

09-NOV-09
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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	S	PSI	PSI	PSI	PSI	EC	ES	STRAIN	FACT	MAIN	STR	MAX	MAX	MIN	MIN	MIN	TOP	MIN	MIN	TOP	MIN	MIN	TOP	
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	P								
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		30.000	0.000	7.000	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		75.000	0.000	7.000	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

32 2 SAME AS FOOTING 1

SUPERSTRUCTURE AREA*STD.										GROUP II WIND					* WIND ON PIER			
TRANS.	LONG.	WIND	FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	APT	APL	PT	PL		
1681.	1681.	1	50	0	44	6	41	12	33	16	17	19	12.271	12.271	8.239	37.290		

STD. * WIND ON SUPERSTRUCTURE INTENSITIES										GROUP III WIND					* WIND ON LL ARMS										
WIND	FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	WIND	FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	LENGTHS OF LL	* WIND ON LL	LL	ARMS
TRANS.	LONGI.	APT	TRANS.	LONGI.	APT	APT	APT	APT	APT	APT	APT	APT	APT	TRANS.	LONGI.	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
FT	FL	APT	APL	COEFFICIENT	COEFFICIENT	PT	FLOW
							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	0.269	13.021	0.923	14.655	0.269	0.000	-13.021	6.109	0.940	28.195	28.195	
	2	-0.269	3.004	0.077	2.805	-0.269	-3.004	0.000	0.391	0.060	4.511	4.511	
EXPANSION OF CAP	1	-5.851	189.754	14.818	254.788	-5.851	0.000	-189.754	0.000	0.000	0.000	0.000	
	2	5.851	-537.737	-14.818	-573.620	5.851	537.737	0.000	0.000	0.000	0.000	0.000	
SHRINKAGE OF CAP	1	14.302	-463.844	-36.222	-622.816	14.302	0.000	463.844	0.000	0.000	0.000	0.000	
	2	-14.302	1314.469	36.222	1402.182	-14.302	-1314.469	0.000	0.000	0.000	0.000	0.000	
DEAD LOAD TOTAL	1	526.924	855.150	22.803	-171.054	662.582	93.600	-948.750	0.000	0.000	0.000	0.000	
	2	662.582	-1076.306	-22.803	-633.934	1740.990	3182.100	-2105.794	0.000	0.000	0.000	0.000	
		1345.561											
		1740.990											
TRAC. FORCE 1 LN	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-154.473	-5.643	-287.080	-287.080	
	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-9.886	-0.361	-34.625	-34.625	
CENT. FORCE 1 LN	1	4.834	101.463	7.188	114.191	4.834	0.000	-101.463	0.000	0.000	0.000	0.000	
	2	-4.834	23.407	0.604	21.857	-4.834	-23.407	0.000	0.000	0.000	0.000	0.000	
WIND ON SUBSTR.	1	2.220	107.284	7.601	120.742	2.220	0.000	-107.284	-227.805	-35.047	-1051.410	-1051.410	
	2	-2.220	24.750	0.638	23.111	-2.220	-24.750	0.000	-14.580	-2.243	-168.226	-168.226	

