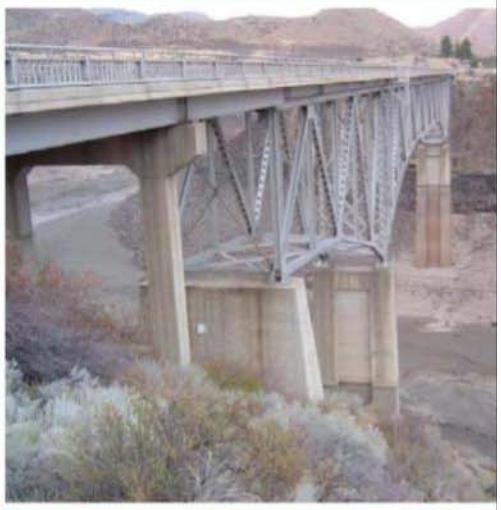
Mores Creek Canyon Steel Truss Bridge Repair and Retrofit





Western Bridge Conference

Sacramento, California - September 21, 2009

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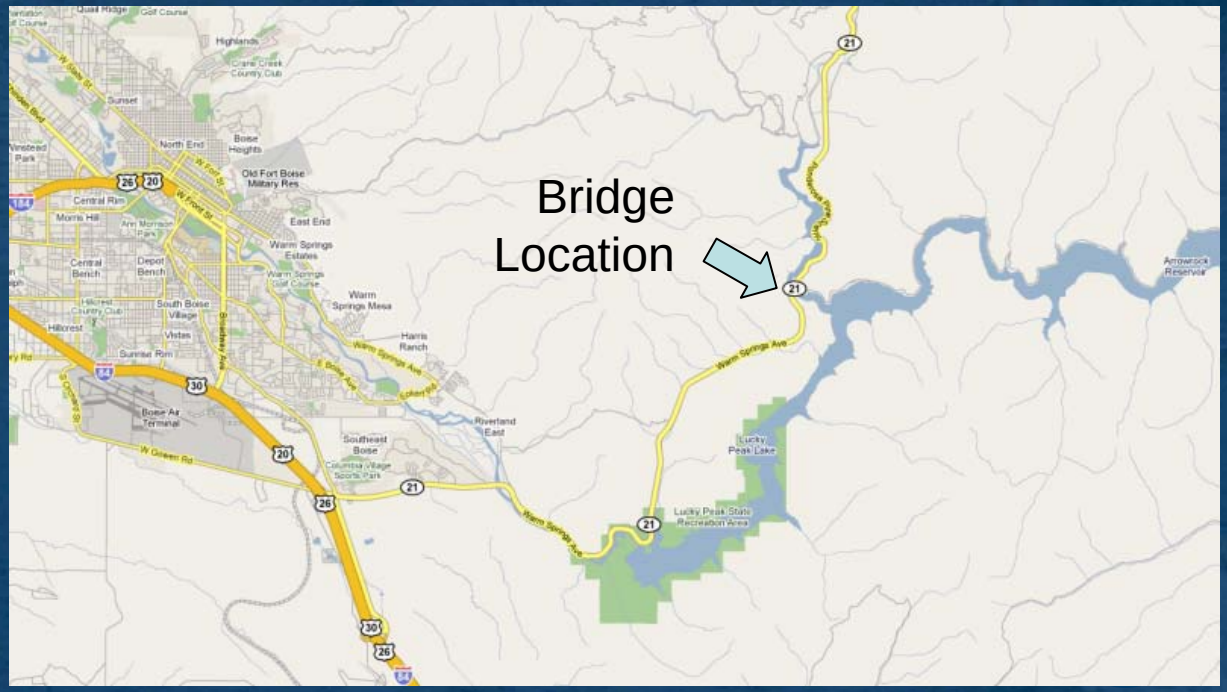
Project Overview

- Location
  - East of Boise Idaho on SH-21, north of Lucky Peak Reservoir, West of Arrowrock Resevoir
- Existing 848’ long Steel Deck Truss
- North-South Connection
- Built in 1951

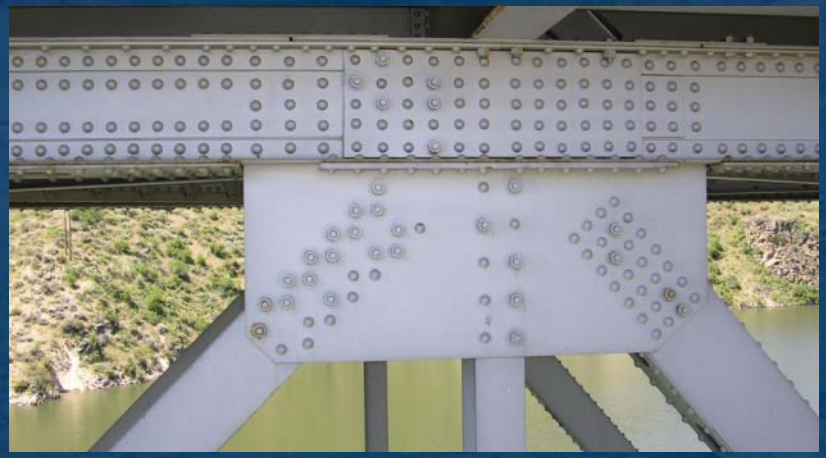


Scope of Work

- Scope of Work
  - Deck Overlay
  - Remove and Replace Railings and Wingwalls
  - Paint Superstructure
  - New Seat Extensions
  - New Seismic Restrainers
  - Permeation Grouting
  - Slope Armoring

Gusset Plate Load Rating

- In accordance with FHWA Bridge Design Guidance No. 1; Load Rating Evaluation of Gusset Plates in Truss Bridges
- Load rated 28 gusset plate panel point locations
- Utilized an automated spreadsheet
  - Minimize time (cost)
  - Minimize chance of errors
  - Easy to follow and check



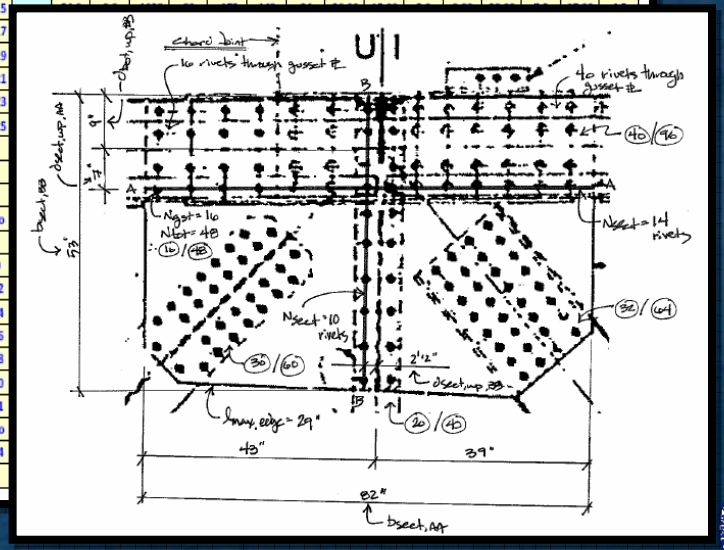
Gusset Plate Elevation

Gusset Plate Load Rating (cont'd)

- Spreadsheet Geometry Input:

