Subject: I-75 PPI Costing Plans		
Comp by: DRB	Date: 10/14/09	Sheet Number:
Check by:	Job Number: 100010194	

BRIDGE #12 LEAFBRIDGE - STRADDLEBENT & OFFSET PIERS

CONSPAN

- GEOMETRY : 0.4167' ℄ PIER TO PRECAST
  - SPAN 1&2 : 120' ℄ PIER ; 119.167' PRECAST ; 113' ℄ BRG ; 5 GIRD @ 7'-0
  - SPANS 3-5 : 155' ℄ PIER ; 154.167' PRECAST ; 153' ℄ BRG 6 GIRD @ 6'-0
  - SPAN 6 : 140' ℄ PIER ; 139.167' PRECAST ; 138' ℄ BRG 5 GIRD @ 7'-0
- DECK : USE 8 1/8" → 7 7/8" EFFECTIVE THICK

- LOADS
  - BARRIERS : 0.410 klf ; FWS = 0.03 ksf ; SWS = 0.25"
  - SIP FORMS : 5 GIRD = (7.0 - 3.5') × 0.016 ksf = 0.056 ksf
    6 GIRD = (6.0 - 3.5') × 0.016 ksf = 0.040 ksf
  - COPING : 2.5"/12" × 3.5' × 0.150 kcf = 0.109 klf
  - DIAPHRAGMS
    5 - GIRD : 5.26k (END) ; 4.20k (INT) 1/2 = 2.63k ; 2.10k
    6 - GIRD : 4.44k (END) ; 3.54k (INT) 1/2 = 2.22k ; 1.77k

Subject: I-75 PPI		
Comp by: DRB	Date: 10/27/09	Sheet Number:
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BRIDGE #12 LEAPBRIDGE PIER #6 STRADDLEBENT

- INVERTED T

- 4'-0" x 9'-6½" W/ BOTTOM FLANGES 2'x3' each

* BRG / GIRDER
  - LINE 1 : #1 = 5.25' ; ALL OTHERS 6.59'
  - LINE 2 : #1 = 5.25' ; ALL OTHERS 8.23

* HINGE : NODES 2 & 4, CAP & COLUMN

- SEAT LOAD: (2) x 2' x 3' x 0.150 kcf = 1.80 klf

PRESTRESS DESIGN

- BEAM AREA = 7320 in² (SCALED)
  - WEIGHT = 7320/144 x 0.150 x 70.4' = 537 k = 270 TON
  - SELFWEIGHT MOMENT = 7320/144 x 0.150 x 70.4²/8 = 4724 k'

PROJECT: I-75 Costing Plans

AASHTO STANDARD Load: Self

Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy	Fz	Mx	My	Mz
1	1	-0	335.4	0	-0	0	0
1	2	-0	-204.2	0	-0	0	0
2	3	-0	335.8	0	-0	0	0
2	4	-0	-204.6	0	-0	0	0
3	5	0	0.5455	0	0	0	-1.093
3	2	0	16.93	0	0	0	1.093
4	2	0	189	0	0	0	0
4	6	0	-175.9	0	0	0	410.6
5	6	0	174.5	0	0	0	-405.5
5	7	0	-170.1	0	0	0	534.7
6	7	0	170.1	0	0	0	-534.7
6	8	0	-136.1	0	0	0	1429
7	8	0	136.1	0	0	0	-1429
7	9	0	-126.5	0	0	0	1644
8	9	0	126.5	0	0	0	-1644
8	10	0	-97.71	0	0	0	2199
9	10	0	97.71	0	0	0	-2199
9	11	0	-78.6	0	0	0	2488
10	11	0	78.6	0	0	0	-2488
10	12	0	-59.32	0	0	0	2717
11	12	0	59.32	0	0	0	-2717
11	13	0	-30.66	0	0	0	2938
12	13	0	30.66	0	0	0	-2938
12	14	0	-20.93	0	0	0	2981
13	14	0	20.93	0	0	0	-2981
13	15	0	17.28	0	0	0	2993
14	15	0	-17.28	0	0	0	-2993
14	16	0	17.45	0	0	0	2993
15	16	0	-17.45	0	0	0	-2993
15	17	0	170.1	0	0	0	536
16	17	0	-169.2	0	0	0	-533.8
16	4	0	186.7	0	0	0	0
17	4	0	16.93	0	0	0	-3.823
17	18	0	0.5455	0	0	0	1.093

PROJECT: I-75 Costing Plans

AASHTO STANDARD Load: D1-Include Cap Seat

Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy	Fz	Mx	My	Mz
1	1	-63.36	1134	0.0393	-217.7	-1.265	1847
1	2	63.36	-1134	-0.0393	218.8	1.265	0
2	3	-63.36	464.8	-0.0393	-208.4	-1.265	1847
2	4	63.36	-464.8	0.0393	207.3	1.265	0
3	5	0	-98.3	0	139.1	0	-87.38
3	2	-5.4	98.3	0	-139.1	0	0
4	2	-57.96	999.2	0.0393	-79.71	-1.265	0
4	6	53.91	-999.2	-0.0393	79.71	1.177	2248
5	6	-53.91	858.6	0.0393	-229.5	-1.177	-2239
5	7	52.56	-858.6	-0.0393	229.5	1.148	2883
6	7	-52.56	858.6	0.0393	-229.5	-1.148	-2883
6	8	42.05	-858.6	-0.0393	229.5	0.918	7897
7	8	-42.05	717.5	0.0393	-88.45	-0.918	-7897
7	9	39.1	-717.5	-0.0393	88.45	0.8536	9074
8	9	-39.1	567.7	0.0393	-238.3	-0.8536	-9074
8	10	30.19	-567.7	-0.0393	238.3	0.659	1.188e+004
9	10	-30.19	419	0.0393	-89.65	-0.659	-1.188e+004
9	11	24.28	-419	-0.0393	89.65	0.5301	1.326e+004
10	11	-24.28	269.2	0.0393	-239.5	-0.5301	-1.326e+004
10	12	18.32	-269.2	-0.0393	239.5	0.4001	1.415e+004
11	12	-18.32	120.6	0.0393	-90.85	-0.4001	-1.415e+004
11	13	9.468	-120.6	-0.0393	90.85	0.2067	1.474e+004
12	13	-9.468	-23.04	0.0393	-234.5	-0.2067	-1.474e+004
12	14	6.462	23.04	-0.0393	234.5	0.1411	1.47e+004
13	14	-6.462	-171.7	0.0393	-85.88	-0.1411	-1.47e+004
13	15	-5.346	171.7	-0.0393	85.88	-0.1167	1.358e+004
14	15	5.346	-171.7	0.0393	-85.88	0.1167	-1.358e+004
14	16	-5.4	171.7	-0.0393	85.88	-0.1179	1.357e+004
15	16	5.4	-464.8	0.0393	207.3	0.1179	-1.357e+004
15	17	-52.56	464.8	-0.0393	-207.3	-1.148	1395
16	17	52.56	-464.8	0.0393	207.3	1.148	-1395
16	4	-57.96	464.8	-0.0393	-207.3	-1.265	0
17	4	-5.4	0	0	0	0	0
17	18	0	0	0	0	0	0

