

09-NOV-09 15:08:15  
 GEORGIA DEPARTMENT OF TRANSPORTATION  
 PRECONSTRUCTION DIVISION - OFFICE OF BRIDGE & STRUCTURAL DESIGN  
 THE ANALYSIS AND DESIGN OF PIERS FOR BRIDGES - V 4.2.07 - AASHTO SPECS 1984 INTERIM  
 REVISED: JUNE 30, 2008  
 32' CURB-CURB; 4 BEAMS; 160' SPAN; 55' TALL; BRIDGE 2B ; PIER 14  
 PROB. NO. 0001

DESIGN NO.	NO. CAN	NO. COL	NO. LLC	SKEW	ANG	F'C	FC	N	FY	FS	DESIGN DATA	CONC.	Z	* * *	CAP	REINFORCING	STEEL	* * *	CAP							
OPTIONS				D	M	PSI	PSI		PSI	PSI	EC	ES	STRAIN	FACT	MAIN	STR	MAX	MAX	MIN	MIN	TOP	MIN	DEPTH	BOT		
D	D	D	L	2	2	6	0-00-00	3500.	1400.	8.	60000.	24000.	3409.	29000.	0.0030	170.	11	5	16	16	11	2	2.00	4.00	3.00	2.00

COLUMN	REINFORCING	STEEL	R	KL	OC	OF	CM	BD1	BD2	IMPACT	SOIL	WT	ALL.S.P.	MIN	MAX	EDGE	PILE	REBAR	ALL.PILE	ALL.PILE
MIN.P	MAX.P	CL.SP.	CLEAR	MODE	COEF					%	KCF	KSF	PL SP	PL SP	PL SP	DIST	DEPTH	CLEAR	CAPACITY	UPLIFT
1.00	8.00	2.50	3.750	1	2.00	0.75	0.90	0.00	1.00	0.75	14.88	0.120	0.000	3.00	9.00	1.250	1.000	3.000	235.000	-9.999

CAP DATA

CN	C	L	A	DE	BC	BE	DH	LH	XB1	XB2	XB3	XB4	XB5	XB6	XB7	XB8
11	C	4.000	3.000	13.000	6.000	6.000	0.000	0.000	3.000							
12	C	59.475	3.000	13.000	6.000		0.000	0.000	3.000	35.752	9.333	8.390				
13	C	10.775	3.000	13.000	6.000	6.000	0.000	0.000	3.000	4.276						

COLUMN DATA

CN	P	I	T	S	HT	A	DT	BT	DB	BB	DL	FLEX	ND	NB	SZ	ND	NB	SZ	ND	NB	SZ	SLOPE	EP	AP			
21	0	C	R		20.000	0.000	6.000	0.000	0.000	0.000	6.500	0.000	27	0	11	27	0	11	51	0	11	51	0	11	0.000	0.000	0.000
22	0	C	R		55.000	0.000	6.000	0.000	0.000	0.000	6.500	0.000	27	0	11	27	0	11	51	0	11	51	0	11	0.000	0.000	0.000

FOOTING DATA

CN	S/P	B	D	T	DEL.B	DEL.D	DEL.T	R.B/D	R.D/B	S.HT.	NP	SYM.	BP	DP	SET.
31	P	2.000	2.000	3.000	0.500	0.500	0.250	1.000	1.000	2.500	4	3	0.000	0.000	0.000

GROUP II WIND

WIND	FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	* WIND	FORCE	ARM	* WIND	ON	PIER	
TRANS.	LONG.	WIND	FT1	FL1	WIND	ON	SUPERSTRUCTURE	INTENSITIES	FT1	FL1	WIND	ON	LIVE	LOAD	INTENSITIES	FT1	FL1
1681.	1681.	1	50	0	44	6	41	12	33	16	17	19	12.271	12.271	8.239	37.290	

