

23-OCT-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
44' CURB-CURB; 6 BEAMS; 138' SPAN; 50' TALL; BRIDGE 4 ; PIER 12

PROB. NO. 0001

DESIGN NO.	NO. CAN	NO. COL	NO. LLC	SKEW D	ANG M	F'C PSI	FC PSI	N	FY PSI	FS PSI	DESIGN DATA		CONC.	Z	* * * CAP			REINFORCING STEEL			* * * CAP					
OPTIONS											EC KSI	ES KSI	STRAIN	FACT	MAIN SIZE	STR TOP	MAX	MAX	MIN	MIN	TOP	MIN	MIN	DEPTH	BOT	
D	D	D	L	2	1	13	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	I
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	2	2.00	0.70	0.90	1.00	1.00	0.75	19.01	0.120	0.000	3.00	9.00	1.250	1.000	3.000	234.000	-9.999	

CAP DATA

CN	C	L	A	DE	BC	BE	DH	LH	XB1	XB2	XB3	XB4	XB5	XB6	XB7	XB8
11	L	23.625	8.000	4.000	6.000	6.000	4.000	15.625	20.500	8.200	4.300					
12	2	SAME AS CANTILEVER 1														

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	1	C	T		50.000	0.000	16.000	6.000	16.000	6.000	6.000	0.000	16	6	11	16	6	11	46	16	11	46	16	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	18.000	18.000	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 ON SUPERSTRUCTURE INTENSITIES										* WIND ON PIER						
STAND. * WIND ON SUPERSTRUCTURE INTENSITIES	TRANS.	LONG.	WIND FT1	FT1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	APT	APL	PT	PL	
1	1346.	2691.	1	50	0	44	6	41	12	33	16	17	19	7.375	7.375	6.475	24.599

GROUP III WIND	* WIND ON LIVE LOAD INTENSITIES										* LENGTHS OF LL			* WIND ON LL											
STAND. * WIND ON LIVE LOAD INTENSITIES	TRANS.	LONG.	WIND FT1	FT1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	TRANS.	LONGI.	APT	APL									
1	50	0	44	6	41	12	33	16	17	19	1	100	0	88	12	82	24	66	32	34	38	138.0	276.0	15.583	15.583

MISCELLANEOUS FORCES

CENTRI.	TRACTION	FORCE	AND	ARMS	EXPANSION	SHRINKAGE	STREAM	FLOW
FT	FL	APT	APL	COEFFICIENT	COEFFICIENT	PT	PL	
6.859	9.732	15.583	15.583	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	274.136	323.102	0.000	646.203	0.000	323.102	274.136					
LL 1	1	77.982	58.071	0.000	0.000	0.000	0.000	0.000					
LL 2	2	77.982	107.018	0.000	87.107	0.000	0.000	0.000					
LL 3	3	77.982	107.018	0.000	207.398	0.000	15.762	0.000					
LL 4	1	0.000	0.000	0.000	0.000	0.000	58.071	77.982					
LL 5	2	0.000	0.000	0.000	87.107	0.000	107.018	77.982					
LL 6	3	0.000	15.762	0.000	207.398	0.000	107.018	77.982					
LL 7	1	0.000	24.887	0.000	111.165	0.000	0.000	0.000					
LL 8	2	39.820	111.166	0.000	121.120	0.000	0.000	0.000					
LL 9	3	39.820	111.166	0.000	217.354	0.000	39.820	0.000					
LL10	2	0.000	32.354	0.000	207.398	0.000	32.354	0.000					
LL11	3	47.287	118.632	0.000	209.887	0.000	32.354	0.000					
LL12	2	77.982	58.071	0.000	0.000	0.000	58.071	77.982					
LL13	3	77.982	107.018	0.000	87.107	0.000	58.071	77.982					