PROGRAM: RC-PIER® v9.0.1 Bentley Systems, Inc.
PHONE : TOLL-FREE 1-800-778-4277

PROJECT: I-75 Costing Plans

AASHTO STANDARD Load: (L+In)2- Impact factor not included.
Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy	Fz	Mx	My	Mz
1	1	-0	122.2	-0.02992	24.72	0.9636	0
1	2	-0	-122.2	0.02992	-25.59	-0.9636	0
2	3	-0	118.6	0.02992	17.69	0.9636	0
2	4	-0	-118.6	-0.02992	-16.82	-0.9636	0
3	5	0	0	0	0	0	0
3	2	0	0	0	0	0	0
4	2	0	122.2	-0.02992	25.59	0.9636	0
4	6	0	-122.2	0.02992	-25.59	-0.8962	274.9
5	6	0	122.2	-0.02992	25.59	0.8962	-274.9
5	7	0	-122.2	0.02992	-25.59	-0.8738	366.6
6	7	0	122.2	-0.02992	25.59	0.8738	-366.6
6	8	0	-122.2	0.02992	-25.59	-0.699	1080
7	8	0	122.2	-0.02992	25.59	0.699	-1080
7	9	0	-122.2	0.02992	-25.59	-0.65	1281
8	9	0	122.2	-0.02992	25.59	0.65	-1281
8	10	0	-122.2	0.02992	-25.59	-0.5018	1885
9	10	0	122.2	-0.02992	25.59	0.5018	-1885
9	11	0	-122.2	0.02992	-25.59	-0.4037	2286
10	11	0	163.3	-0.02992	66.71	0.4037	-2286
10	12	0	-163.3	0.02992	-66.71	-0.3046	2827
11	12	0	163.3	-0.02992	66.71	0.3046	-2827
11	13	0	-163.3	0.02992	-66.71	-0.1574	3630
12	13	0	-19.41	-0.02992	-116	0.1574	-3630
12	14	0	19.41	0.02992	116	-0.1074	3598
13	14	0	-20.42	-0.02992	-115	0.1074	-3598
13	15	0	20.42	0.02992	115	0.08888	3464
14	15	0	-20.42	-0.02992	-115	-0.08888	-3464
14	16	0	20.42	0.02992	115	0.08977	3463
15	16	0	-118.6	-0.02992	-16.82	-0.08977	-3463
15	17	0	118.6	0.02992	16.82	0.8738	355.8
16	17	0	-118.6	-0.02992	-16.82	-0.8738	-355.8
16	4	0	118.6	0.02992	16.82	0.9636	0
17	4	0	0	0	0	0	0
17	18	0	0	0	0	0	0

$L = 65'$ $\quad I = \frac{50}{125+65} = 26\%$

$M_{LL+I} = 3630(1.26) = 4585^{k'}$

PROJECT: I-75 Costing Plans

AASHTO STANDARD Comb: 1 (SER GP I)

Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy	Fz	Mx	My	Mz
1	1	-79.01	1602	-0.01068	-242.2	0.3439	2303
1	2	79.01	-1471	0.01068	241.8	-0.3439	0
2	3	-78.9	954.6	0.01068	-244.7	0.3439	2300
2	4	78.9	-823.4	-0.01068	245	-0.3439	0
3	5	2.599	-89.57	0	133	0	-93.94
3	2	-7.999	107	0	-133	0	6.554
4	2	-71.01	1325	-0.01068	-108.8	0.3439	0
4	6	66.96	-1311	0.01068	108.8	-0.3199	2965
5	6	-64.36	1170	-0.01068	-258.6	0.3199	-2968
5	7	63.01	-1166	0.01068	258.6	-0.3119	3844
6	7	-63.01	1166	-0.01068	-258.6	0.3119	-3844
6	8	52.5	-1132	0.01068	258.6	-0.2495	1.055e+004
7	8	-49.38	996.7	-0.01068	-123.6	0.2495	-1.057e+004
7	9	46.43	-987.2	0.01068	123.6	-0.232	1.219e+004
8	9	-43.83	837.4	-0.01068	-273.5	0.232	-1.221e+004
8	10	34.92	-808.5	0.01068	273.5	-0.1791	1.628e+004
9	10	-31.8	659.9	-0.01068	-124.8	0.1791	-1.63e+004
9	11	25.89	-640.8	0.01068	124.8	-0.1441	1.843e+004
10	11	-23.3	522.1	-0.01068	-243.5	0.1441	-1.844e+004
10	12	17.34	-502.8	0.01068	243.5	-0.1087	2.014e+004
11	12	-14.22	354.2	-0.01068	-94.93	0.1087	-2.015e+004
11	13	5.363	-325.5	0.01068	94.93	-0.05617	2.183e+004
12	13	-2.764	44.75	-0.01068	-375.7	0.05617	-2.184e+004
12	14	-0.242	-35.03	0.01068	375.7	-0.03833	2.19e+004
13	14	3.361	-115.3	-0.01068	-225.4	0.03833	-2.192e+004
13	15	-15.17	153.5	0.01068	225.4	0.03174	2.104e+004
14	15	17.77	-159.6	-0.01068	-231.5	-0.03174	-2.105e+004
14	16	-17.82	159.8	0.01068	231.5	0.03206	2.105e+004
15	16	20.94	-636.2	-0.01068	245	-0.03206	-2.106e+004
15	17	-68.1	788.9	0.01068	-245	0.3119	2392
16	17	68.1	-788	-0.01068	245	-0.3119	-2390
16	4	-73.5	805.5	0.01068	-245	0.3439	0
17	4	-5.4	16.93	0	0	0	-3.823
17	18	0	0.5455	0	0	0	1.093

