

$f_{fu} := 121\ ksi$ Ultimate Design Tensile Strength in Primary Fiber Direction

$E_f := 11.9 \cdot 10^3 \cdot ksi$ Modulus of elasticity (Tensile Modulus) of FRP

$\varepsilon_{fu} := \frac{f_{fu}}{E_f} = 0.01$ Ultimate strain of fiber rupture (in/in)

Design per AASHTO Guide Specifications for Design of Bonded FRP Systems:

In 34th Ave. Bridge, effective strain will be calculated based on other anchorage conddition .

$$\rho_f := \frac{2.\ n_f \cdot t_f \cdot w_f}{b_v \cdot S_f} = 0.007$$

$$R_f := \max\left(min\left(3 \cdot \left(\rho_f \cdot \frac{E_f}{ksi}\right)^{-0.67}, 1.0\right), 0.066\right) = 0.16$$

$$\varepsilon_{fe} := min\left(R_f \cdot \varepsilon_{fu}, 0.004\right) = 0.002$$

$$V_{frp} := \rho_f \cdot E_f \cdot \varepsilon_{fe} \cdot b_v \cdot d_f \cdot \left(\sin\left(\alpha_f\right) + \cos\left(\alpha_f\right)\right) = 66.138\ kip$$

Design per ICC:

Determine the reduction factor on the ultimate strength of the fiber ply (other method)

$$L_e := \frac{2500 \cdot in}{\left(\frac{n_f \cdot t_f}{in} \cdot \frac{E_f}{psi}\right)^{.58}}$$

$$L_e = 0.9\ in$$

$$d_{fe} := d_f - 2 \cdot L_e = 30.296\ in$$ Partially anchored at each end.

$$f'_c := 4\ ksi$$

Reduction factor accounts for concrete strength or other than 4000 psi. (Bond modification coefficient related to concrete strength).

$$k_1 := \left(\frac{f'_c}{4000 \cdot psi}\right)^{\left(\frac{2}{3}\right)} \qquad k_1 = 1$$

Reduction factor accounts for the type of wrapping scheme. (Bond modification coefficient related to bonded surface configuration).

$$k_2 := \frac{d_{fe}}{d_f} \qquad k_2 = 0.947$$

$$\kappa_V := k_1 \cdot k_2 \cdot \frac{L_e}{468 \cdot \varepsilon_{fu} \cdot in} = 0.169$$

$$\varepsilon_{fe} := \kappa_V \cdot \varepsilon_{fu} = 0.002$$

$$V_{frp} := \rho_f \cdot E_f \cdot \varepsilon_{fe} \cdot b_v \cdot d_f \cdot \left(\sin\left(\alpha_f\right) + \cos\left(\alpha_f\right)\right) = 69.993\ kip$$ Shear capacity of FRP

Based on the current load rating, two layers of FRP @ 18 inch should be sufficient to address shear deficiency.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
NBI STRUCTURE INVENTORY AND APPRAISAL REPORT
(ENGLISH UNITS)

CD Date: 4/21/2022 Printed on: 4/21/2022
CD Guid: f439ffb4-0148-4e4a-9910-ed839b882bca

IDENTIFICATION

(1)	STATE NAME - WASHINGTON	530
(8)	STRUCTURE NUMBER	# 085122000000000
(5)	INVENTORY ROUTE (ON/UNDER) - On	1 5 1 03234
	STATE ROUTE MILEPOST	10.00
(2)	HIGHWAY AGENCY DISTRICT - OL Region	03
(3)	COUNTY CODE 53 - Pierce County	(4) PLACE CODE 70000
(6)	FEATURES INTERSECTED	PACIFIC TO A ST
(7)	FACILITY CARRIED	EAST 34TH STREET
(9)	LOCATION	0.2 S JCT I-5
(12)	BASE HIGHWAY NETWORK - Not part of network	0
(13)	LRS INV ROUTE AND SUB ROUTE	
(11)	LRS MILEPOST	
(16)	LATITUDE	47 Deg 13 Min 58.00 Sec
(17)	LONGITUDE	122 Deg 25 Min 54.70 Sec
(98A)	BORDER BR. - Not a border bridge (98B)	(99) BORDER BR. SID - Not a border bridge