Input and Summary Table

JOINT	LEFT CHORD																	RIGHT CHORD																
	General				Loads					Connection				Block-Shear				General				Loads					Connection				Block-Shear			
	Member Name	$DET_{percent}$	Inc_x	Inc_y	DL	$(L+I)_{trans}$	$(L+I)_{comp}$	N_{tot}	N_{gpt}	L_{con}	b_{con}	$N_{w/bolt}$	L_{c_ub}	L_{vg}	N_{vn}	L_{tg}	N_{tn}	Member Name	$DET_{percent}$	Inc_x	Inc_y	DL	$(L+I)_{trans}$	$(L+I)_{comp}$	N_{tot}	N_{gpt}	L_{con}	b_{con}	$N_{w/bolt}$	L_{c_ub}	L_{vg}	N_{vn}	L_{tg}	N_{tn}
		%			kips	kips	kips	planes	planes	in	in	bolts	in	in	bolts	in	bolts		%			kips	kips	kips	planes	planes	in	in	bolts	in	in	bolts	in	bolts
U1	U1U3		54.0	0.0	609	81	-59	96	40	32.00	14.50	3.5	0.00	29.00	6.5	16.50	3.5	U0U1		27.0	0.0	0	0	0	48	16	38.00	14.50	4.0	0.00	40.00	6.5	16.50	3.5
U3	U3U5		54.0	0.0	1053	115	-62	174	69	30.00	15.00	5.0	0.00	32.00	8.5	17.00	3.5	U1U3		54.0	0.0	609	81	-59	100	32	29.00	15.00	4.0	0.00	31.00	7.5	17.00	3.5
U5	U5U7		54.0	0.0	1017	109	-63	200	70	30.00	15.00	5.0	0.00	32.00	7.5	17.00	4.5	U3U5		54.0	0.0	1053	115	-62	200	70	26.00	15.00	5.0	0.00	28.00	7.5	17.00	4.5
U7	U7U9		54.0	0.0	453	67	-47	98	33	31.00	15.00	5.0	0.00	34.00	8.5	17.00	4.5	U5U7		54.0	0.0	1017	109	-63	182	75	27.00	15.00	5.0	0.00	30.00	7.5	17.00	4.5
U9	U9U11		54.0	0.0	-319	11	-77	82	27	37.00	14.50	4.0	0.00	39.00	9.5	16.50	3.5	U7U9		54.0	0.0	453	67	-47	102	37	38.00	15.00	4.0	0.00	40.00	7.5	17.00	3.5
U11	U11U13		54.0	0.0	-831	41	-136	120	44	35.00	15.00	4.0	0.00	37.00	8.5	17.00	3.5	U9U11		54.0	0.0	-319	11	-77	86	27	34.00	14.50	4.0	0.00	36.00	9.5	16.50	3.5
U13	U13U15		54.0	0.0	-1028	89	-175	158	44	29.00	15.00	4.0	0.00	31.00	8.5	17.00	3.5	U11U13		54.0	0.0	-831	41	-136	148	38	30.00	15.00	4.0	0.00	32.00	8.5	17.00	3.5
U15	U15U17		54.0	0.0	-902	137	-180	148	38	30.00	15.00	5.0	0.00	32.00	8.5	17.00	4.5	U13U15																
U17	U17U19		54.0	0.0	-393	159	-125	178	45	34.00	14.00	5.0	0.00	36.00	8.5	17.00	4.5	U15U17																
U19	U19U21		54.0	0.0	186	142	-37	64	20	27.00	14.50	4.0	0.00	29.00	4.5	16.50	3.5	U17U19																
U21	U21U23		54.0	0.0	299	114	0	100	44	27.00	15.00	4.0	0.00	30.00	6.5	17.00	3.5	U19U21																
U23	U23U25		54.0	0.0	79	49	0	74	28	30.00	15.00	4.0	0.00	32.00	6.5	17.00	3.5	U21U23																
U25																		U23U25															
L0																		L0L2															
L2	L0L2		54.0	4.3	-294	45	-44	64	32	38.50	12.00	4.0	0.00	41.00	7.5	17.00	3.5	L2L4																
L4	L2L4		54.0	13.0	-863	56	-104	136	32	38.00	12.00	4.0	0.00	40.00	7.5	18.00	3.5	L4L5																
L5	psuedo		27.0	0.0	0	0	0	2	1									pseudo																
L6	L5L6		27.0	-9.7	-1261	67	-125	144	40	33.00	12.00	4.0	0.00	35.00	9.5	18.00	3.5	L6L8																
L8	L6L8		54.0	-13.0	-775	58	-93	104	28	23.00	12.00	4.0	0.00	25.00	6.5	18.00	3.5	L8L10																
L10	L8L10		54.0	-4.3	-70	47	-34	52	16	30.00	10.00	2.0	0.00	32.00	4.5	15.00	2.5	L10L12																
L12	L10L12		54.0	0.0	0	0	0	32	16									L12L14																
L14	L12L14		54.0	0.0	0	0	0	2	1									L14L16																
L16	L14L16		54.0	0.0	1005	182	-113	140	28	22.00	12.00	4.0	0.00	24.00	6.5	17.00	3.5	L16L18																
L18	L16L18		54.0	4.3	667	156	-149	120	40	36.00	12.00	4.0	0.00	38.00	10.5	16.00	3.5	L18L20																
L20	L18L20		54.0	13.0	85	80	-153	36	18	37.00	6.00	2.0	0.00	39.00	8.5	12.00	1.5	L20L21																
L21	psuedo		27.0	0.0	0	0	0	2	1									psuedo																
L22	L21L22		27.0	-9.7	-428	0	-136	64	32	26.00	11.00	2.0	0.00	31.00	4.5	15.00	1.5	L22L24																
L24	L22L24		54.0	-13.0	-187	0	-88	46	23	20.00	13.00	3.0	0.00	22.00	5.5	15.00	2.5																	



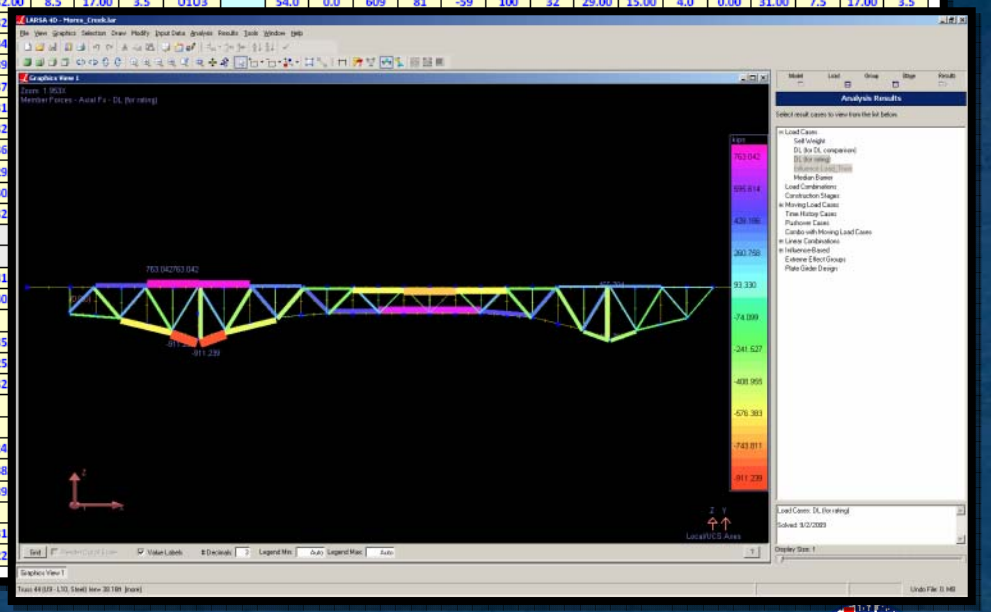
As-Built U1 Geometry

Gusset Plate Load Rating (cont'd)

- Spreadsheet Load Input:

Input and Summary Table

JOINT	LEFT CHORD																	RIGHT CHORD																
	General				Loads					Connection				Block-Shear				General				Loads					Connection				Block-Shear				
	Member Name	$DET_{percent}$	Inc_x	Inc_y	DL	$(L+I)_{trans}$	$(L+I)_{comp}$	N_{tot}	N_{gst}	L_{con}	b_{con}	N_{whit}	$L_{c,sb}$	L_{vg}	N_{vn}	L_{tg}	N_{tn}	Member Name	$DET_{percent}$	Inc_x	Inc_y	DL	$(L+I)_{trans}$	$(L+I)_{comp}$	N_{tot}	N_{gst}	L_{con}	b_{con}	N_{whit}	$L_{c,sb}$	L_{vg}	N_{vn}	L_{tg}	N_{tn}
		%			kips	kips	kips	planes	planes	in	in	bolts	in	in	bolts	in	bolts		%			kips	kips	kips	planes	planes	in	in	bolts	in	in	bolts	in	bolts
U1	U1U3		54.0	0.0	609	81	-59	96	40	32.00	14.50	3.5	0.00	29.00	6.5	16.50	3.5	U0U1		27.0	0.0	0	0	0	48	16	38.00	14.50	4.0	0.00	40.00	6.5	16.50	3.5
U3	U3U5		54.0	0.0	1053	115	-62	174	69	30.00	15.00	5.0	0.00	32.00	8.5	17.00	3.5	U1U3		54.0	0.0	609	81	-59	100	32	29.00	15.00	4.0	0.00	31.00	7.5	17.00	3.5
U5	U5U7		54.0	0.0	1017	109	-63	200	70	30.00	15.00	5.0	0.00	32																			
U7	U7U9		54.0	0.0	453	67	-47	98	33	31.00	15.00	5.0	0.00	34																			
U9	U9U11		54.0	0.0	-319	11	-77	82	27	37.00	14.50	4.0	0.00	39																			
U11	U11U13		54.0	0.0	-831	41	-136	120	44	35.00	15.00	4.0	0.00	37																			
U13	U13U15		54.0	0.0	-1028	89	-175	158	44	29.00	15.00	4.0	0.00	31																			
U15	U15U17		54.0	0.0	-902	137	-180	148	38	30.00	15.00	5.0	0.00	32																			
U17	U17U19		54.0	0.0	-393	159	-125	178	45	34.00	14.00	5.0	0.00	36																			
U19	U19U21		54.0	0.0	186	142	-37	64	20	27.00	14.50	4.0	0.00	29																			
U21	U21U23		54.0	0.0	299	114	0	100	44	27.00	15.00	4.0	0.00	30																			
U23	U23U25		54.0	0.0	79	49	0	74	28	30.00	15.00	4.0	0.00	32																			
U25																																	
L0																																	
L2	L0L2		54.0	4.3	-294	45	-44	64	32	38.50	12.00	4.0	0.00	41																			
L4	L2L4		54.0	13.0	-863	56	-104	136	32	38.00	12.00	4.0	0.00	40																			
L5	psuedo		27.0	0.0	0	0	0	2	1																								
L6	L5L6		27.0	-9.7	-1261	67	-125	144	40	33.00	12.00	4.0	0.00	35																			
L8	L6L8		54.0	-13.0	-775	58	-93	104	28	23.00	12.00	4.0	0.00	25																			
L10	L8L10		54.0	-4.3	-70	47	-34	52	16	30.00	10.00	2.0	0.00	32																			
L12	L10L12		54.0	0.0	0	0	0	32	16																								
L14	L12L14		54.0	0.0	0	0	0	2	1																								
L16	L14L16		54.0	0.0	1005	182	-113	140	28	22.00	12.00	4.0	0.00	24																			
L18	L16L18		54.0	4.3	667	156	-149	120	40	36.00	12.00	4.0	0.00	38																			
L20	L18L20		54.0	13.0	85	80	-153	36	18	37.00	6.00	2.0	0.00	39																			
L21	psuedo		27.0	0.0	0	0	0	2	1																								
L22	L21L22		27.0	-9.7	-428	0	-136	64	32	26.00	11.00	2.0	0.00	31																			
L24	L22L24		54.0	-13.0	-187	0	-88	46	23	20.00	13.00	3.0	0.00	22																			



LARSA Model

Gusset Plate Load Rating (cont'd)

Spreadsheet Calculation:

TENSION RESISTANCE (Continued) — Perform Rating

LEFT DIAGONAL (U5L6):

Effective Gross Section Yielding Resistance:

Effective Whitmore Width, $b_{whit} = b_{con} + 2[L_{con}\tan(30°)]$ =	39.0	in	FHWA Guideline
Gross Area, $A_{g,whit} = b_{whit}t_{plate}$ =	24.39	in^2	
Net Area, $A_{n,whit} = A_{g,whit} - N_{whit}d_{hole}t_{plate}$ =	21.58	in^2	
Effective Gross Area, $A_{e,whit} = \min(A_{g,whit}$ or $A_{n,whit} + \beta A_{g,whit})(1\text{-}DET_{percent})$ =	24.39	in^2	FHWA Eq. (3), A10-4w
Effective Gross Section Yielding Resistance, $R_{r,egsy} = A_{e,whit}F_y$ =	**1219**	kips	FHWA Eq. (2)

Block Shear Rupture Resistance:

Shear Stress Gross Area, $A_{vg} = L_{vg}t_{plate}$ =	38.75	in^2	FHWA Guideline
Tension Stress Gross Area, $A_{tg} = L_{tg}t_{plate}$ =	5.63	in^2	FHWA Guideline
Shear Stress Net Area, $A_{vn} = A_{vg} - N_{vn}d_{hole}t_{plate}$ =	31.02	in^2	FHWA Guideline
Tension Stress Net Area, $A_{tn} = A_{tg} - N_{tn}d_{hole}t_{plate}$ =	3.52	in^2	FHWA Guideline
$R_{r,1} = 0.85(0.58F_yA_{vg} + F_uA_{tn})(1 - DET_{percent})$ =	1164	kips	FHWA Eq. (4)
$R_{r,2} = 0.85(0.58F_uA_{vn} + F_yA_{tg})(1 - DET_{percent})$ =	1309	kips	FHWA Eq. (5)
Block Shear Rupture Resistance R_{bsr}, if $A_{tn} \geq 0.58A_{vn}$, $R_{r,1}$ otherwise $R_{r,2}$ =	**1309**	kips	FHWA Eq. (4)
Controlling Tension Resistance, $R_{r,tens}$ =	**1219**	kips	

RIGHT DIAGONAL (L4U5):

Effective Gross Section Yielding Resistance:

Effective Whitmore Width, $b_{whit} = b_{con} + 2[L_{con}\tan(30°)]$ =	34.2	in	FHWA Guideline
Gross Area, $A_{g,whit} = b_{whit}t_{plate}$ =	21.41	in^2	
Net Area, $A_{n,whit} = A_{g,whit} - N_{whit}d_{hole}t_{plate}$ =	18.59	in^2	
Effective Gross Area, $A_{e,whit} = \min(A_{g,whit}$ or $A_{n,whit} + \beta A_{g,whit})(1\text{-}DET_{percent})$ =	21.41	in^2	FHWA Eq. (3), A10-4w
Effective Gross Section Yielding Resistance, $R_{r,egsy} = A_{e,whit}F_y$ =	**1070**	kips	FHWA Eq. (2)

Block Shear Rupture Resistance:

Shear Stress Gross Area, $A_{vg} = L_{vg}t_{plate}$ =	32.50	in^2	FHWA Guideline
Tension Stress Gross Area, $A_{tg} = L_{tg}t_{plate}$ =	6.25	in^2	FHWA Guideline
Shear Stress Net Area, $A_{vn} = A_{vg} - N_{vn}d_{hole}t_{plate}$ =	26.17	in^2	FHWA Guideline
Tension Stress Net Area, $A_{tn} = A_{tg} - N_{tn}d_{hole}t_{plate}$ =	4.14	in^2	FHWA Guideline
$R_{r,1} = 0.85(0.58F_yA_{vg} + F_uA_{tn})(1 - DET_{percent})$ =	1047	kips	FHWA Eq. (4)
$R_{r,2} = 0.85(0.58F_uA_{vn} + F_yA_{tg})(1 - DET_{percent})$ =	1169	kips	FHWA Eq. (5)
Block Shear Rupture Resistance R_{bsr}, if $A_{tn} \geq 0.58A_{vn}$, $R_{r,1}$ otherwise $R_{r,2}$ =	**1169**	kips	FHWA Eq. (4)
Controlling Tension Resistance, $R_{r,tens}$ =	**1070**	kips	

Spreadsheet Summary:

Input and Summary Table — Live Load Vehicle Name: HS15 Truck — Live Load Vehicle Weight: 30.0 tons