PROJECT: I-75 Costing Plans

AASHTO STANDARD Envelope Strength

Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy	Fz	Mx	My	Mz (Max/Min)
1	1	-138.2	1987	-0.02102	-265.3	0.6769	3899
		-25.5	1764	93.98	-3138	-378	867.2
1	2	130.6	-2250	-131.8	537.4	541.3	0
		130.6	-2250	-131.8	537.4	541.3	0
2	3	-137.9	1111	0.02102	-270.3	0.6768	3890
		-25.83	933.2	-36.98	-1857	-445.3	876.6
2	4	130.3	-1288	59.97	1046	635.1	0
		130.3	-1288	59.97	1046	635.1	0
3	5	-13.96	-122.2	14.98	252.8	0	-35.5
		14.51	-127.1	-1.979	164.7	0	-193.1
3	2	-4.566	139.2	-2.05	-188.1	-6.095	16.33
		-21.53	149.8	6.082	-206.1	17.04	-12.78
4	2	-114.7	2055	111.6	-288.2	-600.3	0
		-114.7	2055	111.6	-288.2	-600.3	0
4	6	70.08	-2038	0.2208	-8.001	-6.613	4604
		29.57	-1382	-80.9	156	235.2	3127
5	6	-38.17	1222	67.83	-294.2	-235.2	-3073
		-70.08	1848	-0.2208	-191.3	6.613	-4586
5	7	68.33	-1843	0.2208	191.3	-6.447	5970
		36.48	-1216	-67.83	294.2	184.3	3987
6	7	-36.48	1216	67.83	-294.2	-184.3	-3987
		-68.33	1843	-0.2208	-191.3	6.447	-5970
6	8	54.66	-1798	0.2208	191.3	-5.158	1.66e+004
		23.34	-1174	-67.83	294.2	217.3	1.096e+004
7	8	-31.27	981.2	56.94	-154.6	-217.3	-1.093e+004
		-54.66	1615	-0.2208	-7.919	5.158	-1.66e+004
7	9	50.82	-1603	0.2208	7.919	-4.796	1.924e+004
		27.58	-969.2	-56.94	154.6	310.3	1.253e+004
8	9	-36.18	795.1	43.87	-392.3	-310.3	-1.248e+004
		-50.82	1271	-0.2208	-339.2	4.796	-1.924e+004
8	10	39.24	-1234	0.2208	339.2	-3.703	2.544e+004
		25.04	-759	-43.87	392.3	526.3	1.633e+004
9	10	-32.97	585.4	32.97	-271.5	-526.3	-1.629e+004
		-39.24	1041	-0.2208	-146	3.703	-2.544e+004
9	11	31.57	-1040	0.1981	106.9	-2.673	2.886e+004
		25.59	-561.5	-32.97	271.5	633.7	1.817e+004
10	11	-34.18	387.3	19.9	-509.1	-633.7	-1.813e+004
		-31.57	666.4	-0.1981	-480.6	2.673	-2.886e+004
10	12	23.82	-979.9	0.0502	85.5	-0.511	3.149e+004
		26.74	-363.2	-19.9	509.1	698.7	1.937e+004
11	12	-34.67	189.5	9.006	-388.3	-698.7	-1.933e+004
		-23.82	786.7	-0.0502	107.7	0.511	-3.149e+004
11	13	12.31	-749.4	0.0502	-107.7	-0.264	3.527e+004
		23.6	-153.7	-9.006	388.3	741.9	2.018e+004
12	13	-32.19	12.69	4.303	-592.8	-741.9	-2.014e+004
		-12.31	-55.78	-0.0502	-697.5	0.264	-3.527e+004
12	14	8.401	68.42	0.0502	697.5	-0.1802	3.517e+004
		28.43	-0.533	-4.303	592.8	734.7	2.015e+004
13	14	-36.36	-173.1	15.2	-472	-734.7	-2.011e+004
		-8.401	-265.1	-0.0502	-500.9	0.1802	-3.517e+004
13	15	-6.95	156.2	0.05044	499.4	0.1498	3.373e+004
		23.54	220.9	-15.2	472	-635.7	1.882e+004
14	15	-23.54	-220.9	15.2	-472	635.7	-1.882e+004
		6.95	-156.2	-0.05044	-499.4	-0.1498	-3.373e+004
14	16	-7.02	156.4	0.05044	499.4	0.1513	3.373e+004
		23.48	221.1	-15.2	472	-635.3	1.881e+004
15	16	-39.34	-535.3	36.98	779.1	635.3	-1.873e+004
		7.02	-1044	-0.05043	388.6	-0.1513	-3.373e+004

PROJECT: I-75 Costing Plans

15	17	-68.33	1243	0.05043	-388.6	1.473	3762
		-19.61	726	-36.98	-779.1	-334.4	2210
16	17	19.61	-725	36.98	779.1	334.4	-2208
		68.33	-1242	-0.05043	388.6	-1.473	-3759
16	4	-123.3	1264	-58.84	-1046	-636.8	0
		-123.3	1264	-58.84	-1046	-636.8	0
17	4	-6.75	21.16	1.131	0	-1.697	-4.779
		-7.02	22.01	1.177	0	-1.765	-4.97
17	18	0	0.7091	0	0	0	1.42
		0	0.6819	0	0	0	1.366

COLUMN BOTTOM LOADS WITHOUT IMPACT

1	1	-138.2	1987	-0.02102	-265.3	0.6769	3899
		-25.5	1764	93.98	-3138	-378	867.2
2	3	-137.9	1111	0.02102	-270.3	0.6768	3890
		-25.83	933.2	-36.98	-1857	-445.3	876.6