GROUP III WIND

STD.	* WIND	ON	SUPERSTRUCTURE	INTENSITIES	* STD.	* WIND	ON	LIVE	LOAD	INTENSITIES	* LENGTHS	OF	LL	* WIND	ON	LL	ARMS								
WIND	FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	TRANS.	LONGI.	APT	APT	APT	APT									
1	50	0	44	6	41	12	33	16	17	19	1	100	0	88	12	82	24	66	32	34	38	159.5	159.5	20.875	20.875

MISCELLANEOUS FORCES

CENTRI.	TRACTION	FORCE	AND	ARMS	EXPANSION	SHRINKAGE	STREAM	FLOW
FT	FL	APT	APL	COEFFICIENT	COEFFICIENT	PT	PL	PL
7.792	6.004	20.875	20.875	0.00018000	0.00044000	0.000	0.000	

DEAD LOAD SUPERSTRUCTURE AND LIVE LOAD CASES

I.D.	NL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
D.L.	0	0.000	0.000	309.200	261.340	237.150	0.000	196.070					
LL01	1	0.000	0.000	33.380	67.360	84.470	0.000	117.980					
LL02	1	0.000	0.000	131.730	84.360	63.810	0.000	16.610					
LL03	2	0.000	0.000	41.350	100.650	121.200	0.000	134.590					
LL04	2	0.000	0.000	37.480	113.060	148.280	0.000	100.780					
LL05	2	0.000	0.000	129.640	151.740	104.050	0.000	20.250					
LL06	2	0.000	0.000	165.110	124.960	91.870	0.000	27.020					

COLUMN MOMENTS(KIP-FEET), SHEARS(KIPS), REACTIONS(KIPS)

LOAD	COL	TRANSVERSE								LONGITUDINAL				
		PC	MT	V	MB	RF	ML	MR	MT	V	MB	MF		
UNIT F.AT CL.CAP	1	0.178	8.950	0.942	9.882	0.178	0.000	-8.950	6.202	0.954	19.082	19.082		
	2	-0.178	1.665	0.058	1.547	-0.178	-1.665	0.000	0.298	0.046	2.523	2.523		
EXPANSION OF CAP	1	-6.459	185.029	21.199	238.946	-6.459	0.000	-185.029	0.000	0.000	0.000	0.000		
	2	6.459	-569.153	-21.199	-596.778	6.459	569.153	0.000	0.000	0.000	0.000	0.000		
SHRINKAGE OF CAP	1	15.788	-452.294	-51.819	-584.089	15.788	0.000	452.294	0.000	0.000	0.000	0.000		
	2	-15.788	1391.263	51.819	1458.790	-15.788	-1391.263	0.000	0.000	0.000	0.000	0.000		
DEAD LOAD TOTAL	1	528.106	670.063	23.667	-196.727	585.362	93.600	-763.664	0.000	0.000	0.000	0.000		
	2	585.362	-820.906	-23.667	-480.768	1550.075	2926.700	-2105.794	0.000	0.000	0.000	0.000		
		1344.379												
		1550.075												
TRAC. FORCE 1 LN	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-156.819	-5.729	-234.154	-234.154		
	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-7.541	-0.275	-20.900	-20.900		
CENT. FORCE 1 LN	1	4.126	69.738	7.337	77.001	4.126	0.000	-69.738	0.000	0.000	0.000	0.000		
	2	-4.126	12.971	0.455	12.056	-4.126	-12.971	0.000	0.000	0.000	0.000	0.000		
WIND ON SUBSTR.	1	1.470	73.739	7.758	81.418	1.470	0.000	-73.739	-231.265	-35.579	-711.584	-711.584		
	2	-1.470	13.715	0.481	12.748	-1.470	-13.715	0.000	-11.120	-1.711	-94.094	-94.094		