PIER-32-4-160-55.OUT												
GROUP 2 WIND 1 1	1	42.208	1201.737	85.141	1352.490	42.208	0.000	-1201.737	-227.805	-35.047	-1051.410	-1051.410
	2	-42.208	277.233	7.148	258.876	-42.208	-277.233	0.000	-14.580	-2.243	-168.226	-168.226
GROUP 2 WIND 1 2	1	42.208	1201.737	85.141	1352.490	42.208	0.000	-1201.737	227.805	35.047	1051.410	1051.410
	2	-42.208	277.233	7.148	258.876	-42.208	-277.233	0.000	14.580	2.243	168.226	168.226
GROUP 2 WIND 2 1	1	37.410	1070.402	75.836	1204.680	37.410	0.000	-1070.402	-405.742	-44.526	-1452.110	-1452.110
	2	-37.410	246.935	6.367	230.584	-37.410	-246.935	0.000	-25.967	-2.850	-221.171	-221.171
GROUP 2 WIND 2 2	1	37.410	1070.402	75.836	1204.680	37.410	0.000	-1070.402	405.742	44.526	1452.110	1452.110
	2	-37.410	246.935	6.367	230.584	-37.410	-246.935	0.000	25.967	2.850	221.171	221.171
GROUP 2 WIND 3 1	1	35.011	1004.735	71.184	1130.775	35.011	0.000	-1004.735	-583.678	-54.006	-1852.811	-1852.811
	2	-35.011	231.786	5.976	216.438	-35.011	-231.786	0.000	-37.355	-3.456	-274.116	-274.116
GROUP 2 WIND 3 2	1	35.011	1004.735	71.184	1130.775	35.011	0.000	-1004.735	583.678	54.006	1852.811	1852.811
	2	-35.011	231.786	5.976	216.438	-35.011	-231.786	0.000	37.355	3.456	274.116	274.116
GROUP 2 WIND 4 1	1	28.612	829.623	58.777	933.696	28.612	0.000	-829.623	-702.302	-60.325	-2119.944	-2119.944
	2	-28.612	191.389	4.935	178.716	-28.612	-191.389	0.000	-44.947	-3.861	-309.413	-309.413
GROUP 2 WIND 4 2	1	28.612	829.623	58.777	933.696	28.612	0.000	-829.623	702.302	60.325	2119.944	2119.944
	2	-28.612	191.389	4.935	178.716	-28.612	-191.389	0.000	44.947	3.861	309.413	309.413
GROUP 2 WIND 5 1	1	15.816	479.398	33.964	539.536	15.816	0.000	-479.398	-791.271	-65.065	-2320.294	-2320.294
	2	-15.816	110.594	2.852	103.271	-15.816	-110.594	0.000	-50.641	-4.164	-335.886	-335.886
GROUP 2 WIND 5 2	1	15.816	479.398	33.964	539.536	15.816	0.000	-479.398	791.271	65.065	2320.294	2320.294
	2	-15.816	110.594	2.852	103.271	-15.816	-110.594	0.000	50.641	4.164	335.886	335.886