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

TRANSVERSE													* LONGITUDINAL		
LOAD	COL	PC	MT	V	MB	RF	ML	MR	MT	V	MB	MF			
UNIT F.AT CL.CAP	1	0.000	-6.000	1.000	50.000	0.000	0.000	0.000	6.000	1.000	50.000	50.000			
DEAD LOAD TOTAL	1	2124.629	0.000	0.000	0.000	2758.229	11085.280	-11085.280	0.000	0.000	0.000	0.000			
TRAC. FORCE 1 LN	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-210.046	-9.732	-638.254	-638.254			
CENT. FORCE 1 LN	1	0.000	-148.038	6.859	449.834	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
WIND ON SUBSTR.	1	0.000	-38.850	6.475	323.750	0.000	0.000	0.000	-147.594	-24.599	-1229.950	-1229.950			
GROUP 2 WIND 1 1	1	0.000	-938.987	73.775	4185.088	0.000	0.000	0.000	-147.594	-24.599	-1229.950	-1229.950			
GROUP 2 WIND 1 2	1	0.000	-938.987	73.775	4185.088	0.000	0.000	0.000	147.594	24.599	1229.950	1229.950			

PIER-44-6-138-50.OUT															
GROUP	WIND	2	1	1	0.000	-830.971	65.699	3721.727	0.000	0.000	0.000	-363.547	-40.745	-2156.327	-2156.327
GROUP 2	WIND 2	2	1	1	0.000	-830.971	65.699	3721.727	0.000	0.000	0.000	363.547	40.745	2156.327	2156.327
GROUP 2	WIND 3	1	1	1	0.000	-776.963	61.661	3490.047	0.000	0.000	0.000	-579.500	-56.891	-3082.704	-3082.704
GROUP 2	WIND 3	2	1	1	0.000	-776.963	61.661	3490.047	0.000	0.000	0.000	579.500	56.891	3082.704	3082.704
GROUP 2	WIND 4	1	1	1	0.000	-632.941	50.893	2872.233	0.000	0.000	0.000	-723.468	-67.655	-3700.288	-3700.288
GROUP 2	WIND 4	2	1	1	0.000	-632.941	50.893	2872.233	0.000	0.000	0.000	723.468	67.655	3700.288	3700.288
GROUP 2	WIND 5	1	1	1	0.000	-344.897	29.357	1636.605	0.000	0.000	0.000	-831.444	-75.728	-4163.477	-4163.477
GROUP 2	WIND 5	2	1	1	0.000	-344.897	29.357	1636.605	0.000	0.000	0.000	831.444	75.728	4163.477	4163.477
GROUP 3	WIND 1	1	1	1	0.000	-579.542	35.932	2160.572	0.000	0.000	0.000	-44.278	-7.380	-368.985	-368.985
GROUP 3	WIND 1	2	1	1	0.000	-579.542	35.932	2160.572	0.000	0.000	0.000	44.278	7.380	368.985	368.985
GROUP 3	WIND 2	1	1	1	0.000	-511.395	31.854	1912.958	0.000	0.000	0.000	-180.547	-15.536	-864.109	-864.109
GROUP 3	WIND 2	2	1	1	0.000	-511.395	31.854	1912.958	0.000	0.000	0.000	180.547	15.536	864.109	864.109
GROUP 3	WIND 3	1	1	1	0.000	-477.322	29.814	1789.151	0.000	0.000	0.000	-316.816	-23.691	-1359.233	-1359.233
GROUP 3	WIND 3	2	1	1	0.000	-477.322	29.814	1789.151	0.000	0.000	0.000	316.816	23.691	1359.233	1359.233
GROUP 3	WIND 4	1	1	1	0.000	-386.460	24.376	1459.000	0.000	0.000	0.000	-407.661	-29.129	-1689.316	-1689.316
GROUP 3	WIND 4	2	1	1	0.000	-386.460	24.376	1459.000	0.000	0.000	0.000	407.661	29.129	1689.316	1689.316
GROUP 3	WIND 5	1	1	1	0.000	-204.736	13.499	798.697	0.000	0.000	0.000	-475.796	-33.206	-1936.877	-1936.877
GROUP 3	WIND 5	2	1	1	0.000	-204.736	13.499	798.697	0.000	0.000	0.000	475.796	33.206	1936.877	1936.877
LIVE LOAD LL	1	1	1	1	136.053	-2312.904	0.000	2312.904	136.053	2312.904	0.000	0.000	0.000	0.000	0.000

