

29-OCT-09
17:16:45

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; 139' SPAN; 50' TALL; BRIDGE 4 ; PIER 13

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	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	18.94	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 FORCE			* WIND ON PIER		
STAND. TRANS.	WIND FT1	WIND FT2	WIND FT3	WIND FT4	WIND FT5	WIND FT1	WIND FT2	WIND FT3	WIND FT4	WIND FT5	APT	APL	APT	APL	PT	PL
1350.	2701.	1	50	0	44	6	41	12	33	16	17	19	7.375	7.375	6.475	24.599

GROUP III WIND	WIND ON SUPERSTRUCTURE INTENSITIES										* WIND ON LIVE LOAD INTENSITIES					* LENGTHS OF LL				* WIND ON LL					
STAND. WIND	FT1	FT2	FT3	FT4	FT5	FT1	FT2	FT3	FT4	FT5	FT1	FT2	FT3	FT4	FT5	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	138.5	277.0	15.583	15.583

MISCELLANEOUS FORCES

CENTRI. FT	TRACTION FL	FORCE APT	AND ARMS APL	EXPANSION COEFFICIENT	SHRINKAGE COEFFICIENT	STREAM PT	FLOW PL
6.859	9.764	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	275.097	324.209	0.000	648.418	0.000	324.209	275.097					
LL 1	1	78.181	58.220	0.000	0.000	0.000	0.000	0.000					
LL 2	2	78.181	107.291	0.000	87.329	0.000	0.000	0.000					
LL 3	3	78.181	107.291	0.000	207.929	0.000	15.802	0.000					
LL 4	1	0.000	0.000	0.000	0.000	0.000	58.220	78.181					
LL 5	2	0.000	0.000	0.000	87.329	0.000	107.291	78.181					
LL 6	3	0.000	15.802	0.000	207.929	0.000	107.291	78.181					
LL 7	1	0.000	24.951	0.000	111.449	0.000	0.000	0.000					
LL 8	2	39.922	111.450	0.000	121.430	0.000	0.000	0.000					
LL 9	3	39.922	111.450	0.000	217.910	0.000	39.922	0.000					
LL10	2	0.000	32.437	0.000	207.928	0.000	32.437	0.000					
LL11	3	47.408	118.935	0.000	210.424	0.000	32.437	0.000					
LL12	2	78.181	58.220	0.000	0.000	0.000	58.220	78.181					
LL13	3	78.181	107.291	0.000	87.329	0.000	58.220	78.181					

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	2130.980	0.000	0.000	0.000	2764.580	11118.597	-11118.597	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	-210.736	-9.764	-640.352	-640.352		
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	-941.662	73.975	4196.562	0.000	0.000	0.000	-147.594	-24.599	-1229.950	-1229.950		
GROUP 2 WIND 1 2	1	0.000	-941.662	73.975	4196.562	0.000	0.000	0.000	147.594	24.599	1229.950	1229.950		

