

13-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
43' CURB-CURB; 6 BEAMS; 140' SPAN; 50' TALL; BRIDGE 17 ; PIER 27

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	ALL.PILE	I	P	
MIN.P	MAX.P	CL.SP.	CLEAR	MODE	COEF					%	KCF	KSF		PL	SP	DIST	DEPTH	CLEAR	CAPACITY	UPLIFT				
1.00	8.00	2.50	3.750	2	2.00	0.70	0.90	1.00	1.00	0.75	18.87	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	L	23.320	7.625	4.000	6.000	6.000	4.000	15.695	19.745	7.898	4.222					
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	15.250	6.000	15.250	6.000	6.000	0.000	15	6	11	15	6	11	43	16	11	43	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	17.250	17.250	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															
SUPERSTRUCTURE AREA*STD.															
TRANS. LONG. WIND FT1 FL1 WIND ON SUPERSTRUCTURE INTENSITIES * WIND FORCE ARM * WIND ON PIER															
1365. 2730. 1 50 0 44 6 41 12 33 16 17 19 7.375 7.375 6.475 23.822															

GROUP III WIND

STD.	* WIND ON SUPERSTRUCTURE INTENSITIES	* STD.	* WIND ON LIVE LOAD INTENSITIES	* LENGTHS OF LL	* WIND ON LL	LL ARMS	
WIND FT1	FL1 FT2 FL2 FT3 FL3 FT4 FL4 FT5 FL5	WIND FT1	FL1 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	140.0	280.0	15.583	15.583

MISCELLANEOUS FORCES

CENTRI.	TRACTION	FORCE	AND	ARMS	EXPANSION	SHRINKAGE	STREAM	FLOW
FT	FL	APT	APL	COEFFICIENT	COEFFICIENT	PT	PL	
0.000	9.860	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	276.646	319.768	0.000	639.536	0.000	319.768	276.646					
LL 1	1	84.347	53.064	0.000	0.000	0.000	0.000	0.000					
LL 2	2	84.347	103.050	0.000	87.426	0.000	0.000	0.000					
LL 3	3	84.347	103.050	0.000	204.342	0.000	20.495	0.000					
LL 4	1	0.000	0.000	0.000	0.000	0.000	53.064	84.347					
LL 5	2	0.000	0.000	0.000	87.426	0.000	103.050	84.347					
LL 6	3	0.000	20.495	0.000	204.342	0.000	103.050	84.347					
LL 7	1	0.000	26.097	0.000	111.314	0.000	0.000	0.000					
LL 8	2	44.383	111.314	0.000	119.125	0.000	0.000	0.000					
LL 9	3	44.383	111.314	0.000	212.154	0.000	44.383	0.000					
LL10	2	0.000	35.240	0.000	204.342	0.000	35.240	0.000					
LL11	3	54.856	117.795	0.000	204.342	0.000	35.240	0.000					
LL12	2	84.347	53.064	0.000	0.000	0.000	53.064	84.347					
LL13	3	84.347	103.050	0.000	87.426	0.000	53.064	84.347					

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	2111.670	0.000	0.000	0.000	2715.570	10697.414	-10697.414	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	-212.808	-9.860	-646.648	-646.648
WIND ON SUBSTR.	1	0.000	-38.850	6.475	323.750	0.000	0.000	0.000	-142.932	-23.822	-1191.100	-1191.100
GROUP 2 WIND 1 1	1	0.000	-951.694	74.725	4239.594	0.000	0.000	0.000	-142.932	-23.822	-1191.100	-1191.100
GROUP 2 WIND 1 2	1	0.000	-951.694	74.725	4239.594	0.000	0.000	0.000	142.932	23.822	1191.100	1191.100
GROUP 2 WIND 2 1	1	0.000	-842.152	66.535	3769.693	0.000	0.000	0.000	-362.015	-40.202	-2130.903	-2130.903