□ 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	22.558	568.213	40.257	639.493	22.558	0.000	-568.213	-68.342	-10.514	-315.423	-315.423
	2	-22.558	131.083	3.380	122.403	-22.558	-131.083	0.000	-4.374	-0.673	-50.468	-50.468
GROUP 3 WIND 1 2	1	22.558	568.213	40.257	639.493	22.558	0.000	-568.213	68.342	10.514	315.423	315.423
	2	-22.558	131.083	3.380	122.403	-22.558	-131.083	0.000	4.374	0.673	50.468	50.468
GROUP 3 WIND 2 1	1	19.931	503.890	35.700	567.101	19.931	0.000	-503.890	-170.967	-15.157	-527.151	-527.151
	2	-19.931	116.244	2.997	108.547	-19.931	-116.244	0.000	-10.942	-0.970	-77.389	-77.389
GROUP 3 WIND 2 2	1	19.931	503.890	35.700	567.101	19.931	0.000	-503.890	170.967	15.157	527.151	527.151
	2	-19.931	116.244	2.997	108.547	-19.931	-116.244	0.000	10.942	0.970	77.389	77.389
GROUP 3 WIND 3 1	1	18.618	471.728	33.421	530.905	18.618	0.000	-471.728	-273.592	-19.799	-738.878	-738.878
	2	-18.618	108.825	2.806	101.619	-18.618	-108.825	0.000	-17.510	-1.267	-104.311	-104.311
GROUP 3 WIND 3 2	1	18.618	471.728	33.421	530.905	18.618	0.000	-471.728	273.592	19.799	738.878	738.878
	2	-18.618	108.825	2.806	101.619	-18.618	-108.825	0.000	17.510	1.267	104.311	104.311
GROUP 3 WIND 4 1	1	15.115	385.964	27.345	434.381	15.115	0.000	-385.964	-342.008	-22.895	-880.030	-880.030
	2	-15.115	89.039	2.296	83.144	-15.115	-89.039	0.000	-21.889	-1.465	-122.258	-122.258
GROUP 3 WIND 4 2	1	15.115	385.964	27.345	434.381	15.115	0.000	-385.964	342.008	22.895	880.030	880.030
	2	-15.115	89.039	2.296	83.144	-15.115	-89.039	0.000	21.889	1.465	122.258	122.258
GROUP 3 WIND 5 1	1	8.109	214.435	15.192	241.335	8.109	0.000	-214.435	-393.321	-25.216	-985.894	-985.894
	2	-8.109	49.469	1.275	46.193	-8.109	-49.469	0.000	-25.173	-1.614	-135.719	-135.719
GROUP 3 WIND 5 2	1	8.109	214.435	15.192	241.335	8.109	0.000	-214.435	393.321	25.216	985.894	985.894
	2	-8.109	49.469	1.275	46.193	-8.109	-49.469	0.000	25.173	1.614	135.719	135.719
LIVE LOAD LL01	1	14.308	34.670	0.813	-10.294	14.308	0.000	-34.670	0.000	0.000	0.000	0.000
	2	288.882	-37.680	-0.813	-23.260	288.882	896.102	-858.422	0.000	0.000	0.000	0.000
LIVE LOAD LL02	1	62.029	177.213	5.219	-20.628	62.029	0.000	-177.213	0.000	0.000	0.000	0.000
	2	234.481	-249.323	-5.219	-142.139	234.481	370.177	-120.854	0.000	0.000	0.000	0.000
LIVE LOAD LL03	1	23.079	61.188	1.616	-12.694	23.079	0.000	-61.188	0.000	0.000	0.000	0.000
	2	374.711	-76.204	-1.616	-45.028	374.711	1055.481	-979.277	0.000	0.000	0.000	0.000
LIVE LOAD LL04	1	29.319	84.504	2.449	-11.043	29.319	0.000	-84.504	0.000	0.000	0.000	0.000
	2	370.281	-116.750	-2.449	-66.902	370.281	850.025	-733.275	0.000	0.000	0.000	0.000
LIVE LOAD LL05	1	75.383	221.030	6.629	-22.158	75.383	0.000	-221.030	0.000	0.000	0.000	0.000
	2	330.297	-317.303	-6.629	-179.879	330.297	464.642	-147.339	0.000	0.000	0.000	0.000
LIVE LOAD LL06	1	81.178	232.993	6.881	-26.563	81.178	0.000	-232.993	0.000	0.000	0.000	0.000
	2	327.782	-328.789	-6.881	-187.284	327.782	525.386	-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	-1233.375	-1233.375	-2003.006	328.882	-2795.633	-539.769	-2538.747		624.161		805.858		624.161
P 2	570.664	593.552	330.735	2035.940	-894.613	1277.191	-365.095	578.531	578.531	760.228	760.228	578.531	578.531
P 3	11533.561	17857.320	11533.561	11843.074	11224.046	15466.590	11533.561	34.743	-367.217	216.440	-367.217	34.743	-549.432
P 4	7443.893	12206.670	7443.893	7451.697	7436.088	10299.545	7443.893	-509.172	-848.914	-509.172	-848.914	-691.387	-1302.417
P 5	-213.822	841.260	-1046.172	49.599	-477.243	560.362	-836.787	-976.525	-1284.820	-976.525	-1284.820	-1430.029	-1957.933
C 2L	-4136.729	-4136.729	-6428.179	-3776.327	-4497.132	-4136.729	-5679.263	-1330.451		-1330.451		-2003.563	