STRUCTURE TYPE AND MATERIAL

(43)	STRUCTURE TYPE MAIN: MATERIAL - Concrete	
	DESIGN - Arch - deck	111
(44)	STRUCTURE TYPE APPR: MATERIAL - Concrete	
	DESIGN - Mixed types	120
(45)	NO. OF SPANS IN MAIN UNIT	1
(46)	NO. OF APPROACH SPANS	7
(107)	DECK STRUCTURE TYPE - Conc. CIP	1
(108)	WEARING SURFACE / PROTECTIVE SYSTEM:	
(A)	TYPE OF WEARING SURFACE - Bituminous	6
(B)	TYPE OF MEMBRANE - None	0
(C)	TYPE OF DECK PROTECTION - None	0

AGE AND SERVICE

(27)	YEAR BUILT	1937
(106)	YEAR RECONSTRUCTED	0000
(42)	TYPE OF SERVICE ON - Highway & Pedestrian	5
	UNDER - Other	0
(28)	LANES: ON STRUCTURE 2	UNDER STRUCTURE 0
(29)	AVERAGE DAILY TRAFFIC	4700
(30)	YEAR OF ADT 2020	(109) TRUCK ADT 5%
(19)	BYPASS, DETOUR LENGTH	1 mi

GEOMETRIC DATA

(48)	LENGTH OF MAXIMUM SPAN	243 ft
(49)	STRUCTURE LENGTH	485 ft
(50)	CURB OR SIDEWALK: LEFT 5.0 ft	RIGHT 5.0 ft
(51)	BRIDGE ROADWAY WIDTH CURB TO CURB	24.0 ft
(52)	DECK WIDTH OUT TO OUT	34.0 ft
(32)	APPROACH ROADWAY WIDTH (W/SHOULDERS)	25 ft
(33)	BRIDGE MEDIAN - No median	0
(34)	SKEW 0 Deg	(35) STRUCTURE FLARED No 0
(10)	INVENTORY ROUTE MIN VERT CLEAR	99 ft 99 in
(47)	INVENTORY ROUTE TOTAL HORIZ CLEAR	24 ft 00 in
(53)	MIN VERT CLEAR OVER BRIDGE RDW	99 ft 99 in
(54)	MIN VERT UNDERCLEAR	0 ft 00 in N
(55)	MIN LAT UNDERCLEAR RT	0.0 ft N
(56)	MIN LAT UNDERCLEAR LT	0.0 ft

NAVIGATION DATA

(38)	NAVIGATION CONTROL - Not applicable	N
(111)	PIER PROTECTION - Not Applicable	
(39)	NAVIGATION VERTICAL CLEARANCE	000 ft
(116)	VERT-LIFT BRIDGE NAV MIN VERT CLR	
(40)	NAVIGATION HORIZONTAL CLR	0000 ft

WSBIS DATA

BRIDGE NUMBER	28 34thP-A
BRIDGE NAME	EAST 34TH STREET
CUSTODIAN	TACOMA
CROSSING DESC	EAST 34TH STREET
MAIN LISTING FLAG	M
SUFFICIENCY RATING	47.92 SD

CLASSIFICATION

(112)	NBIS BRIDGE LENGTH	Y
(104)	HIGHWAY SYSTEM - Not on the NHS	0
(26)	FUNCTIONAL CLASS - Collector	17
(100)	DEFENSE HIGHWAY - Not a STRAHNET route	0
(101)	PARALLEL STRUCTURE - Not a parallel bridge	N
(102)	DIRECTION OF TRAFFIC - 2-way traffic	2
(103)	TEMPORARY STRUCTURE - Not Applicable	
(105)	FEDERAL LANDS HIGHWAY - Not Applicable	0
(110)	DESIGNATED NATIONAL NETWORK - Not part of network	0
(20)	TOLL - Non-toll structure	3
(21)	MAINTENANCE - City or Municipal Highway Agency	04
(22)	OWNER - City or Municipal Highway Agency	4
(37)	HISTORICAL SIGNIFICANCE - On the NRHP	1