										PIER-43-6-140-50.OUT					
GROUP	WIND	2	2	1	0.000	-842.152	66.535	3769.693	0.000	0.000	0.000	362.015	40.202	2130.903	2130.903
GROUP 2	WIND	3	1	1	0.000	-787.382	62.440	3534.742	0.000	0.000	0.000	-581.097	-56.582	-3070.705	-3070.705
GROUP 2	WIND	3	2	1	0.000	-787.382	62.440	3534.742	0.000	0.000	0.000	581.097	56.582	3070.705	3070.705
GROUP 2	WIND	4	1	1	0.000	-641.327	51.520	2908.207	0.000	0.000	0.000	-727.152	-67.502	-3697.240	-3697.240
GROUP 2	WIND	4	2	1	0.000	-641.327	51.520	2908.207	0.000	0.000	0.000	727.152	67.502	3697.240	3697.240
GROUP 2	WIND	5	1	1	0.000	-349.217	29.680	1655.137	0.000	0.000	0.000	-836.693	-75.692	-4167.141	-4167.141
GROUP 2	WIND	5	2	1	0.000	-349.217	29.680	1655.137	0.000	0.000	0.000	836.693	75.692	4167.141	4167.141
GROUP 3	WIND	1	1	1	0.000	-587.670	36.417	2190.040	0.000	0.000	0.000	-42.880	-7.147	-357.330	-357.330
GROUP 3	WIND	1	2	1	0.000	-587.670	36.417	2190.040	0.000	0.000	0.000	42.880	7.147	357.330	357.330
GROUP 3	WIND	2	1	1	0.000	-518.548	32.280	1938.890	0.000	0.000	0.000	-181.123	-15.421	-859.630	-859.630
GROUP 3	WIND	2	2	1	0.000	-518.548	32.280	1938.890	0.000	0.000	0.000	181.123	15.421	859.630	859.630
GROUP 3	WIND	3	1	1	0.000	-483.987	30.212	1813.315	0.000	0.000	0.000	-319.367	-23.695	-1361.929	-1361.929
GROUP 3	WIND	3	2	1	0.000	-483.987	30.212	1813.315	0.000	0.000	0.000	319.367	23.695	1361.929	1361.929
GROUP 3	WIND	4	1	1	0.000	-391.825	24.696	1478.449	0.000	0.000	0.000	-411.529	-29.211	-1696.796	-1696.796
GROUP 3	WIND	4	2	1	0.000	-391.825	24.696	1478.449	0.000	0.000	0.000	411.529	29.211	1696.796	1696.796
GROUP 3	WIND	5	1	1	0.000	-207.500	13.664	808.716	0.000	0.000	0.000	-480.651	-33.348	-1947.946	-1947.946
GROUP 3	WIND	5	2	1	0.000	-207.500	13.664	808.716	0.000	0.000	0.000	480.651	33.348	1947.946	1947.946
LIVE LOAD	LL	1	1	1	137.411	-2294.081	0.000	2294.081	137.411	2294.081	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL	2	1	1	274.823	-2886.265	0.000	2886.265	274.823	2886.265	0.000	0.000	0.000	0.000	0.000

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

													TRANSVERSE			* LONGITUDINAL		
LOAD	COL	PC	MT	V	MB	RF	ML	MR	MT	V	MB	MF						
LIVE LOAD LL 3	1	371.011	-2379.115	0.000	2379.115	371.011	2597.639	-218.524	0.000	0.000	0.000	0.000						
LIVE LOAD LL 4	1	137.411	2294.081	0.000	-2294.081	137.411	0.000	-2294.081	0.000	0.000	0.000	0.000						
LIVE LOAD LL 5	1	274.823	2886.265	0.000	-2886.265	274.823	0.000	-2886.265	0.000	0.000	0.000	0.000						
LIVE LOAD LL 6	1	371.011	2379.115	0.000	-2379.115	371.011	218.524	-2597.639	0.000	0.000	0.000	0.000						
LIVE LOAD LL 7	1	137.411	-309.171	0.000	309.171	137.411	309.171	0.000	0.000	0.000	0.000	0.000						
LIVE LOAD LL 8	1	274.822	-2195.079	0.000	2195.079	274.822	2195.079	0.000	0.000	0.000	0.000	0.000						
LIVE LOAD LL 9	1	371.011	-1502.347	0.000	1502.347	371.011	1975.572	-473.225	0.000	0.000	0.000	0.000						
LIVE LOAD LL10	1	274.822	0.000	0.000	0.000	274.822	417.488	-417.488	0.000	0.000	0.000	0.000						
LIVE LOAD LL11	1	371.010	-1855.045	0.000	1855.045	371.010	2230.784	-375.740	0.000	0.000	0.000	0.000						
LIVE LOAD LL12	1	274.822	0.000	0.000	0.000	274.822	2294.081	-2294.081	0.000	0.000	0.000	0.000						
LIVE LOAD LL13	1	371.011	-532.966	0.000	532.966	371.011	2597.639	-2064.673	0.000	0.000	0.000	0.000						