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

LOAD	COL	PC	MT	TRANSVERSE						LONGITUDINAL			
				V	MB	RF	ML	MR	MT	V	MB	MF	
LIVE LOAD LL 2	1	272.107	-2914.952	0.000	2914.952	272.107	2914.952	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 3	1	367.344	-2448.972	0.000	2448.972	367.344	2623.457	-174.485	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 4	1	136.053	2312.904	0.000	-2312.904	136.053	0.000	-2312.904	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 5	1	272.107	2914.952	0.000	-2914.952	272.107	0.000	-2914.952	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 6	1	367.344	2448.972	0.000	-2448.972	367.344	174.485	-2623.457	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 7	1	136.052	-306.110	0.000	306.110	136.052	306.110	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 8	1	272.106	-2183.652	0.000	2183.652	272.106	2183.652	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 9	1	367.344	-1524.479	0.000	1524.479	367.344	1965.287	-440.807	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL10	1	272.106	0.000	0.000	0.000	272.106	397.954	-397.954	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL11	1	367.344	-1827.543	0.000	1827.543	367.344	2185.701	-358.159	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL12	1	272.106	0.000	0.000	0.000	272.106	2312.904	-2312.904	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL13	1	367.344	-541.843	0.000	541.843	367.344	2623.457	-2081.614	0.000	0.000	0.000	0.000	0.000

CAP MOMENTS AND SHEARS

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	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	-16.088	-372.464	-16.088	-372.464	-16.088	-541.763
P 2	-3294.916	-3294.916	-4683.167	-3294.916	-3294.916	-3294.916	-4126.204	-428.585	-848.618	-428.585	-848.618	-597.884	-1250.253
P 3	-7022.569	-7022.569	-10137.851	-7022.569	-7022.569	-7022.569	-8888.007	-886.097	-886.097	-886.097	-886.097	-1287.732	-1287.732
C 1L	-14410.864	-14410.864	-20739.225	-14410.864	-14410.864	-14410.864	-18200.301	-960.977		-960.977		-1362.612	
C 1R	-14410.864	-14410.864	-20739.225	-14410.864	-14410.864	-14410.864	-18200.301		960.977		1362.612		960.977
P 5	-7022.569	-7022.569	-10137.851	-7022.569	-7022.569	-7022.569	-8888.007	886.097	886.097	1287.732	1287.732	886.097	886.097
P 6	-3294.917	-3294.917	-4683.167	-3294.917	-3294.917	-3294.917	-4126.205	848.618	428.585	1250.253	597.884	848.618	428.585
P 7	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	372.464	16.088	541.763	16.088	372.464	16.087

PT.	UNF.		TOP REINFORCE.		BOT. REINFORCE.		CAP DESIGN DATA				D IN.	FC PSI	PS %	FS/FF RATIO	FS/FZ RATIO	
	M+	M-	AS	NO. SIZE	AS	NO. SIZE	M.SP.	AV/IN	LEFT STIRRUPS	RIGHT STIRRUPS						
P 1	-18.750	-18.750	3.12	2 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	57.60	0.08	0.000	0.075
P 2	-2534.551	-3174.003	13.41	9 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.167	D#5@ 7.45	82.79	0.25	0.531	1.199
P 3	-5401.976	-6836.929	25.20	17 # 11	3.12	2 # 11	24.00	0.131	#5@ 4.74	24.00	0.131	#5@ 4.74	96.00	0.42	0.543	0.979
C 1-11085.280-14000.232			48.65	32 # 11	3.12	2 # 11	24.00	0.123	#5@ 5.06	24.00	0.123	#5@ 5.06	105.00M	0.71	0.557	0.903
P 5	-5401.976	-6836.929	25.20	17 # 11	3.12	2 # 11	24.00	0.131	#5@ 4.74	24.00	0.131	#5@ 4.74	96.00	0.42	0.543	0.979
P 6	-2534.551	-3174.004	13.41	9 # 11	3.12	2 # 11	24.00	0.167	D#5@ 7.45	24.00	0.060	#5@10.33	82.79	0.25	0.531	1.199