JOINT	RATINGS SUMMARY																	
	Fasteners		Tension		Compression		Shear		Section AA		Section BB		Section CC		Minimum		Rating		Unsup. Edge ($L_{max,edge}/t_{min}$)
	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	Inventory	Operating	
																	tons	tons	
U1	4.79	7.98	4.92	8.19	3.57	5.95	3.75	6.25	-	-	-	-	-	-	3.57	5.95	107.1	178.6	0.77
U3	3.71	6.19	4.42	7.36	7.33	12.22	8.15	13.59	-	-	-	-	-	-	3.71	6.19	111.4	185.6	0.78
U5	2.84	4.74	4.55	7.58	11.05	18.41	10.00	16.67	-	-	-	-	-	-	2.84	4.74	85.3	142.2	1.20
U7	3.41	5.68	3.82	6.36	3.61	6.02	5.54	9.24	-	-	-	-	-	-	3.41	5.68	102.3	170.4	0.98
U9	3.46	5.77	10.31	17.18	3.65	6.08	4.89	8.15	-	-	-	-	-	-	3.46	5.77	103.9	173.1	0.98
U11	2.87	4.79	12.52	20.86	3.39	5.65	5.89	9.82	-	-	-	-	-	-	2.87	4.79	86.1	143.6	0.94
U13	2.55	4.25	8.19	13.64	4.08	6.80	8.08	13.47	-	-	-	-	-	-	2.55	4.25	76.5	127.6	0.59
U15	3.72	6.20	13.85	23.09	4.15	6.92	13.39	22.31	-	-	-	-	-	-	3.72	6.20	111.6	185.9	0.52
U17	3.56	5.93	13.20	22.00	2.98	4.96	7.07	11.79	-	-	-	-	-	-	2.98	4.96	89.4	148.9	0.94
U19	3.31	5.51	5.38	8.96	2.45	4.09	1.67	2.78	-	-	-	-	-	-	1.67	2.78	50.0	83.4	0.82
U21	2.72	4.54	7.86	13.10	17.25	28.76	10.97	18.29	-	-	-	-	-	-	2.72	4.54	81.6	136.1	1.06
U23	2.24	3.73	7.38	12.31	2.82	4.70	4.51	7.51	-	-	-	-	-	-	2.24	3.73	67.2	112.0	0.66
U25	2.39	3.98	6.99	11.65	5.60	9.33	8.29	13.82	-	-	-	-	-	-	2.39	3.98	71.6	119.3	0.78
L0	2.96	4.94	8.58	14.30	2.70	4.50	3.63	6.06	-	-	-	-	-	-	2.70	4.50	80.9	134.9	0.58
L2	4.30	7.16	15.40	25.66	2.76	4.60	6.58	10.97	-	-	-	-	-	-	2.76	4.60	82.8	137.9	1.04
L4	2.84	4.74	19.82	33.03	5.31	8.85	9.54	15.90	-	-	-	-	-	-	2.84	4.74	85.3	142.2	1.00
L5	4.49	7.49	59.51	99.18	15.87	26.45	12.27	20.44	-	-	-	-	-	-	4.49	7.49	134.8	224.7	
L6	3.11	5.18	18.57	30.95	4.77	7.95	6.75	11.25	-	-	-	-	-	-	3.11	5.18	93.2	155.3	0.81
L8	3.42	5.69	11.84	19.73	8.52	14.19	5.41	9.02	-	-	-	-	-	-	3.42	5.69	102.5	170.8	0.81
L10	1.64	2.73	9.54	15.90	2.00	3.34	3.88	6.47	-	-	-	-	-	-	1.64	2.73	49.2	81.9	0.85
L12	2.55	4.25	11.90	19.84	4.87	8.11	7.22	12.04	-	-	-	-	-	-	2.55	4.25	76.5	127.6	0.57
L14	2.08	3.47	7.67	12.78	6.56	10.94	8.27	13.79	-	-	-	-	-	-	2.08	3.47	62.5	104.2	0.46
L16	2.78	4.63	6.08	10.13	8.18	13.63	9.09	15.14	-	-	-	-	-	-	2.78	4.63	83.4	138.9	0.73
L18	2.82	4.70	7.98	13.30	5.66	9.43	5.79	9.66	-	-	-	-	-	-	2.82	4.70	84.6	141.0	0.95
L20	2.11	3.51	9.83	16.38	2.61	4.35	4.00	6.67	-	-	-	-	-	-	2.11	3.51	63.2	105.3	0.91
L21	3.17	5.28	555.47	925.79	3.37	5.61	8.57	14.29	-	-	-	-	-	-	3.17	5.28	95.1	158.5	0.89
L22	2.37	3.95	12.89	21.49	3.62	6.03	5.50	9.17	-	-	-	-	-	-	2.37	3.95	71.2	118.6	1.18
L24	2.15	3.59	7.69	12.82	2.72	4.54	2.58	4.30	-	-	-	-	-	-	2.15	3.59	64.6	107.6	0.71

Load Rating Conclusions

- HS 15 Lane RF = 0.97, controlled by Gusset Plates
- HS 15 Truck & Permit controlled by Stringers & Floorbeams

STRINGER & FLOORBEAM RATINGS

Vehicle	Inventory Rating				Operating Rating			
	Factor	Tons	Controlling Member	Limit State	Factor	Tons	Controlling Member	Limit State
H15 Truck	1.18	17.7	Interior Truss Stringer	Serviceability	1.97	29.6	Interior Truss Stringer	Serviceability
HS15 Truck	1.06	28.7	Truss Floorbeam	Serviceability	1.77	47.9	Truss Floorbeam	Serviceability
HS15 Lane	1.26	34.0	Truss Floorbeam	Serviceability	2.10	56.8	Truss Floorbeam	Serviceability
ITD Type 3 Truck	0.78	21.1	Interior Truss Stringer	Serviceability	1.30	35.2	Interior Truss Stringer	Serviceability
ITD Type 3S2 Truck	0.90	35.5	Interior Truss Stringer	Serviceability	1.50	59.3	Interior Truss Stringer	Serviceability
ITD Type 3-3 Truck	0.99	39.2	Truss Floorbeam	Serviceability	1.66	65.4	Truss Floorbeam	Serviceability
ITD 121k Truck	0.84	50.9	Truss Floorbeam	Serviceability	1.40	85.0	Truss Floorbeam	Serviceability

TRUSS GUSSET PLATE RATINGS

Vehicle	Inventory Rating				Operating Rating			
	Factor	Tons	Controlling Member	Limit State	Factor	Tons	Controlling Member	Limit State
H15 Truck	2.81	42.2	L10	Fastener	4.68	70.3	L10	Fastener
HS15 Truck	1.64	44.2	L10	Fastener	2.73	73.7	L10	Fastener
HS15 Lane	0.97	26.1	U19	Shear	1.61	43.6	U19	Shear
ITD Type 3 Truck	1.59	43.0	L10	Fastener	2.65	71.6	L10	Fastener
ITD Type 3S2 Truck	1.19	47.0	L10	Fastener	1.98	78.3	L10	Fastener
ITD Type 3-3 Truck	1.18	46.8	L10	Fastener	1.97	78.0	L10	Fastener
ITD 121k Truck	0.84	50.6	L10	Fastener	1.39	84.3	L10	Fastener

TRUSS MEMBER RATINGS

Vehicle	Inventory Rating				Operating Rating			
	Factor	Tons	Controlling Member	Limit State	Factor	Tons	Controlling Member	Limit State
H15 Truck	2.65	39.7	L22 - L23 & L23 - L24	Compression	4.42	66.3	L22 - L23 & L23 - L24	Compression
HS15 Truck	1.62	43.7	L20 - L21 & L21 - L22	Compression	2.70	72.9	L20 - L21 & L21 - L22	Compression
HS15 Lane	1.31	35.5	L12 - U13	Compression	2.19	59.2	L12 - U13	Compression
ITD Type 3 Truck	1.52	41.1	L22 - L23 & L23 - L24	Compression	2.54	68.6	L22 - L23 & L23 - L24	Compression
ITD Type 3S2 Truck	1.20	47.3	L20 - L21 & L21 - L22	Compression	2.00	78.9	L20 - L21 & L21 - L22	Compression
ITD Type 3-3 Truck	1.19	47.1	L20 - L21 & L21 - L22	Compression	1.99	78.7	L20 - L21 & L21 - L22	Compression
ITD 121k Truck	0.88	53.2	L20 - L21 & L21 - L22	Compression	1.47	88.9	L20 - L21 & L21 - L22	Compression