CONDITION

(58)	DECK	3
(59)	SUPERSTRUCTURE	5
(60)	SUBSTRUCTURE	5
(61)	CHANNEL AND CHANNEL PROTECTION	N
(62)	CULVERTS	N

LOAD RATING AND POSTING

(31)	DESIGN LOAD - H 20	4
(63)	OPER RATING METHOD - Ld Factor (LFR) tons HS20	1
(64)	OPERATING RATING	36 T
(65)	INV RATING METHOD - Ld Factor (LFR) tons HS20	1
(66)	INVENTORY RATING	21 T
(70)	BRIDGE POSTING - Equal or above legal loads	5
(41)	STRUCT OPEN, POSTED, CLOSED - Posted for load restrictions	P

APPRAISAL

(67)	STRUCTURAL EVALUATION	5
(68)	DECK GEOMETRY	2
(69)	UNDERCLEARANCES, VERTICAL & HORIZONTAL	N
(71)	WATERWAY ADEQUACY	N
(72)	APPROACH ROADWAY ALIGNMENT	8
(36)	TRAFFIC SAFETY FEATURES	0000
(113)	SCOUR CRITICAL BRIDGE	N

PROPOSED IMPROVEMENTS

(75)	TYPE OF WORK -	351
(76)	LENGTH OF STRUCTURE IMPROVEMENT	485 ft
(94)	BRIDGE IMPROVEMENT COST	$3,110,000
(95)	ROADWAY IMPROVEMENT COST	$622,000
(96)	TOTAL PROJECT COST	$6,220,000
(97)	YEAR OF IMPROVEMENT COST ESTIMATE	2022
(114)	FUTURE ADT	7200
(115)	YEAR OF FUTURE ADT	2037

INSPECTIONS

(90)	INSPECTION DATE 06/20	(91) FREQUENCY 24 MO
(92)	CRITICAL FEATURE INSPECTION:	(93) CFI DATE
	(A) FRACTURE CRIT DETAIL - NO -	Month (A) __/__
	(B) UNDERWATER INSP - NO -	Month (B) __/__
	(C) OTHER SPECIAL INSP - NO -	Month (C) __/__

Washington State Department of Transportation

WSBIS Local Agency Inventory Report

Bridge ID

1001 Structure ID	2009 Bridge Number	2132 Bridge Name	1019 Owner	1286 Cust	1021 County	2023 City	1156 Location	2181 Section	2183 Twnshp	2185 Range	1188 Latitude	1196 Longitude
08512200	28 34thP-A	EAST 34TH STREET	04	04	27	1280	0.2 S JCT I-5	09	20	03E	47° 13' 58.00"	122° 25' 54.70"

Facilities

1232 Feature Intersected	1256 Facilities Carried	1274 Region	7281 Leg1	7283 Leg2	1276 FIPS	1285 Toll	1288 Para	1289 Temp	1293 OPC	1292 NRHP	2295 HAER	7296 LRHP
PACIFIC TO A ST	EAST 34TH STREET	OL	2	0	70000	3	N		P	1	4	0

Printed Date	
4/21/2022	

Sufficiency Rating:	47.92
Status:	SD
Routine Risk Category:	Low Risk
Underwater Risk Category:	

Layout

1332 Year Built	1336 Year Rebuilt	1340 Bridge Length	2346 Screening Length	1348 Maximum Span Length	1352 Lanes On	1356 Curb to Curb Deck Width	1360 Out to Out Deck Width	1364 Sidewalk Left	1367 Sidewalk Right	1310 Skew	1312 Flared	1370 Min Vert Over Deck	1374 Min Vert Under	1378 Vert Code	1379 Min Lat Under Right	1382 Lat Code	1383 Min Lat Under Left	1386 Nav Ctl Code	1387 Nav Vert Clear	1390 Nav Horiz Clear	1394 Nav Vert Lift Clear	1291 Median	1397 Appr Rdwy
1937	0	485		243	2	24.0	34.0	5.0	5.0	0	N	99' 99"	00' 00"	N	0.0	N	0.0	N	0	0		0	25