P 7 -18.750 -18.750 3.12 2 # 11 3.12 2 # 11 24.00 0.060 #5@10.33 0.00 0.000 #5@ 0.00 57.60 0.08 0.000 0.075

PIER-44-6-138-50.OUT

NOTE: *** FS/FZ RATIO EXCEEDS 1.0! ***

NOTE: *** CAP DEPTH HAD TO BE INCREMENTED FOR DESIGN! REVIEW REBAR CONSTRAINTS! RE-ANALYZE IF NEW DEPTH IS USED!
 □ COLUMN ANALYSIS AND DESIGN OUTPUT

CRITICAL COLUMN LOADS

CN	T	B	GR	LLC	WC	R	E	C	S	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	T	1	LL	3	0.0			C		3559.5	-5836.3	0.0	3559.5	5982.2	2530.8	22445.6	37901.4	16034.0	6.329	72.00	192.00
1	B	3	LL	3	5.1			C		4063.2	5800.9	-4758.2	4063.2	6650.3	5555.6	17639.4	28881.0	24126.6	4.343	72.00	192.00

COLUMN DESIGN DATA

CN	T	B	FACE 1	B	FACE 2	D	FACE 3	D	FACE 4	AS	PS	BD12	BD	SUMPU	SUMPC	DEL.T	DEL.L	CM	R	PHIC
1	T	16	# 11	16	# 11	29	# 11	29	# 11	140.40	1.016	1.00	0.000	3971.	162821.	1.025	1.185	1.000	2	0.70
1	B	16	# 11	16	# 11	29	# 11	29	# 11	140.40	1.016	1.00	0.000	3651.	162821.	1.023	1.168	1.000	2	0.70

FOOTING 1 DESIGN LOADS

F	G	LLID	WC	ES	C	S	P	MT	VT	ML	VL	P4	P3	P2	P1	MTF	VBF	VPF	LOAD	
1	3	LL	3	3.1			C	3066.896	5061.489	48.334	-3082.518	-49.968	177.878	112.001	225.173	291.050	67.210	0.000	26.657	MAX.P1
1	3	LL	3	1.1			C	3986.964	7062.782	70.787	-2719.951	-43.753	211.838	153.752	312.129	370.215	88.943	0.000	34.655	MAX.MT
1	3	LL	3	3.1			C	3986.964	6579.935	62.834	-4007.273	-64.958	231.242	145.602	292.725	378.365	87.373	0.000	34.655	MAX.VT
1	3	LL	3	3.1			C	3986.964	6579.935	62.834	-4007.273	-64.958	231.242	145.602	292.725	378.365	87.373	0.000	34.655	MAX.VP
1	3	LL	3	5.1			C	3986.964	5292.345	41.624	-4758.211	-77.328	254.283	152.570	269.684	371.397	431.770	68.558	34.655	MAX.ML
1	3	LL	3	5.1			C	3986.964	5292.345	41.624	-4758.211	-77.328	254.283	152.570	269.684	371.397	431.770	68.558	34.655	MAX.VL
1	3	LL	3	3.1			C	3066.896	5061.489	48.334	-3082.518	-49.968	177.878	112.001	225.173	291.050	67.210	0.000	26.657	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	
21.500	21.500	6.500	0.995	0.43	47 # 4	@ 5.375	TOP TRAN	119.960	74.030	148.060	61.340	0.000	
				1.57	22 #11	@11.625	BOT.LONG	437.845	75.183	150.365	62.295	0.000	

NUMBER OF PILES = 18 BP = 3.167 DP = 4.750