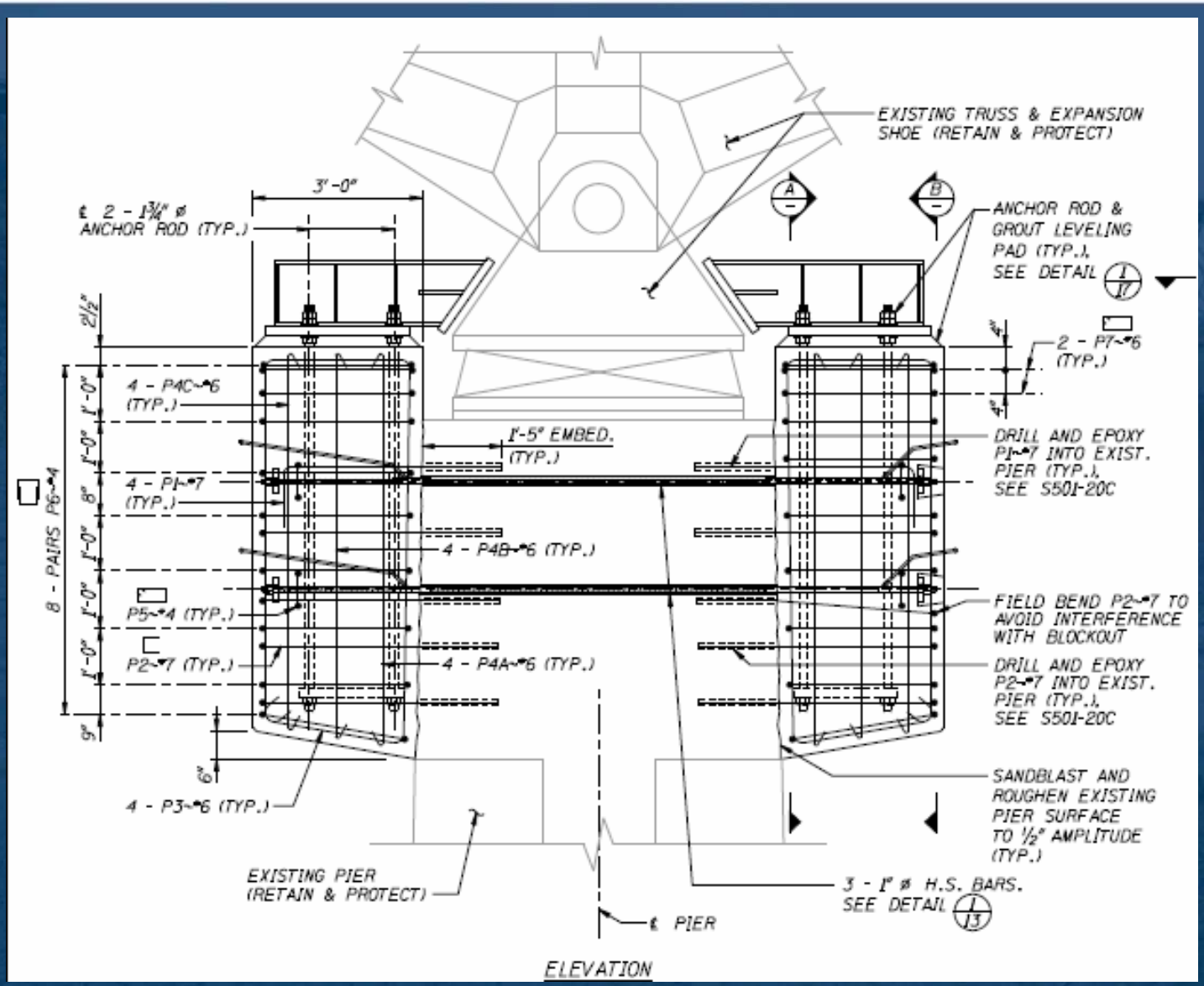
HDR

Seismic Retrofit

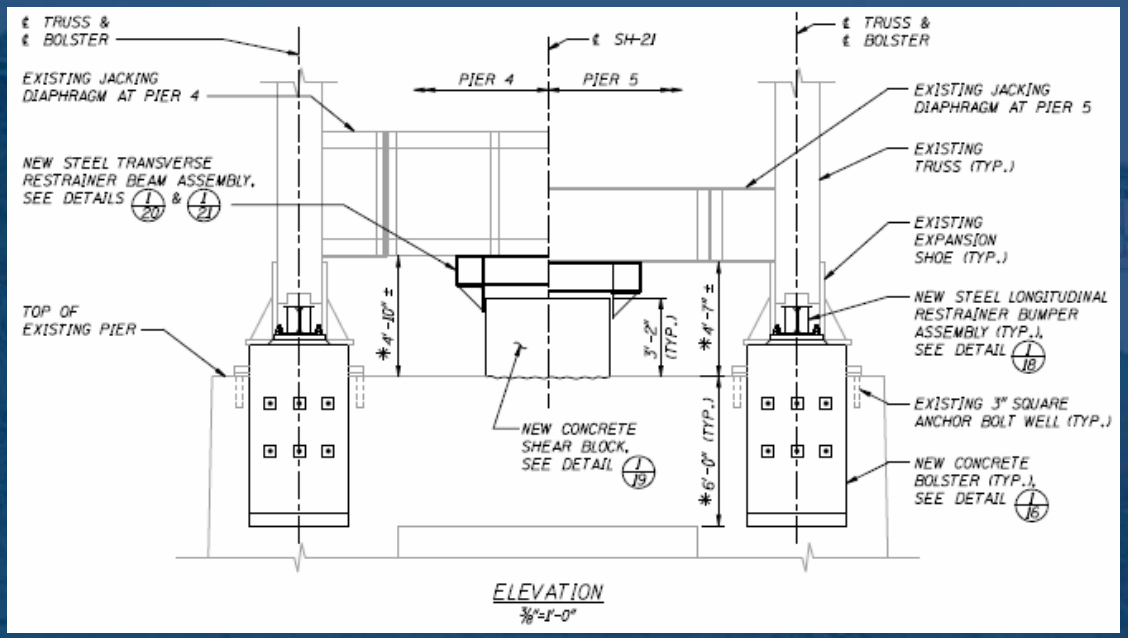
- Relatively low seismic area
  - A = 0.11g, Seismic Performance Zone 2
- Multimodal response spectrum analysis
- LRFD design
- Pier 3 fixed, Piers 4 & 5 expansion
- Long spans create large displacement demands