PIER-32-4-160-55.OUT												
GROUP 2 WIND 1 1	1	33.812	825.988	86.899	912.002	33.812	0.000	-825.988	-231.265	-35.579	-711.584	-711.584
	2	-33.812	153.626	5.390	142.798	-33.812	-153.626	0.000	-11.120	-1.711	-94.094	-94.094
GROUP 2 WIND 1 2	1	33.812	825.988	86.899	912.002	33.812	0.000	-825.988	231.265	35.579	711.584	711.584
	2	-33.812	153.626	5.390	142.798	-33.812	-153.626	0.000	11.120	1.711	94.094	94.094
GROUP 2 WIND 2 1	1	29.931	735.718	77.402	812.332	29.931	0.000	-735.718	-411.903	-45.202	-1022.137	-1022.137
	2	-29.931	136.837	4.801	127.192	-29.931	-136.837	0.000	-19.806	-2.174	-125.222	-125.222
GROUP 2 WIND 2 2	1	29.931	735.718	77.402	812.332	29.931	0.000	-735.718	411.903	45.202	1022.137	1022.137
	2	-29.931	136.837	4.801	127.192	-29.931	-136.837	0.000	19.806	2.174	125.222	125.222
GROUP 2 WIND 3 1	1	27.991	690.583	72.654	762.497	27.991	0.000	-690.583	-592.542	-54.826	-1332.689	-1332.689
	2	-27.991	128.442	4.506	119.389	-27.991	-128.442	0.000	-28.492	-2.636	-156.350	-156.350
GROUP 2 WIND 3 2	1	27.991	690.583	72.654	762.497	27.991	0.000	-690.583	592.542	54.826	1332.689	1332.689
	2	-27.991	128.442	4.506	119.389	-27.991	-128.442	0.000	28.492	2.636	156.350	156.350
GROUP 2 WIND 4 1	1	22.816	570.223	59.991	629.603	22.816	0.000	-570.223	-712.967	-61.241	-1539.724	-1539.724
	2	-22.816	106.056	3.721	98.581	-22.816	-106.056	0.000	-34.282	-2.945	-177.102	-177.102
GROUP 2 WIND 4 2	1	22.816	570.223	59.991	629.603	22.816	0.000	-570.223	712.967	61.241	1539.724	1539.724
	2	-22.816	106.056	3.721	98.581	-22.816	-106.056	0.000	34.282	2.945	177.102	177.102
GROUP 2 WIND 5 1	1	12.467	329.504	34.666	363.817	12.467	0.000	-329.504	-803.287	-66.053	-1695.001	-1695.001
	2	-12.467	61.285	2.150	56.965	-12.467	-61.285	0.000	-38.625	-3.176	-192.666	-192.666
GROUP 2 WIND 5 2	1	12.467	329.504	34.666	363.817	12.467	0.000	-329.504	803.287	66.053	1695.001	1695.001
	2	-12.467	61.285	2.150	56.965	-12.467	-61.285	0.000	38.625	3.176	192.666	192.666

□ COLUMN MOMENTS(KIP- FEET), SHEARS(KIPS), REACTIONS(KIPS)