PIER-44-6-139-50.out															
GROUP	WIND	2	1	1	0.000	-833.325	65.875	3731.825	0.000	0.000	0.000	-364.349	-40.805	-2159.769	-2159.769
GROUP 2	WIND 2	2	1	1	0.000	-833.325	65.875	3731.825	0.000	0.000	0.000	364.349	40.805	2159.769	2159.769
GROUP 2	WIND 3	1	1	1	0.000	-779.156	61.825	3499.456	0.000	0.000	0.000	-581.104	-57.011	-3089.588	-3089.588
GROUP 2	WIND 3	2	1	1	0.000	-779.156	61.825	3499.456	0.000	0.000	0.000	581.104	57.011	3089.588	3089.588
GROUP 2	WIND 4	1	1	1	0.000	-634.706	51.025	2879.806	0.000	0.000	0.000	-725.608	-67.815	-3709.468	-3709.468
GROUP 2	WIND 4	2	1	1	0.000	-634.706	51.025	2879.806	0.000	0.000	0.000	725.608	67.815	3709.468	3709.468
GROUP 2	WIND 5	1	1	1	0.000	-345.806	29.425	1640.506	0.000	0.000	0.000	-833.986	-75.918	-4174.378	-4174.378
GROUP 2	WIND 5	2	1	1	0.000	-345.806	29.425	1640.506	0.000	0.000	0.000	833.986	75.918	4174.378	4174.378
GROUP 3	WIND 1	1	1	1	0.000	-581.423	36.042	2167.293	0.000	0.000	0.000	-44.278	-7.380	-368.985	-368.985
GROUP 3	WIND 1	2	1	1	0.000	-581.423	36.042	2167.293	0.000	0.000	0.000	44.278	7.380	368.985	368.985
GROUP 3	WIND 2	1	1	1	0.000	-513.051	31.950	1918.873	0.000	0.000	0.000	-181.047	-15.566	-865.929	-865.929
GROUP 3	WIND 2	2	1	1	0.000	-513.051	31.950	1918.873	0.000	0.000	0.000	181.047	15.566	865.929	865.929
GROUP 3	WIND 3	1	1	1	0.000	-478.865	29.904	1794.663	0.000	0.000	0.000	-317.815	-23.751	-1362.872	-1362.872
GROUP 3	WIND 3	2	1	1	0.000	-478.865	29.904	1794.663	0.000	0.000	0.000	317.815	23.751	1362.872	1362.872
GROUP 3	WIND 4	1	1	1	0.000	-387.702	24.448	1463.436	0.000	0.000	0.000	-408.994	-29.208	-1694.168	-1694.168
GROUP 3	WIND 4	2	1	1	0.000	-387.702	24.448	1463.436	0.000	0.000	0.000	408.994	29.208	1694.168	1694.168
GROUP 3	WIND 5	1	1	1	0.000	-205.376	13.536	800.982	0.000	0.000	0.000	-477.378	-33.301	-1942.640	-1942.640
GROUP 3	WIND 5	2	1	1	0.000	-205.376	13.536	800.982	0.000	0.000	0.000	477.378	33.301	1942.640	1942.640
LIVE LOAD LL	1	1	1	1	136.401	-2318.816	0.000	2318.816	136.401	2318.816	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	272.801	-2922.390	0.000	2922.390	272.801	2922.390	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 3	1	368.283	-2455.223	0.000	2455.223	368.283	2630.151	-174.928	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 4	1	136.401	2318.816	0.000	-2318.816	136.401	0.000	-2318.816	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 5	1	272.801	2922.390	0.000	-2922.390	272.801	0.000	-2922.390	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 6	1	368.283	2455.222	0.000	-2455.222	368.283	174.928	-2630.151	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 7	1	136.400	-306.897	0.000	306.897	136.400	306.897	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 8	1	272.802	-2189.236	0.000	2189.236	272.802	2189.236	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 9	1	368.284	-1528.376	0.000	1528.376	368.284	1970.312	-441.937	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL10	1	272.802	0.000	0.000	0.000	272.802	398.975	-398.975	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL11	1	368.284	-1832.210	0.000	1832.210	368.284	2191.288	-359.078	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL12	1	272.802	0.000	0.000	0.000	272.802	2318.816	-2318.816	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL13	1	368.282	-543.216	0.000	543.216	368.282	2630.151	-2086.935	0.000	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	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	-24.375	-16.088	-373.714	-16.088	-373.714	-16.088	-543.445
P 2	-3305.160	-3305.160	-4696.954	-3305.160	-3305.160	-3305.160	-4138.570	-429.835	-851.306	-429.835	-851.306	-599.566	-1253.966
P 3	-7044.373	-7044.373	-10167.604	-7044.373	-7044.373	-7044.373	-8914.570	-888.785	-888.785	-888.785	-888.785	-1291.445	-1291.445
C 1L	-14454.175	-14454.175	-20798.684	-14454.175	-14454.175	-14454.175	-18253.281	-963.665		-963.665		-1366.325	
C 1R	-14454.175	-14454.175	-20798.684	-14454.175	-14454.175	-14454.175	-18253.281		963.665		1366.325		963.665
P 5	-7044.372	-7044.372	-10167.604	-7044.372	-7044.372	-7044.372	-8914.570	888.785	888.785	1291.445	1291.445	888.785	888.785
P 6	-3305.159	-3305.159	-4696.953	-3305.159	-3305.159	-3305.159	-4138.569	851.306	429.835	1253.966	599.566	851.306	429.835
P 7	-24.374	-24.373	-24.374	-24.374	-24.374	-24.373	-24.374	373.714	16.088	543.445	16.088	373.714	16.088