PROJECT: I-75 Costing Plans

AASHTO STANDARD Envelope Service

Coord. system: Global Units: kips kips-ft

Memb	Node	Fx	Fy(Max/Min)	Fz	Mx	My	Mz
1	1	-63.36	1826	-0.1508	-145.1	4.857	1847
		-20.4	1411	75.18	-2510	-302.4	693.8
1	2	26.23	-1280	-75.18	324.5	302.4	0
		63.36	-1695	0.1508	140.7	-4.857	0
2	3	-63.36	1093	0.0317	-289.6	1.021	1847
		-20.66	746.6	-29.59	-1486	-356.3	701.3
2	4	26.49	-615.4	29.59	623.3	356.3	0
		63.36	-961.4	-0.0317	290.6	-1.021	0
3	5	6.779	-88.54	-12.62	178.5	0	-106.2
		-6.876	-101.9	-10.46	199.7	0	-66.63
3	2	1.476	119.3	10.46	-199.7	31.37	1.093
		-12.18	106	12.71	-178.5	38	9.831
4	2	-57.96	1545	-0.1508	-1.651	4.857	0
		-27.71	1118	64.72	-124.8	-333.8	0
4	6	23.66	-1105	-64.72	124.8	188.2	2502
		53.91	-1532	0.1508	1.651	-4.518	3461
5	6	-53.91	1386	-0.1508	-154.7	4.518	-3447
		-30.53	977.2	54.26	-235.3	-188.2	-2458
5	7	29.18	-972.9	-54.26	235.3	147.5	3189
		52.56	-1382	0.1508	154.7	-4.404	4486
6	7	-52.56	1382	-0.1508	-154.7	4.404	-4486
		-29.18	972.9	54.26	-235.3	-147.5	-3189
6	8	18.67	-938.9	-54.26	235.3	173.9	8772
		42.05	-1348	0.1508	154.7	-3.524	1.246e+004
7	8	-42.05	1207	-0.1508	-13.58	3.524	-1.246e+004
		-25.02	784.9	45.55	-123.7	-173.9	-8741
7	9	22.06	-775.4	-45.55	123.7	248.3	1.002e+004
		39.1	-1197	0.1508	13.58	-3.276	1.443e+004
8	9	-39.1	993.5	-0.06366	-176.2	1.383	-1.389e+004
		-28.94	636.1	35.09	-313.8	-248.3	-9987
8	10	20.03	-607.2	-35.09	313.8	421	1.306e+004
		30.19	-964.7	0.06366	176.2	-1.068	1.873e+004
9	10	-30.19	816	-0.06366	-27.55	1.068	-1.873e+004
		-26.37	468.3	26.38	-217.2	-421	-1.303e+004
9	11	20.47	-449.2	-26.38	217.2	506.9	1.454e+004
		24.28	-796.9	0.06366	27.55	-0.8587	2.138e+004
10	11	-24.28	734.4	-0.03153	-81.56	0.4254	-2.116e+004
		-27.35	309.9	15.92	-407.3	-506.9	-1.45e+004
10	12	21.39	-290.6	-15.92	407.3	559	1.55e+004
		18.32	-715.1	0.03153	81.56	-0.321	2.356e+004
11	12	-18.32	566.5	-0.03153	67.06	0.321	-2.356e+004
		-27.73	151.6	7.205	-310.6	-559	-1.547e+004
11	13	18.88	-123	-7.205	310.6	593.5	1.614e+004
		9.468	-537.8	0.03153	-67.06	-0.1659	2.627e+004
12	13	-9.468	103	-0.073	-498.5	0.384	-2.5e+004
		-9.468	-38.31	-0.03153	-509.1	0.1659	-2.627e+004
12	14	6.462	48.04	0.03153	509.1	-0.1132	2.62e+004
		6.462	-93.24	0.073	498.5	-0.2621	2.517e+004
13	14	-6.462	-86.25	-0.03711	-356.2	0.1332	-2.573e+004
		-6.462	-227.3	-0.1508	-245	0.5415	-2.442e+004
13	15	-5.346	265.5	0.1508	245	0.448	2.28e+004
		-5.346	124.5	0.03711	356.2	0.1102	2.504e+004
14	15	5.346	-124.5	-0.03711	-356.2	-0.1102	-2.504e+004
		5.346	-265.5	-0.1508	-245	-0.448	-2.28e+004
14	16	-5.4	265.6	0.1508	245	0.4525	2.28e+004
		-5.4	124.6	0.03711	356.2	0.1114	2.503e+004
15	16	-31.47	-428.2	29.59	623.3	508.2	-1.499e+004
		5.4	-774.2	-0.0317	290.6	-0.09511	-2.509e+004

PROJECT: I-75 Costing Plans

15	17	-52.56	926.8	0.0317	-290.6	0.9255	2806
		-15.69	580.8	-29.59	-623.3	-267.5	1768
16	17	15.69	-580	29.59	623.3	267.5	-1766
		52.56	-926	-0.0317	290.6	-0.9255	-2804
16	4	-57.96	943.4	0.0317	-290.6	1.021	0
		-21.09	597.4	-29.59	-623.3	-356.3	0
17	4	-5.4	16.93	0.9051	0	-1.358	-3.823
		-5.4	16.93	0.9051	0	-1.358	-3.823
17	18	0	0.5455	0	0	0	1.093
		0	0.5455	0	0	0	1.093

COLUMN BOTTOM LOADS WITHOUT IMPACT

1	1	-63.36	1771	-0.1214	-156.4	3.908	1847
		-20.4	1411	75.18	-2510	-302.4	693.8
2	3	-63.36	1047	0.02069	-277.1	0.6662	1847
		-20.66	746.6	-29.59	-1486	-356.3	701.3