LOAD	COL	TRANSVERSE *								LONGITUDINAL		
		PC	MT	V	MB	RF	ML	MR	MT	V	MB	MF
GROUP 3 WIND 1 1	1	18.589	390.549	41.088	431.219	18.589	0.000	-390.549	-69.379	-10.674	-213.475	-213.475
	2	-18.589	72.639	2.548	67.519	-18.589	-72.639	0.000	3.336	-0.513	-28.228	-28.228
GROUP 3 WIND 1 2	1	18.589	390.549	41.088	431.219	18.589	0.000	-390.549	69.379	10.674	213.475	213.475
	2	-18.589	72.639	2.548	67.519	-18.589	-72.639	0.000	3.336	0.513	28.228	28.228
GROUP 3 WIND 2 1	1	16.411	346.338	36.437	382.404	16.411	0.000	-346.338	-173.563	-15.387	-381.286	-381.286
	2	-16.411	64.416	2.260	59.875	-16.411	-64.416	0.000	-8.346	-0.740	-44.229	-44.229
GROUP 3 WIND 2 2	1	16.411	346.338	36.437	382.404	16.411	0.000	-346.338	173.563	15.387	381.286	381.286
	2	-16.411	64.416	2.260	59.875	-16.411	-64.416	0.000	8.346	0.740	44.229	44.229
GROUP 3 WIND 3 1	1	15.322	324.232	34.111	357.996	15.322	0.000	-324.232	-277.746	-20.100	-549.098	-549.098
	2	-15.322	60.304	2.116	56.054	-15.322	-60.304	0.000	-13.355	-0.966	-60.230	-60.230
GROUP 3 WIND 3 2	1	15.322	324.232	34.111	357.996	15.322	0.000	-324.232	277.746	20.100	549.098	549.098
	2	-15.322	60.304	2.116	56.054	-15.322	-60.304	0.000	13.355	0.966	60.230	60.230
GROUP 3 WIND 4 1	1	12.418	265.284	27.910	292.909	12.418	0.000	-265.284	-347.202	-23.242	-660.972	-660.972
	2	-12.418	49.340	1.731	45.863	-12.418	-49.340	0.000	-16.695	-1.118	-70.898	-70.898
GROUP 3 WIND 4 2	1	12.418	265.284	27.910	292.909	12.418	0.000	-265.284	347.202	23.242	660.972	660.972
	2	-12.418	49.340	1.731	45.863	-12.418	-49.340	0.000	16.695	1.118	70.898	70.898
GROUP 3 WIND 5 1	1	6.611	147.387	15.506	162.735	6.611	0.000	-147.387	-399.294	-25.599	-744.878	-744.878
	2	-6.611	27.413	0.962	25.480	-6.611	-27.413	0.000	-19.200	-1.231	-78.898	-78.898
GROUP 3 WIND 5 2	1	6.611	147.387	15.506	162.735	6.611	0.000	-147.387	399.294	25.599	744.878	744.878
	2	-6.611	27.413	0.962	25.480	-6.611	-27.413	0.000	19.200	1.231	78.898	78.898
LIVE LOAD LL01	1	14.335	27.284	0.840	-10.486	14.335	0.000	-27.284	0.000	0.000	0.000	0.000
	2	288.855	-28.669	-0.840	-17.525	288.855	887.091	-858.422	0.000	0.000	0.000	0.000
LIVE LOAD LL02	1	62.365	138.336	5.432	-29.691	62.365	0.000	-138.336	0.000	0.000	0.000	0.000
	2	234.145	-190.469	-5.432	-108.307	234.145	311.323	-120.854	0.000	0.000	0.000	0.000
LIVE LOAD LL03	1	23.160	47.960	1.677	-14.416	23.160	0.000	-47.960	0.000	0.000	0.000	0.000
	2	374.629	-58.112	-1.677	-34.133	374.629	1037.389	-979.277	0.000	0.000	0.000	0.000
LIVE LOAD LL04	1	29.472	66.008	2.547	-15.060	29.472	0.000	-66.008	0.000	0.000	0.000	0.000
	2	370.128	-89.168	-2.547	-50.939	370.128	822.443	-733.275	0.000	0.000	0.000	0.000
LIVE LOAD LL05	1	75.824	172.415	6.903	-34.363	75.824	0.000	-172.415	0.000	0.000	0.000	0.000
	2	329.856	-242.468	-6.903	-137.177	329.856	389.807	-147.339	0.000	0.000	0.000	0.000
LIVE LOAD LL06	1	81.623	181.859	7.162	-38.619	81.623	0.000	-181.859	0.000	0.000	0.000	0.000
	2	327.337	-251.187	-7.162	-142.724	327.337	447.784	-196.598	0.000	0.000	0.000	0.000