Pier 4 & 5 Expansion (Roller) Bearing

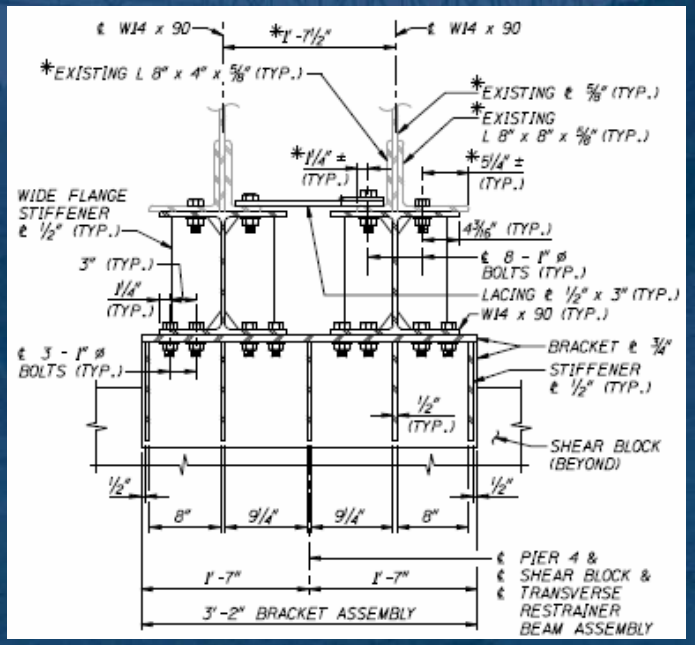
Seismic: Longitudinal Restrainers



Seismic: Transverse Restrainers



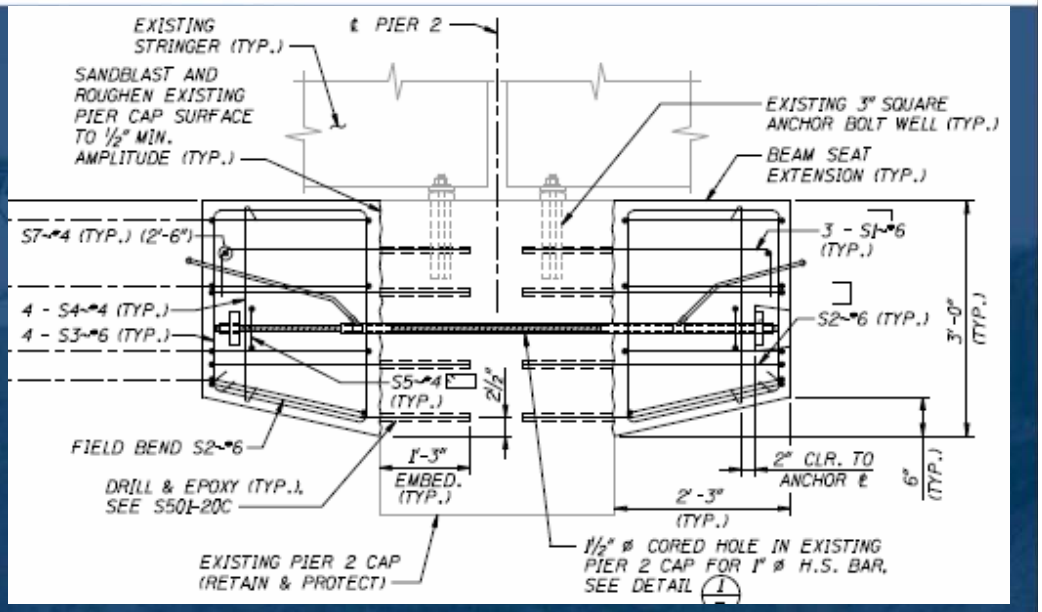
Jacking Diaphragm



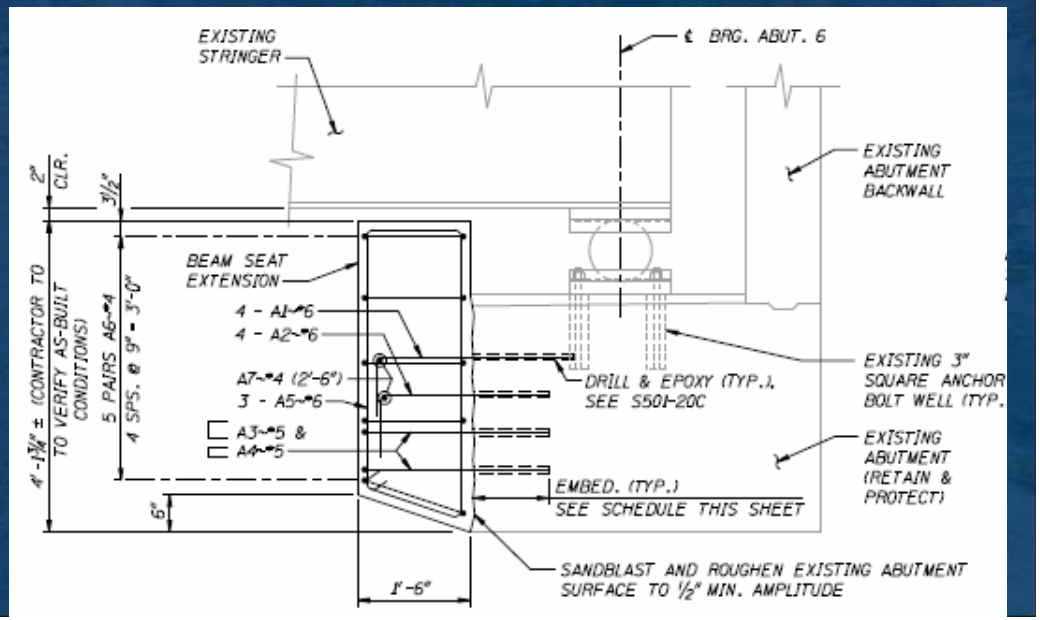
Transverse Restrainer Section

Seismic: Additional Considerations

- Pier 2



- Abut. 6



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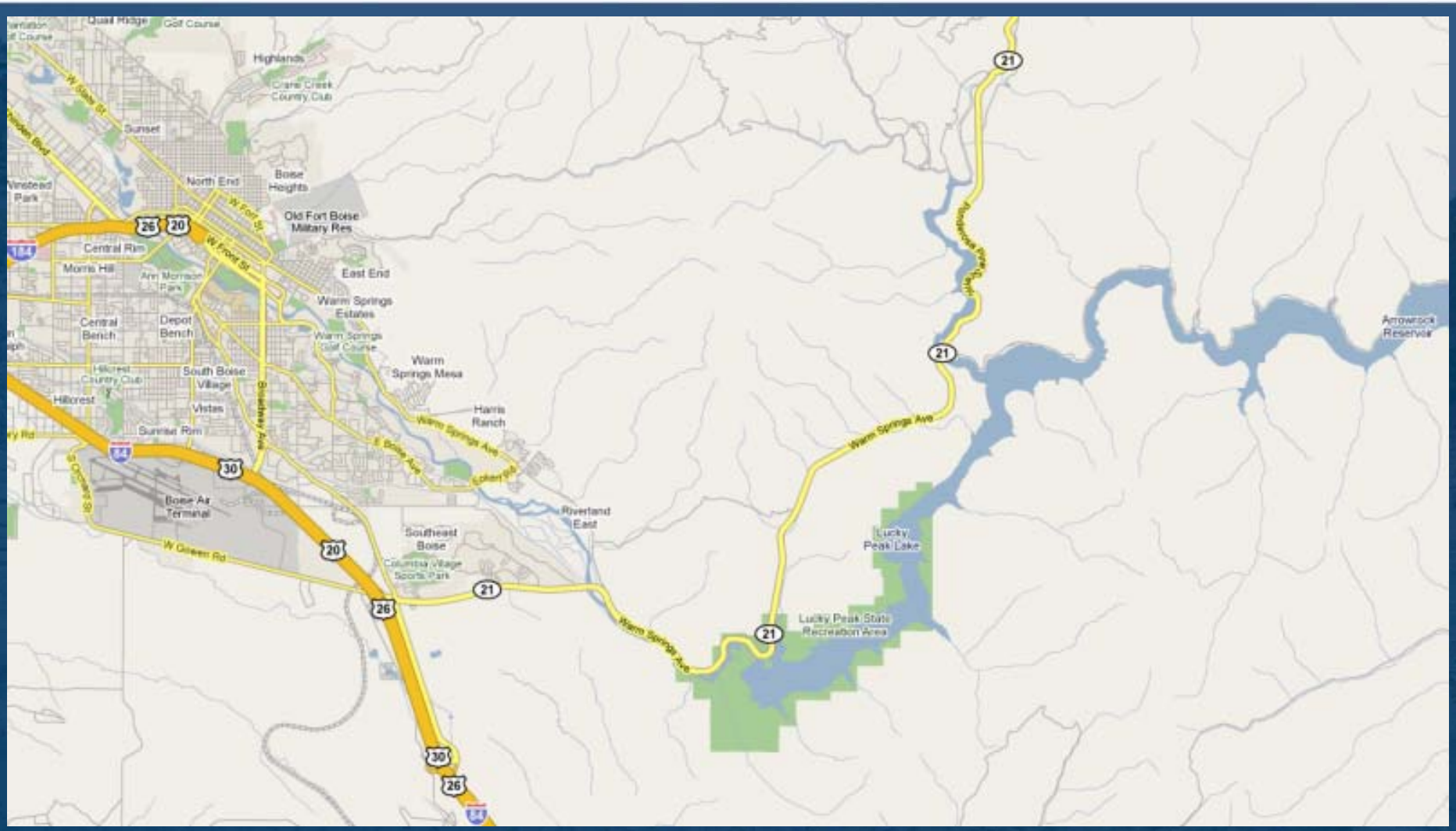
Pier 4 Footing Scope of Work

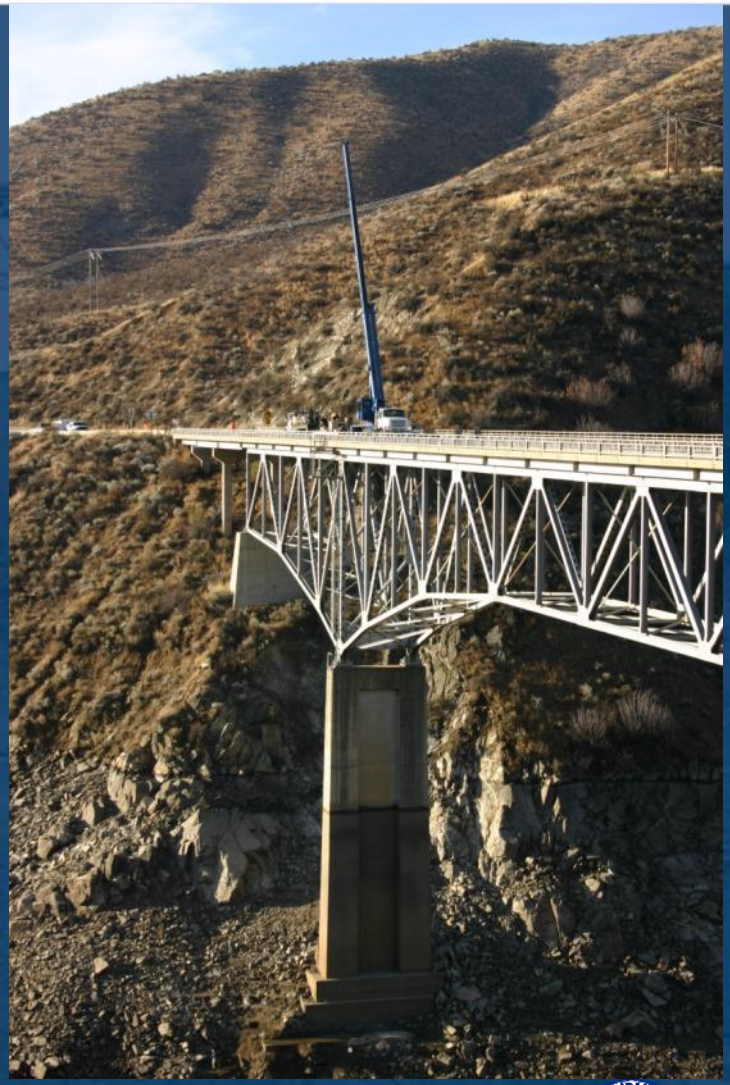
- Scope of Work
  - Deck Overlay
  - Remove and Replace Railings and Wingwalls
  - Paint Superstructure
  - New Seat Extensions
  - New Seismic Restrainers
  - Permeation Grouting
  - Slope Armoring