			STRAND LAYOUT #1			STRAND LAYOUT #2			STRAND LAYOUT #3			STRAND LAYOUT #4		
Row	Spa	Y	Strands	n x d	Total Strands	Strands	n x d	Total Strands	Strands	n x d	Total Strands	Strands	n x d	Total Strands
1	3.00	3.00	20	60	**84**	20	60	**84**		0	**0**		0	**0**
2	2.00	5.00	14	70		20	100			0			0	
3	2.00	7.00	14	98	**Sum(n x d)**	20	140	**Sum(n x d)**		0	**Sum(n x d)**		0	**Sum(n x d)**
4	2.00	9.00	4	36	**2010**	10	90	**954**		0	**0**		0	**0**
5	2.00	11.00	4	44		10	110			0			0	
6	2.00	13.00		0	**Y strands**		0	**Y strands**		0	**Y strands**		0	**Y strands**
7	2.00	15.00		0	**23.929**		0	**11.357**		0	**0.000**		0	**0.000**
8	2.00	17.00		0			0			0			0	
9	2.00	19.00		0	**Y beam**		0	**Y beam**		0	**Y beam**		0	**Y beam**
10	2.00	21.00		0	**48.750**		0	**48.750**		0	**0.000**		0	**0.000**
11	2.00	23.00		0			0			0			0	
12	2.00	25.00		0	**e**		0	**e**		0	**e**		0	**e**
13	2.00	27.00		0	**24.821**		0	**37.393**		0	**0.000**		0	**0.000**
14	2.00	29.00		0			0			0			0	
15	2.00	31.00		0			0			0			0	
16	2.00	33.00		0			0			0			0	
17	2.00	35.00		0			0			0			0	
18	2.00	37.00		0			0			0			0	
19	2.00	39.00		0			0			0			0	
20	2.00	41.00		0			0			0			0	
21	2.00	43.00		0			0			0			0	
22	2.00	45.00		0			0			0			0	
23	2.00	47.00		0			0			0			0	
24	2.00	49.00	6	294			0			0			0	
25	2.00	51.00	6	306			0			0			0	
26	2.00	53.00	6	318			0			0			0	
27	2.00	55.00	6	330			0			0			0	
28	2.00	57.00		0			0			0			0	
29	2.00	59.00		0			0			0			0	
30	2.00	61.00		0			0			0			0	
31	2.00	63.00		0			0			0			0	
32	2.00	65.00		0			0			0			0	
33	2.00	67.00		0			0			0			0	
34	2.00	69.00		0			0			0			0	
35	2.00	71.00		0			0			0			0	
36	2.00	73.00		0			0			0			0	
37	38.50	111.50		0			0			0			0	
38	2.00	113.50	4	454		4	454			0			0	

Project: I-75 HOV Lanes

Bridge 12 Bent 6 Straddle Bent Cap

Job No: 100010194 **By:** DRB 10/20/2009 **Chk:**

AASHTO 9.16 LOSS OF PRESTRESS

AASHTO 9.16.2 Prestress Loss

$\Delta f_s = SH + ES + CR_c + CR_s$

Low-Relaxation — Type of Prestressing Strand

$f'_s =$ 270.00 — Prestressing Steel Ultimate Strength (ksi)

9.16.2.1.1: Shrinkage

RH = 70.00 — Mean Annual Ambient Relative Humidity (%)

SH = 17,000 - 150 RH = 6,500 psi

9.16.2.1.2: Elastic Shortening

$E_s =$ 28,000 — Modulus of Elasticity of Prestress Steel (ksi)

$E_{ci} =$ 3,990 — Modulus of Elasticity of Concrete at Release (ksi)

$A^*_s =$ 18.228 — Total Area of Prestressing Steel (in^2)

$A_b =$ 7320.0 — Area of Non-Composite Beam (in^2)

$I_b =$ 8,649,900 — Moment of Inertia of Non-Composite Beam (in^4)

$M_{b\,D/L} =$ 4723.8 — Dead Load Moment of Non-Composite Beam (kip-ft)

e = 37.393 — Non-Composite Eccentricity of C.G. of P/S Steel @ Max. Moment (in)

$f_{si} =$ 192.4 ksi (Assumed)* $f_{si} =$ 192.4 ksi (Calculated) **OK**

* per AASHTO, you can start with an assumption of 0.69 f's = 186.3 ksi

$P_i = f_{si}$ (Assumed) x $A^*_s =$ 3,507.1 kips

Concrete Stress @ C.G. Strands = f_{cir}

$$f_{cir} = \left(\frac{P_i}{A_b} + \frac{P_i e^2}{I_b} \right) - \frac{M_{b\,D/L} \times e}{I_b} = 801 \text{ psi}$$

$$ES = \frac{E_s}{E_{ci}} \times f_{cir} = 5{,}621 \text{ psi}$$

Note:

Project: I-75 HOV Lanes

Bridge 12 Bent 6 Straddle Bent Cap

Job No: 100010194 **By:** DRB 10/20/2009 **Chk:** _____

AASHTO 9.16 LOSS OF PRESTRESS

9.16.2.1.3: Creep of Concrete

f_{cir} =	801	Concrete Stress @ C.G. of P/S Steel at Release (psi)
$M_{D/L}$ =	17,733.0	Total Non-Composite Dead Load Moment (kip-ft)
$M_{SD/L}$ =	0.0	Total Composite Dead Load Moment (kip-ft)
I_c =	8,649,900	Moment of Inertia of Composite Beam (in^4)
e_c =	37.393	Composite Eccentricity of C.G. of P/S Steel @ Max. Moment (in)

Concrete Stress @ C.G. of Strands due to Other* Dead Loads = f_{cds} = 675 psi

* All Dead Loads except for Beam Dead Load

CR_c = **$12 f_{cir} - 7 f_{cds}$ = 4,888 psi**

9.16.2.1.4: Relaxation of Prestressing Steel

At Release: Assume losses due to Elastic Shortening only

CR_{si} = 5,000 - 0.10 x ES = 4,438 psi

Final: As Defined by AASHTO E'qn 9-10A

CR_s = 5,000 - 0.10 x ES - 0.05 x (SH + CR_c) = 3,869 psi

INITIAL LOSS AT RELEASE

Δf_{si} = ES + CR_{si} = 10,059 psi = 4.97% of Initial

TOTAL LOSS

Δf_s = SH + ES + CR_c + CR_s = 20,877 psi = 10.31% of Initial

Note: _____

Project: I-75 HOV Lanes

Bridge 12 Bent 6 Straddle Bent Cap

Job No: 100010194 **By:** DRB 10/27/2009 **Chk:** _____

LFD FLEXURAL STRENGTH OF PRESTRESSED RECTANGULAR SECTIONS

AASHTO 9.17

STRENGTH CAPACITY REDUCTION FACTORS

ϕ_{ps}	1.00	**Factory Produced Prestressed Concrete Members**	**AASHTO 9.14**

BEAM DATA

Span (ft)	64.40	Span Length	
b (in)	48.00	Width of Top of Prestressed Member	
h (in)	116.50	Height of Prestressed Member	
A_b (in^2)	7,320	Area of Beam	
I_b (in^2)	8,649,900	Moment of Inertia of Beam	
y_b (in)	48.75	Neutral Axis of Prestressed Member	
e_m (in)	37.39	Eccentricity of Prestress Steel at Midspan	
e_e (in)	24.82	Eccentricity of Prestress Steel at End of Beam	
t_{cf} (in)	116.50	Compression Flange Thickness (Enter the Total Depth for a Rectangular Section)	