□ CAP ANALYSIS AND DESIGN DATA

POINT	D.L.TOT.	MOMENTS(KIP- FEET)						SHEARS(KIPS)					
		G1 MAX.+	G1 MAX.-	G2 MAX.+	G2 MAX.-	G3 MAX.+	G3 MAX.-	DL T.LT	DL T.RT	G1 + LT	G1 + RT	G1 - LT	G1 - RT
P 1	-7.605	-7.605	-7.605	-7.605	-7.605	-7.605	-7.605	-15.210	-15.210	-15.210	-15.210	-15.210	-15.210
C 1L	-121.680	-121.680	-121.680	-121.680	-121.680	-121.680	-121.680	-60.840		-60.840		-60.840	
C 1R	-992.763	-992.763	-1568.900	81.021	-2066.547	-520.519	-1918.214		625.698		806.518		625.698
P 2	815.887	952.684	692.136	1825.433	-193.660	1375.142	196.050	580.068	580.068	760.888	760.888	580.068	580.068
P 3	11833.730	18305.941	11833.730	12077.745	11589.717	15824.683	11833.730	36.280	-365.680	217.100	-365.680	36.280	-546.929
P 4	7758.407	12672.749	7758.407	7802.580	7714.235	10722.014	7758.407	-507.635	-847.377	-507.635	-847.377	-688.884	-1299.914
P 5	113.588	1306.660	-699.377	249.065	-21.889	901.238	-437.275	-974.989	-1283.283	-974.989	-1283.283	-1427.526	-1955.439
C 2L	-3804.709	-3804.709	-6056.881	-3604.995	-4004.424	-3804.709	-5247.746	-1328.914		-1328.914		-2001.069	

PIER-32-4-160-55.OUT														
C 2R	-2737.532	-2737.532	-4863.542	-2737.532	-2737.532	-2737.532	-2737.532	-4010.592	418.779	710.974	418.779			
P 6	-1549.641	-1549.641	-2799.066	-1549.641	-1549.641	-1549.641	-1549.641	-2297.800	373.149	373.149	665.344	665.344	373.149	373.149
P 7	-93.108	-93.108	-93.108	-93.108	-93.108	-93.108	-93.108	-93.108	308.111	53.220	600.306	53.220	308.111	53.220

PT.	M+ UNF. K-FT.	M- UNF. K-FT.	TOP REINFORCE.		BOT. REINFORCE.		CAP DESIGN DATA				RIGHT STIRRUPS		D IN.	FC PSI	PS %	FS/FF RATIO	FS/FZ RATIO
			AS	NO. SIZE	AS	NO. SIZE	M.SP.	AV/IN	BAR&SPAC	M.SP.	AV/IN	BAR&SPAC					
P 1	-5.850	-5.850	3.12	2 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	0.00	0.000	#5@ 0.00	156.00		0.03	0.000	0.008
C 1	-93.600	-1085.000	4.02	3 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	156.00		0.04	0.714	0.892
P 2	690.616	517.993	3.12	2 # 11	3.62	3 # 11	24.00	0.060	#5@10.33	24.00	0.060	#5@10.33	156.00		0.06	0.113	0.568
P 3	12084.082	9102.870	3.12	2 # 11	27.29	18 # 11	0.00	0.000	#5@ 0.00	0.00	0.000	#5@ 0.00	156.00		0.27	0.619	0.974
P 4	8231.637	5968.006	3.12	2 # 11	19.20	13 # 11	24.00	0.060	#5@10.33	24.00	0.060	#5@10.33	156.00		0.19	0.606	0.983
P 5	643.985	-287.090	3.12	2 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.109	#5@ 5.68	156.00		0.05	0.726	0.000
C 2	-2105.794	-3964.089	11.85	8 # 11	3.12	2 # 11	24.00	0.115	#5@ 5.39	24.00	0.060	#5@10.33	156.00		0.11	0.649	0.895
P 6	-1192.031	-1767.538	5.45	4 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.060	#5@10.33	156.00		0.05	0.409	0.994
P 7	-71.621	-71.622	3.12	2 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	0.00	0.000	#5@ 0.00	156.00		0.03	0.000	0.101