Location

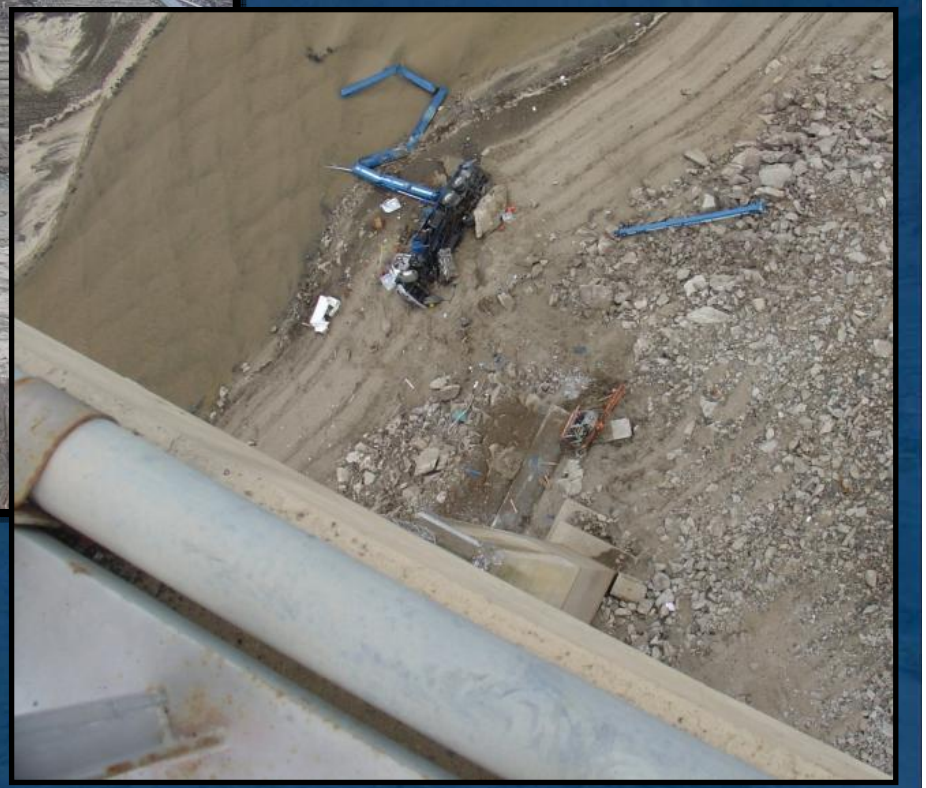

Quad Ridge Golf Course
Highlands
Crane Creek Country Club
Sunset
North End
Boise Heights
Old Fort Boise Military Res
Central Rim
Morris Hill
Ann Morrison Park
East End
Warm Springs Estates
Warm Springs Golf Course
Central Bench
Depot Bench
Warm Springs Mesa
Harris Ranch
Hillcrest Country Club
South Boise Village
Hillcrest
Vistas
Sunset Rim
Broadway Ave
Warm Springs Ave
S Orchard St
Boise Air Terminal
W Gowen Rd
Southeast Boise
Columbia Village Sports Park
Riverland East
Lucky Peak Lake
Lucky Peak State Recreation Area
Arrowrock Reservoir
Arrowrock Dam
26
20
184
84
30
21

Pier 4 Field Investigation

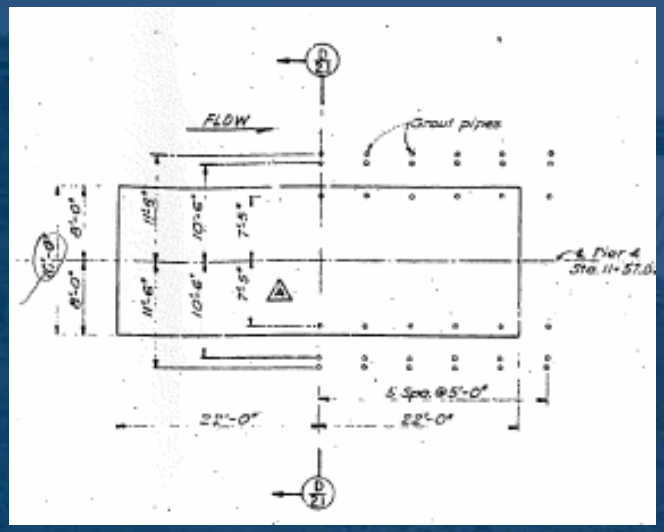
Pier 4 Field Investigation (cont'd)

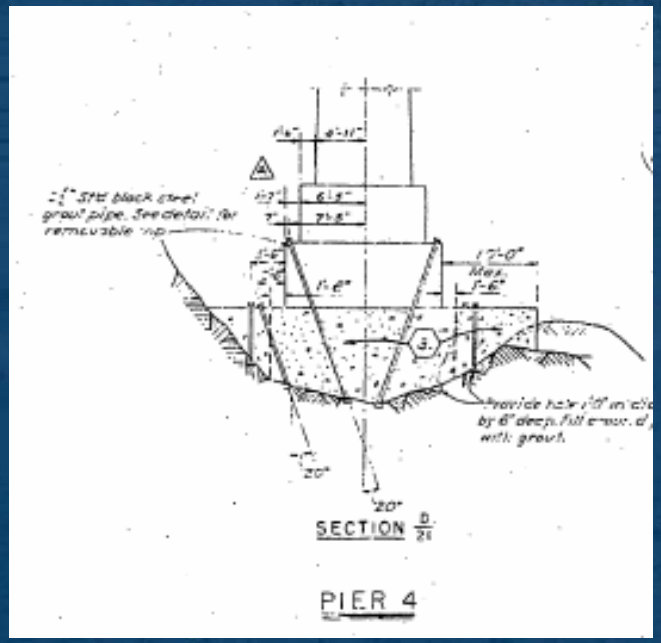


Pier 4 Field Investigation (cont'd)