CONCRETE DATA

γ_c (kcf)	0.150	Unit Weight of Concrete	
f'_{ci} (ksi)	4.800	Compressive Strength of Concrete at Release	
f'_c (ksi)	6.000	Compressive Strength of Concrete at 28 Days	
n_{ci}	0.60	Factor: Allowable Compressive Stress at Release	AASHTO 9.15.2.1
n_{ti}	3	Factor: Allowable Tensile Stress at Release	AASHTO 9.15.2.1
n_{cfa}	0.60	Factor: Allowable Final Compressive Stress, Case a	AASHTO 9.15.2.2
n_{cfb}	0.40	Factor: Allowable Final Compressive Stress, Case b	AASHTO 9.15.2.2
n_{cfc}	0.40	Factor: Allowable Final Compressive Stress, Case b	AASHTO 9.15.2.2
n_{tf}	6	Factor: Allowable Final Tensile Stress	AASHTO 9.15.2.2

PRESTRESS STRAND DATA

Low-Relaxation		Type of Prestressing Strand
A_{str} (in^2)	0.217	Area of an Individual Prestress Strand
n_s	84	Total Number of Strands
f'_s (ksi)	270	Ultimate Stress of Prestress Steel

SERVICE LOAD MOMENTS

M_{Beam} (kip-ft)	4,724	Dead Load Moment of Beam Only (at Release)
M_{DL} (kip-ft)	17,733	Total Dead Load Moment (at Final Loading)
M_{LL+I} (kip-ft)	4,585	Total Live Load + Impact Moment
M_S (kip-ft)	21,920	Maximum Service Load Moment

FACTORED MOMENTS

M_U (kip-ft)	35,270	Maximum Load Factored Moment

Project: I-75 HOV Lanes

Bridge 12 Bent 6 Straddle Bent Cap

Job No: 100010194 **By:** DRB 10/27/2009 **Chk:** _____

LFD FLEXURAL STRENGTH OF PRESTRESSED RECTANGULAR SECTIONS
AASHTO 9.17

BEAM PROPERTIES

S_b (in^3)	177,434	Section Modulus to Bottom Flange = I_b / y_b
S_t (in^3)	127,674	Section Modulus to Top Flange = $I_b / (h - y_b)$
d (in)	105.14	Depth to Centroid of Prestressing Steel = $h - y_b + e_m$

PRESTRESS PROPERTIES

f^*_y (ksi)	243	Ultimate Stress of Prestress Steel
A^*_s (in^2)	18.228	Area of Prestressing Steel
0.75 f's (ksi)	202.5	Prestress Prior to Transfer

Initial Prestress Force

Calculated by "Prestress Loss GDOT" — Method to Calculate Initial Losses After Release

f_{si} (ksi)	192.4	Prestress Immediately After Transfer
P_i (kips)	3,508	Initial Prestress Force = $f_{si} \times A^*_s$

Final Prestress Force

Calculated by "Prestress Loss GDOT" — Method to Calculate Final Losses

f_{loss} (ksi)	20.9	Total Loss of Prestress
P_f (kips)	3,311	Final Prestress Force = $(0.75 \times f'_s - f_{loss}) A^*_s$

FLEXURAL STRENGTH OF PRESTRESSED MEMBER

p^*	0.0036	Ratio of Prestress Steel = A^*_s / bd	
γ^*	0.28	Factor for Type of Prestressing Steel	AASHTO 9.1.2
β_1	0.75	Compression Zone Depth Ratio	AASHTO 8.16.2.7

Average Stress in Prestressing Steel at Ultimate Load

$$f^*_{su} = \text{MIN}\{ f'_s[1 - (\gamma^* / \beta_1)(p^* f'_s / f'_c)], f^*_y \} = 243.0 \text{ ksi}$$

$$\phi_{ps}M_n = \phi\left\{ A^*_s f^*_{su} d \left(1 - 0.6 \frac{p^* f^*_{su}}{f'_c}\right)\right\} = 35{,}404 \text{ kip-ft} \quad 100\% \quad \textbf{OK}$$

Project: I-75 HOV Lanes

Bridge 12 Bent 6 Straddle Bent Cap

Job No: 100010194 **By:** DRB 10/27/2009 **Chk:** _____

LFD FLEXURAL STRENGTH OF PRESTRESSED RECTANGULAR SECTIONS
AASHTO 9.17

SERVICE LOAD STRESS at RELEASE

Bottom Flange Compression at the End of the Beam — Allowable Stress F_{bi} = 2.880 ksi

$$f_{bi} = \frac{-P_i}{A_b} + \frac{-P_i\, e_e}{S_b} = \mathbf{-0.970\ ksi} \quad 34\% \quad \mathbf{OK}$$

Top Flange Tension at the End of the Beam — Allowable Stress F_{bi} = 0.208 ksi

$$f_{ti} = \frac{-P_i}{A_b} + \frac{P_i\, e_e}{S_t} = \mathbf{0.203\ ksi} \quad 98\% \quad \mathbf{OK}$$

SERVICE LOAD STRESS at FINAL

Top Flange Compression at Midspan Case a: Maximum Service Load Combination

Allowable Stress F_{tf_a} = 3.600 ksi

$$f_{tf_a} = \frac{-P_f}{A_b} + \frac{P_f\, e_m - M_S}{S_t} = \mathbf{-1.543\ ksi} \quad 43\% \quad \mathbf{OK}$$