PIER-32-4-160-55.OUT													
C 2R	-2737.532	-2737.532	-4863.542	-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	-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	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				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
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	-1384.669	5.45	4 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	156.00	0.05	0.704	0.778
P 2	449.515	252.097	3.12	2 # 11	3.96	3 # 11	24.00	0.060	#5@10.33	24.00	0.060	#5@10.33	156.00	0.04	0.137	0.369
P 3	11784.803	8871.970	3.12	2 # 11	26.61	18 # 11	0.00	0.000	#5@ 0.00	0.00	0.000	#5@ 0.00	156.00	0.27	0.595	0.950
P 4	7919.889	5726.072	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	0.575	0.946
P 5	335.238	-547.873	3.12	2 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.109	#5@ 5.66	156.00	0.04	0.623	0.000
C 2	-2105.794	-4237.581	12.58	9 # 11	3.12	2 # 11	24.00	0.115	#5@ 5.38	24.00	0.060	#5@10.33	156.00	0.11	0.647	0.820
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 S	C F	S F	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	B	5	4.1	R	S	603.3	-2106.0	2649.9	603.3	2106.0	2710.4	1838.8	6421.3	8264.2	3.049	84.00	84.00			
2	T	1	LL06	0.0	C	2448.3	-2052.1	0.0	2448.3	2108.9	1938.0	9035.4	7786.8	7155.8	3.692	84.00	84.00			
2	B	1	LL03	0.0	C	3064.2	-865.0	0.0	3064.2	1103.8	2546.6	10145.7	3656.1	8434.7	3.312	84.00	84.00			

COLUMN DESIGN DATA

CN	T B	B NO. SIZE	FACE 1 NO. SIZE	D NO. SIZE	FACE 2 NO. SIZE	FACE 3 NO. SIZE	FACE 4 NO. SIZE	AS	PS	BD12	BD	SUMP	SUMP	DEL.T	DEL.L	CM	R	PHIC
1	B	36 # 11	0 # 0	0 # 0	0 # 0	0 # 0	56.16	1.013	0.75	0.038	2004.	175151.	1.000	1.023	0.445	1	0.75	
2	T	36 # 11	0 # 0	0 # 0	0 # 0	0 # 0	56.16	1.013	1.00	0.692	3667.	136342.	1.028	2.262	1.000	1	0.75	
2	B	36 # 11	0 # 0	0 # 0	0 # 0	0 # 0	56.16	1.013	1.00	0.942	3643.	128216.	1.029	2.374	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	2053.640	-648.456	-23.728	0.000	0.000	195.113	195.113	223.304	223.304	191.519	36.484	49.823	MAX.P1		
2	1	LL04	0.0	C	2950.472	-893.717	-32.703	0.000	0.000	278.066	278.066	316.920	316.920	273.257	51.952	71.366	MAX.MT		
2	1	LL04	0.0	C	2950.472	-893.717	-32.703	0.000	0.000	278.066	278.066	316.920	316.920	273.257	51.952	71.366	MAX.VT		
2	1	LL03	0.0	C	2958.845	-852.380	-31.130	0.000	0.000	279.731	279.731	316.777	316.777	273.127	51.928	71.563	MAX.VP		
2	1	LL03	0.0	C	2958.845	-852.380	-31.130	0.000	0.000	279.731	279.731	316.777	316.777	188.227	36.115	71.563	MAX.ML		
2	1	LL04	0.0	C	2950.472	-893.717	-32.703	0.000	0.000	278.066	278.066	316.920	316.920	187.707	36.018	71.366	MAX.VL		
1	5	4.1R	S	648.272	-1727.566	-72.196	2119.944	60.325	98.427	-12.216	64.469	175.112	97.109	18.901	16.801	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
16.000	16.000	4.750	0.950	1.07	22 # 8	@ 8.625	TOP LONG	191.503	48.384	96.768	40.090	0.000
				1.52	16 #11	@12.000	BOT. TRAN	280.688	49.838	99.676	41.295	0.000

NUMBER OF PILES = 11 BP = 2.250 DP = 6.750

FOOTING 2 DESIGN SAME AS FOOTING 1