Crossing

1432 On Under	1433 Hwy Class	1434 Service Level	1435 Route Number	2440 Milepost	1445 ADT	1451 Truck %	1453 Year of ADT	1457 Future ADT	1463 Future ADT Year	1467 Linear Referencing System	2410 NBI Bridge	7479 Fed Aid Route #	1483 NHS	1484 BHS	1485 STRAH	1486 FLH	1487 Funct. Class	1489 NTN	1490 Lane Use Direction	1354 Lanes Under	1491 Horizontal Clearance Route Dir	1495 Horizontal Clearance Reverse Dir	1499 Max Vert Clearance Route	1413 Detour	2441 Speed Limitl
1	5	1	03234	10.00	4700	5	2020	7200	2037		Y	3234	0	0	0	0	17	N	2	0	24' 00"			1	30

Design

1532 Main Span Material	1533 Main Span Design	1535 Appr Span Material	1536 Appr Span Design	1538 Number Main Spans	1541 Number Appr Spans	1544 Service On	1545 Service Under	1546 Deck Type	1547 Wearing Surface	1548 Membrane	1549 Deck Protect	1550 Design Load Code	1551 Oper Rating Method	1552 Oper Rating Tons	1553 Oper Rating Factor	1554 Inv Rating Method	1555 Inv Rating Tons	1556 Inv Rating Factor	1585 Border State Cd	1588 Border Pct	1590 Border Structure ID	7565 Fed Aid Project No	7557 Design Exemption
1	11	1	20	1	7	5	0	1	6	0	0	4	1	36	1.01	1	21	0.60					

Load Rating

2587 Type 3	2588 Type 3S2	2589 Type 3-3	2590 NRL	2591 SHV 4	2592 SHV 5	2593 SHV 6	2594 SHV 7	2597 EV 2	2598 EV 3	2595 OL 1	2596 OL 2
1.33	1.33	1.53	1.06	1.07	1.07	1.05	1.03	1.03	0.74	0.87	0.79

Waterway/ Prop Imp

7832 Water Type	7833 Flood Pln Intr	7834 Flood Control	7835 Scour Hist	7836 Strmbd Matrl	7837 Substr Stablty	7838 Wtrwy Obstr	7839 Strmbd Stablty	7840 Strmbd Anabrn	7841 Piers In Watr	1844 Type Work	1846 Work Meth	1847 Stru Imp Length	2853 Roadway Width	2860 Cost Per SF	1867 Struct Cost	1873 Rdwy Cost	2870 Engr Cost	1861 Total Cost	1879 Estmt Year	2883 Prop Imp Cost Calc
										35	1	485	27	400	2619	524	2095	5238	2014	Y
														475	**3110**	**622**	**2488**	**6220**	**2022**	

Inspection Report Types

2920 Inspection	1990 Date	2646 Inspector	2649 Cert No	2654 Co-Inspector
Routine				
Fracture Critical				
Special Feature				
Underwater				
UW Interim				

Inspection	Date	Inspector	Cert No	Co-Inspector
Interim	4/4/2022	SJC	G0315	CDN
In Depth				
Damage				
PRM Safety				
SEC Safety				

Inspection	Date	Inspector	Cert No	Co-Inspector
Condition				
Short Span				
Geometric				
Info	4/4/2022	SJC	G0315	CDN
Inventory				

Control Data Date: 4/21/2022

Control Data Guid: f439ffb4-0148-4e4a-9910-ed839b882bca

34th Street Bridge April, 2022

Deck view looking west

de 

deck view looking east

Please note, the following photographs of the deficiencies found during our interim inspection are not all inclusive of all of the delaminations, spalls, and cracks found during this inspection.

Exposed, rusting reinforcing steel, approx. Sta

Deck delamination with exposed reinforcing steel

Typical delamination in wheel line

Delamination inside wheel lines

deck cracking with delamination

Failed construction joint with assoicated delaminations

Delamintion with exposed reinforcing steel

Failed expansion joints with delaminations

Delamination, spalls, and exposed reinforcing steel.