Top Flange Compression at Midspan Case b: Prestress + Dead Load

Allowable Stress F_{tf_b} = 2.400 ksi

$$f_{tf_b} = \frac{-P_f}{A_b} + \frac{P_f\, e_m - M_{DL}}{S_t} = \mathbf{-1.149\ ksi} \quad 48\% \quad \mathbf{OK}$$

Top Flange Compression at Midspan Case c: Live Load + ½ (Prestress + Dead Load)

Allowable Stress F_{tf_c} = 2.400 ksi

$$f_{tf_c} = \frac{-\tfrac{1}{2} P_f}{A_b} + \frac{\tfrac{1}{2}(P_f\, e_m - M_{DL}) - M_{LL+I}}{S_t} = \mathbf{-1.006\ ksi} \quad 42\% \quad \mathbf{OK}$$

Bottom Flange Tension at Midspan — Allowable Stress F_{bf} = 0.465 ksi

$$f_{tf_a} = \frac{-P_f}{A_b} + \frac{-P_f\, e_m + M_S}{S_b} = \mathbf{0.333\ ksi} \quad 72\% \quad \mathbf{OK}$$

Note: _____

LOADS

Pier Info:

Pier View: Upstation.

Load Cases: 70

Loadcase ID: D1 Name: Include Cap Seat

Multiplier = 1.000

Cap loads

Type	Dir	Arm ft	Mag1	x1/L	Mag2	x2/L
UDL	X		-1.80 klf	0.00		1.00

Bearing loads

Line #	Bearing #	Dir	Load kips
1	3	Y	-143.64
1	4	Y	-149.81
1	5	Y	-149.81
1	6	Y	-149.81
1	0	Y	-148.62
1	0	Y	-144.55
2	1	Y	-148.62
2	2	Y	-148.62
2	3	Y	-148.63
2	4	Y	-141.09
1	6	Y	-139.09

← DL + FWS

FWS = 0.030 ksf × 32' × $\frac{(155' + 140')}{2}$ ÷ (2×5) = 14.2 k/BRG

DL = 149.81 k − 14.2 k = 135.65 k

Auto generation details:

Generated Dead Load

Imported dead load reaction from Conspan for Pier: 5

Loadcase ID: (L+In)1 Name:

Multiplier = 1.000

Bearing loads

Line #	Bearing #	Dir	Load kips
1	3	Y	-115.89
1	4	Y	26.29
1	5	Y	0.00
1	6	Y	0.00
1	0	Y	58.31
1	0	Y	-208.06
2	1	Y	-1.45
2	2	Y	0.00
2	3	Y	0.00
2	4	Y	0.00
1	6	Y	0.00

$LL+I = (208.06 + 115.89)/2 = 162.0^k/BRG$

Auto generation details:

Generated Live Load

Longitudinal Reaction: Simple Span Distribution

Selected Vehicles:

- HS20 truck
- H20/HS20 Lane Load
- Military

Transverse Positioning

Number of loaded lanes = all combinations

Live Load Positions = Variable Spacing

Minimum Spacing Between Positions = 1.00 ft

Generate Braking/Longitudinal Force = Selected

Generate Centrifugal Force = Selected

Total number of Considered Truck Positions = 12

Total number of Possible Combination = 88

Project: I-75 HOV Lanes

Bridge 12 Bent 6

Job No: 100010194 **By:** DRB 10/20/2009 **Chk:**

η_D	1.00	Ductility Load Modifier	A1.3.3
η_R	1.00	Redundancy Load Modifier	A1.3.4
η_I	1.00	Importance Load Modifier	A1.3.5

V_{DC}	135.7	Unfactored Dead Load (kips)
V_{DW}	14.2	Unfactored Future Wearing Surface (kips)
V_{LL+I}	162.0	Unfactored Live Load + Impact (kips)

fy	60	Reinforcement Yield Strength (ksi)
f'c	6.000	28-Day Strength of Concrete (ksi)
γ_c	0.150	Unit Weight of Concrete (kip/ft^3)

Span	155.000	Span Length C-C Brg (ft)
W_{c-c}	32.000	Bridge Width Curb-Curb (ft)
# Beams	5	

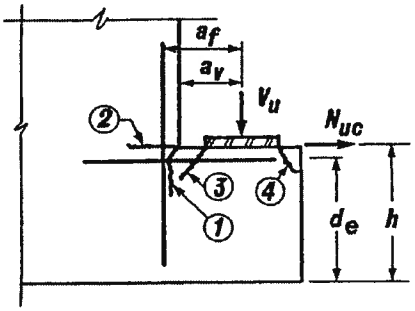

Figure 5.13.2.5.1-1 Notation and Potential Crack Locations for Ledge Beams.

h	36.000	Depth of Beam Ledge (in)	Fig A5.13.2.5.1-1
d_e	33.500	Depth of Horizontal Steel (in)	Fig A5.13.2.5.1-1
S	78.000	CL-CL Girder Spacing (in)	Fig A5.13.2.5.2-1
c	60.000	CL Exterior Girder to End of Ledge Beam (in)	Fig A5.13.2.5.2-1
W	20.000	Width of Bearing Area (in)	Fig A5.13.2.5.2-1
a_v	12.000	CL Brg to Face of Beam Web (in)	Fig A5.13.2.5.2-1
a_f	14.500	CL Brg to Main Hanger Reinforcement (in)	Fig A5.13.2.5.3-1
L	10.000	Length of Bearing Area (in)	Fig A5.13.2.5.4-1
b_f	96.000	Width of Bottom of Inverted T (in)	Fig A5.13.2.5.5-2
d_f	33.000	Top Ledge to Compression Reinforcement (in)	Fig A5.13.2.5.5-2
b_t	48.000	Width of Top of Inverted T (in)	

Bar_{crack1}	#6	Main Horizontal Reinforcement Across Crack 1
spa_{crack1}	9.000	Spacing of Main Horizontal Reinforcement Across Crack 1 (in)
Bar_{crack2}	#6	Main Hanger Reinforcement Across Crack 2
spa_{crack2}	6.000	Spacing of Main Hanger Reinforcement Across Crack 2 (in)
# Legs	4	Number of Legs in the Main Hanger Reinforcement Across Crack 2