Pier 4 Permeation Grouting





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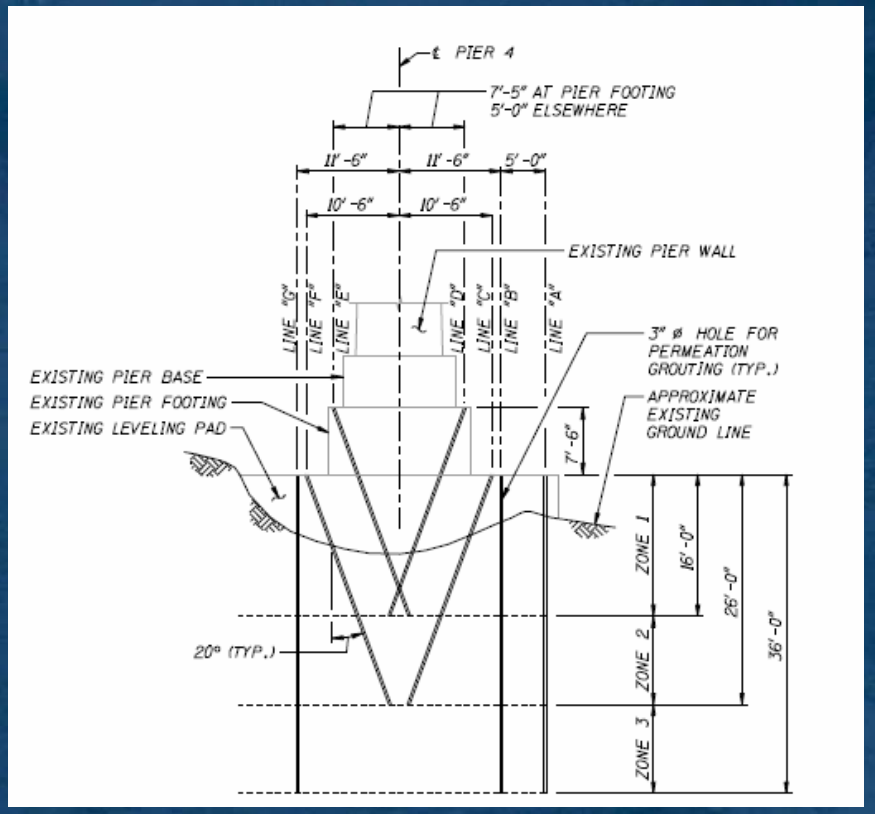
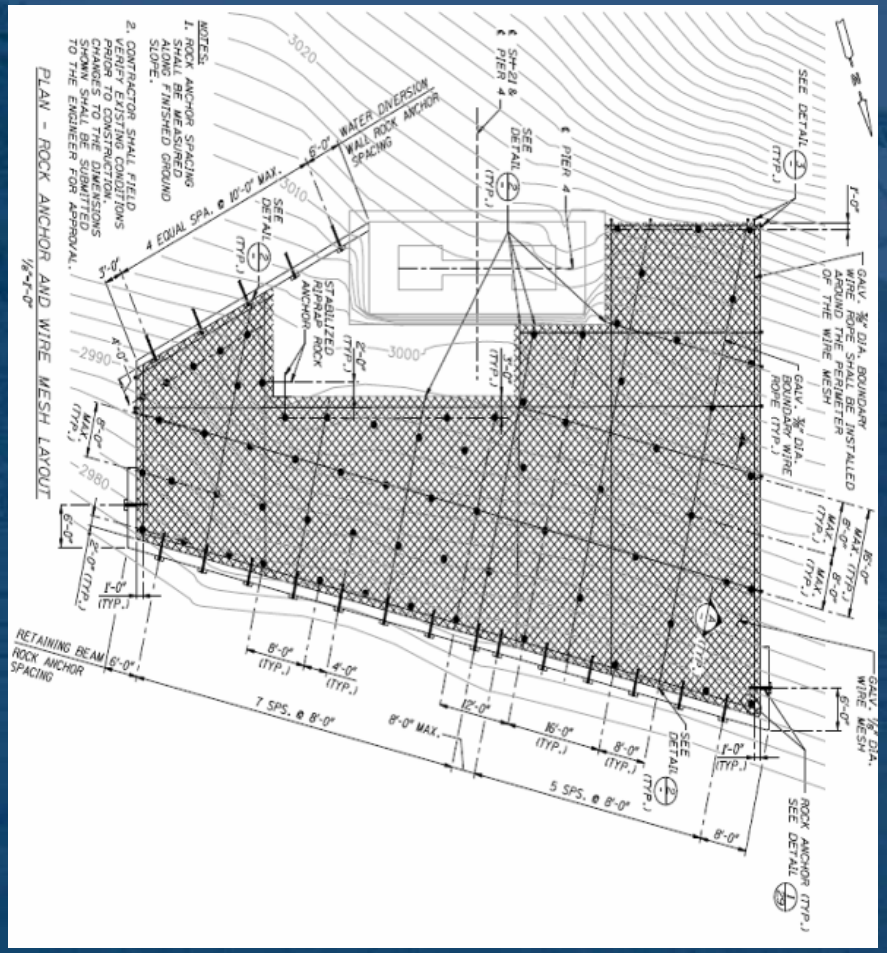
Consulting Engineers & Scientists

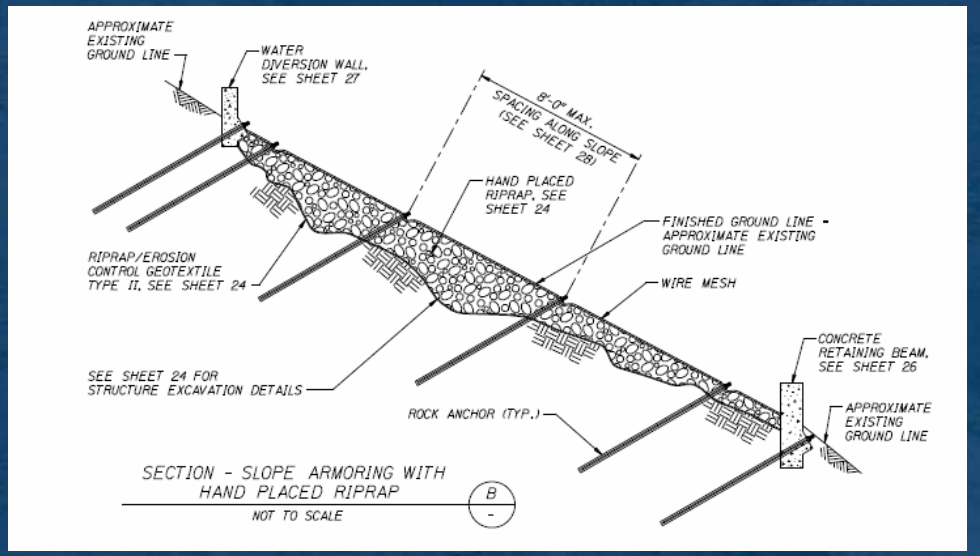
Pier 4 Permeation Grouting (cont'd)



Pier 4 Slope Armoring

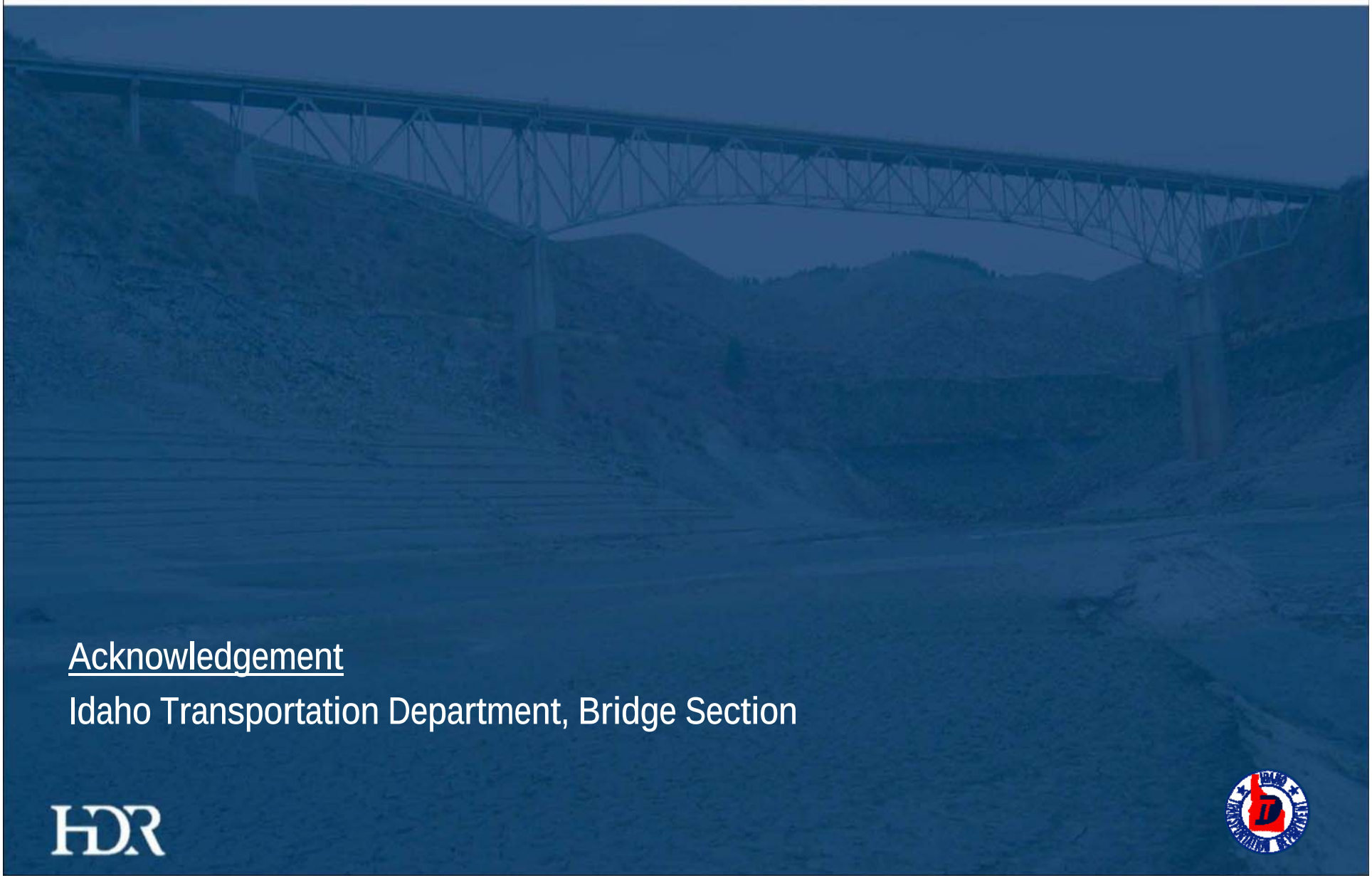
Pier 4 Slope Armoring (cont'd)





HDR

Thank you



Acknowledgement

Idaho Transportation Department, Bridge Section