COLUMN ANALYSIS AND DESIGN OUTPUT

CRITICAL COLUMN LOADS																							
CN	T	B	GR	LLC	WC	R	E	C	S	F	S	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	T		5		1.1		E					694.3	2101.4	-289.1	694.3	2101.4	297.0	2499.6	7557.2	1068.1	3.597	72.00	72.00
1	B		5		4.1	R	S					540.0	-1701.5	1924.7	540.0	1701.5	1961.4	1373.5	4328.7	4989.8	2.544	72.00	72.00
2	T		1	LL06	0.0			C				2447.6	-1578.8	0.0	2447.6	1606.9	1491.2	7018.0	4608.9	4277.0	2.868	72.00	72.00
2	B		1	LL03	0.0			C				2817.7	-667.8	0.0	2817.7	860.1	1790.0	7734.9	2361.8	4915.2	2.745	72.00	72.00

COLUMN DESIGN DATA																	
CN	T	B	FACE 1 NO. SIZE	FACE 2 NO. SIZE	FACE 3 NO. SIZE	FACE 4 NO. SIZE	AS	PS	BD12	BD	SUMPU	SUMPC	DEL.T	DEL.L	CM	R	PHIC
1	T		27 # 11	0 # 0	0 # 0	0 # 0	42.12	1.035	1.00	0.199	2505.	258747.	1.000	1.027	0.400	1	0.75
1	B		27 # 11	0 # 0	0 # 0	0 # 0	42.12	1.035	0.75	0.054	1879.	300815.	1.000	1.019	0.447	1	0.75
2	T		27 # 11	0 # 0	0 # 0	0 # 0	42.12	1.035	1.00	0.684	3493.	199813.	1.018	2.031	1.000	1	0.75
2	B		27 # 11	0 # 0	0 # 0	0 # 0	42.12	1.035	1.00	0.928	3469.	201367.	1.018	2.118	1.000	1	0.75

FOOTING 1 DESIGN LOADS																			
F	G	LLID	WC	ES	C	S	P	MT	VT	ML	VL	P4	P3	P2	P1	MTF	VBF	VPF	LOAD
2	1	LL04	0.0		C		1864.010	-500.997	-24.974	0.000	0.000	181.086	181.086	214.816	214.816	133.101	-0.115	49.381	MAX.P1
2	1	LL04	0.0		C		2703.837	-689.917	-34.398	0.000	0.000	262.174	262.174	308.624	308.624	191.838	-0.149	71.451	MAX.MT
2	1	LL03	0.0		C		2712.344	-658.157	-32.753	0.000	0.000	264.101	264.101	308.398	308.398	191.693	-0.149	71.671	MAX.VT
2	1	LL03	0.0		C		2712.344	-658.157	-32.753	0.000	0.000	264.101	264.101	308.398	308.398	191.693	-0.149	71.671	MAX.VP
2	1	LL03	0.0		C		2712.344	-658.157	-32.753	0.000	0.000	264.101	264.101	308.398	308.398	131.675	-0.149	71.671	MAX.ML
2	1	LL03	0.0		C		2712.344	-658.157	-32.753	0.000	0.000	264.101	264.101	308.398	308.398	131.675	-0.149	71.671	MAX.VL
2	4	LL02	0.0	E	C		1756.225	-1159.768	-49.139	0.000	0.000	149.156	149.156	225.190	225.190	139.745	-0.115	46.595	MAX.P3

FOOTING 1 ANALYSIS/DESIGN RESULTS

FOOTING SIZE				* BAR REINFORCEMENT STEEL				* SECTION CAPACITIES				
B	D	T	P1/PA	AS	NO. SIZE	SPAC.	PLACEMENT	MT.	VB	VP	DS	FC
11.500	11.500	4.250	0.914	0.89	18 # 7	@ 7.625	TOP LONG	142.188	41.558	83.117	34.435	0.000
				1.24	15 # 9	@ 9.125	BOT. TRAN	201.560	42.767	85.534	35.436	0.000

NUMBER OF PILES = 10 BP = 1.500 DP = 4.500

FOOTING 2 DESIGN SAME AS FOOTING 1