η_i	1.00	Load Modifier	A1.3.2.1
γ_{p-DC}	1.25	Strength I Load Factor for Dead Load	Table A3.4.1-2
γ_{p-DW}	1.50	Strength I Load Factor for Future Wearing Surface	Table A3.4.1-2
γ_{-LL+I}	1.75	Strength I Load Factor for Live Load + Impact	Table A3.4.1-2

Project: I-75 HOV Lanes
Bridge 12 Bent 6
Job No: 100010194 **By:** DRB 10/20/2009 **Chk:**

# Lanes	**2**		
N_{BR}	**3.4**	Unfactored Longitudinal Braking Force (kips)	
ϕ_v	**0.90**	Resistance Factor for Shear in Normal Weight Concrete	A5.5.4.2.1
β_1	**0.75**	Compresion Zone Depth Ratio	A5.7.2.2
b_l	**24.000**	Width of Ledge (in)	

CRACK 1: Design for Shear **A5.13.2.5.2**

$b_{w\text{-}v1}$	**68.00**	Width of the Concrete Face for Shear Along Crack 1 (in)	A5.13.2.5.2
V_{n1}	**1,822.4**	Nominal Interface Shear Resistance of Concrete Along Cr 1 (kips)	A5.8.4.1-3
$V_{ledge\text{-}DL1}$	**5.1**	UnFactored Shear at Crack 1 due to Ledge Dead Load (kips)	
V_{u1}	**480.7**	Strength I Factored Shear at Crack 1 (kips)	

$\phi_v V_{n1}$ = **1,640.2 kip** >= $\eta_i V_{u1}$ = **480.7 kip** **OK 341%** A5.8.4.1-1

CRACK 1: Design for Flexure and Horizontal Force **A5.13.2.5.3**

$b_{w\text{-}f1}$	**78.00**	Width of the Concrete Face for Flexure Case 1 (in)	A5.13.2.5.3
A_s	**3.81**	Area of Tension Reinforcement in the Overhang (in^2)	
c_{no}	**0.77**	Location of Neutral Axis (in)	A5.7.3.1.2-4
a_{no}	**0.58**	Depth of equivalent stress block (in)	A5.7.3.2.2
ϕ_S	**0.90**	Resistance Factor for Strength Load	Figure AC5.5.4.2.1-1
N_{u1}	**6.0**	Strength I Factored Lateral Force at Crack 1 (kips)	
$\phi_S M_{n1}$	**555.0**	Factored Flexural resistance of the Beam Overhang (kip-ft)	A5.7.3.2.1
M_{u1}	**480.7**	Strength I Factored Moment at Crack 1 (kip-ft)	

$\phi_S M_{n1}$ = **555.0 kip-ft** >= $\eta_i M_{u1}$ = **480.7 kip-ft/ft** **OK 115%**

CRACK 3: Design for Punching Shear **A5.13.2.5.4**

Interior Pads, or Exterior Pads where c > S/2

$V_{n3\text{-}1}$	**1,097.5**	Nominal Punching Shear Resistance of Concrete (kips)	A5.13.2.5.4-1

Exterior Pads where (c < S/2) and (c - 0.5W < d_e)

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Bridge 12 Bent 6

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$V_{n3\text{-}2}$	**0.0**	Nominal Punching Shear Resistance of Concrete (kips)	A5.13.2.5.4-2

Exterior Pads where (c < S/2) and (c - 0.5W > d_e)

$V_{n3\text{-}3}$	**0.0**	Nominal Punching Shear Resistance of Concrete (kips)	A5.13.2.5.4-2
V_{n3}	**1097.5**	Controlling Nominal Punching Shear Resistance of Concrete (kips)	
$V_{ledge\text{-}DL3}$	**5.6**	UnFactored Shear at Crack 3 due to Ledge Dead Load (kips)	
V_{u3}	**481.4**	Strength I Factored Punching Shear at Crack 3 (kips)	

$\phi_v V_{n3}$ =	**987.8**	**kip**	>=	$\eta_i V_{u3}$ =	**480.7**	**kip**	**OK 205%**	A5.8.4.1-1

CRACK 2: Design of Hanger Reinforcement - Inverted T **A5.13.2.5.5**

A_{hr}	**0.44**	Area of One Leg of Hanger Reinforcement (in^2)	

Service Limit State Single-Beam Ledges x 2

$b_{w\text{-}ser}$	**56.00**	Effective Length of Ledge = MIN(S, W + $3a_v$) (in)	
$V_{n2\text{-}ser}$	**492.8**	Nominal Shear Resistance for Service Limit State (kips)	A5.13.2.5.5-1

Strength Limit State Single-Beam Ledges x 2

$b_{w\text{-}str1}$	**78.00**	Effective Length of Ledge = S (in)	
$V_{n2\text{-}str1}$	**1,372.8**	Nominal Shear Resistance for Strength Limit State (kips)	A5.13.2.5.5-2

Inverted T-Beams

Check Minimum Interior & Exterior Beam Spacing

S =	**78.0**	**in**	>=	**W/2 + d_f =**	**43.0**	**in**	**OK 181%**
c - W/2 =	**50.0**	**in**	>=	**d_f =**	**33.0**	**in**	**OK 152%**

$b_{w\text{-}str2}$	**86.00**	Effective Length of Ledge = W + $2d_f$ (in)	
$V_{n2\text{-}str2}$	**1,245.7**	Nominal Shear Resistance for Strength Limit State (kips)	A5.13.2.5.5-3
$V_{n2\text{-}str}$	**1,245.7**	Nominal Interface Shear Resistance for Strength Limit State (kips)	
$V_{ledge\text{-}DL2}$	**15.9**	UnFactored Shear at Crack 2 due to Dead Load of the Ledge Only (kips)	
V_{u2}	**968.6**	Strength I Factored Hanger Load at Crack 2 (kips)	

$\phi_v V_{n2\text{-}str}$ =	**1,121.1**	**kip**	>=	$\eta_i V_u$ =	**968.6**	**kip**	**OK 116%**	A5.8.4.1-1

Note: **Approximate using LRFD Methodology with HS20 Load**