PT.	UNF.		TOP REINFORCE.		BOT. REINFORCE.		CAP DESIGN DATA		RIGHT STIRRUPS		D IN.	FC PSI	PS %	FS/FF RATIO	FS/FZ RATIO	
	M+ K-FT.	M- K-FT.	AS	NO. SIZE	AS	NO. SIZE	M.SP.	AV/IN	BAR&SPAC	M.SP.						AV/IN
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	-2542.431	-3183.515	13.45	9 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.167	D#5@ 7.40	82.79	0.25	0.534	1.202
P 3	-5418.749	-6857.362	25.28	17 # 11	3.12	2 # 11	24.00	0.132	#5@ 4.71	24.00	0.132	#5@ 4.71	96.00	0.42	0.546	0.982
C 1-11118.597-14040.986			48.80	32 # 11	3.12	2 # 11	24.00	0.123	#5@ 5.03	24.00	0.123	#5@ 5.03	105.00M	0.71	0.560	0.906
P 5	-5418.748	-6857.362	25.28	17 # 11	3.12	2 # 11	24.00	0.132	#5@ 4.71	24.00	0.132	#5@ 4.71	96.00	0.42	0.546	0.982
P 6	-2542.430	-3183.515	13.45	9 # 11	3.12	2 # 11	24.00	0.167	D#5@ 7.40	24.00	0.060	#5@10.33	82.79	0.25	0.534	1.202

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P 7 -18.749 -18.749 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

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		3569.8	-5849.9	0.0	3569.8	5996.5	2539.3	22445.4	37882.0	16041.5	6.310	72.00	192.00
1	B	3	LL	9	5.1			C		4072.7	4607.1-4773.1	4072.7	6666.2	5575.3	17627.9	28863.7	24140.3	4.330	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	3982.	162821.	1.025	1.186	1.000	2	0.70
1	B	16	# 11	16	# 11	29	# 11	29	# 11	140.40	1.016	1.00	0.000	3661.	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	3074.218	5073.467	48.424-3091.824	-50.114	177.295	111.462	224.644	290.477	67.198	0.000	26.963	MAX.P1
1	3	LL	3	1.1			C	3996.483	7079.927	70.930-2727.317	-43.865	211.084	153.053	311.437	369.468	88.927	0.000	35.052	MAX.MT
1	3	LL	3	3.1			C	3996.483	6595.507	62.951-4019.371	-65.148	230.484	144.901	292.037	377.620	87.357	0.000	35.052	MAX.VT
1	3	LL11	3.1				C	3996.484	5914.562	62.951-4019.371	-65.148	237.652	152.069	284.869	370.452	85.357	0.000	35.052	MAX.VP
1	3	LL	3	5.1			C	3996.483	5303.723	41.673-4773.069	-77.563	253.518	151.862	269.003	370.658	432.075	68.104	35.052	MAX.ML
1	3	LL	3	5.1			C	3996.483	5303.723	41.673-4773.069	-77.563	253.518	151.862	269.003	370.658	432.075	68.104	35.052	MAX.VL
1	3	LL	2	3.1			C	2993.940	5151.359	43.622-2643.577	-43.279	167.585	111.245	225.434	281.775	66.094	0.000	26.265	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	6.250	0.993	0.45	49 # 4	@ 5.250	TOP TRAN	118.879	70.409	140.819	58.340	0.000	
				1.66	23 #11	@11.125	BOT.LONG	434.760	71.562	143.124	59.295	0.000	

NUMBER OF PILES = 18 BP = 3.167 DP = 4.750