□ CAP ANALYSIS AND DESIGN DATA

														CAP MOMENTS AND SHEARS							
														**							
														MOMENTS(KIP-FEET)				SHEARS(KIPS)			
POINT	D.L.TOT.	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	-32.177	-32.177	-32.177	-32.177	-32.177	-32.177	-32.177	-18.636	-378.276	-18.636	-378.276	-18.636	-561.394								
P 2	-3223.501	-3223.501	-4669.761	-3223.501	-3223.501	-3223.501	-4089.525	-432.958	-848.657	-432.958	-848.657	-616.076	-1255.496								
P 3	-6882.471	-6882.471	-10046.406	-6882.471	-6882.471	-6882.471	-8777.043	-885.517	-885.517	-885.517	-885.517	-1292.356	-1292.356								
C 1L	-13906.638	-13906.638	-20172.719	-13906.638	-13906.638	-13906.638	-17658.783	-956.887		-956.887		-1363.726									
C 1R	-13906.638	-13906.638	-20172.719	-13906.638	-13906.638	-13906.638	-17658.783		956.887		1363.726		956.887								
P 5	-6882.471	-6882.471	-10046.406	-6882.471	-6882.471	-6882.471	-8777.043	885.517	885.517	1292.356	1292.356	885.517	885.517								
P 6	-3223.500	-3223.500	-4669.761	-3223.500	-3223.500	-3223.500	-4089.525	848.657	432.958	1255.496	616.076	848.657	432.958								
P 7	-32.177	-32.177	-32.177	-32.177	-32.177	-32.177	-32.177	378.276	18.636	561.394	18.636	378.276	18.636								

														CAP DESIGN DATA													
														LEFT STIRRUPS		RIGHT STIRRUPS		D		FC		PS		FS/FF		FS/FZ	
PT.	M+ UNF. K-FT.	M- UNF. K-FT.	TOP REINFORCE. AS NO.SIZE	BOT.REINFORCE. AS NO.SIZE	M.SP.	AV/IN	BAR&SPAC	M.SP.	AV/IN	BAR&SPAC	D IN.	FC PSI	PS %	FS/FF RATIO	FS/FZ RATIO												
P 1	-24.752	-24.752	3.12 2 # 11	3.12 2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	58.93		0.08	0.000	0.097												
P 2	-2479.616	-3145.789	13.32 9 # 11	3.12 2 # 11	24.00	0.060	#5@10.33	24.00	0.167D#5@	7.44	83.09		0.25	0.542	1.183												
P 3	-5294.209	-6751.572	24.97 17 # 11	3.12 2 # 11	24.00	0.132	#5@ 4.71	24.00	0.132	#5@ 4.71	96.00		0.41	0.545	0.967												
C 1-10697.414-13583.680			48.89 32 # 11	3.12 2 # 11	24.00	0.131	#5@ 4.73	24.00	0.131	#5@ 4.73	102.00M		0.74	0.568	0.905												
P 5	-5294.209	-6751.572	24.97 17 # 11	3.12 2 # 11	24.00	0.132	#5@ 4.71	24.00	0.132	#5@ 4.71	96.00		0.41	0.545	0.967												
P 6	-2479.616	-3145.788	13.32 9 # 11	3.12 2 # 11	24.00	0.167D#5@	7.44	24.00	0.060	#5@10.33	83.09		0.25	0.542	1.183												
P 7	-24.751	-24.752	3.12 2 # 11	3.12 2 # 11	24.00	0.060	#5@10.33	0.00	0.000	#5@ 0.00	58.93		0.08	0.000	0.097												

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					3550.6	-5165.1	0.0	3550.6	5570.1	2545.0	21452.7	33816.7	15451.2	6.064	72.00	183.00
1	B		3	LL 3	5.1					4012.6	4144.2-4802.1		4012.6	6280.0	5646.7	16535.4	25887.0	23276.4	4.122	72.00	183.00

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		27 # 11		27 # 11	134.16	1.018	1.00	0.000	3943.	141359.	1.029	1.195	1.000	2	0.70
1	B		16 # 11		16 # 11		27 # 11		27 # 11	134.16	1.018	1.00	0.000	3620.	141359.	1.026	1.176	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				3027.684	3814.758	30.212-3107.880	-50.317	201.145	122.433	215.012	293.724	89.335	0.000	28.936	MAX.P1	
1	3	LL 2	1.1				3830.796	6003.563	47.343-2145.815	-34.927	218.663	164.293	309.966	364.336	118.565	0.000	36.600	MAX.MT	
1	3	LL 2	3.1				3830.796	5513.821	39.276-3451.794	-56.439	241.435	153.942	287.194	374.687	116.234	0.000	36.600	MAX.VT	
1	3	LL 3	3.1				3935.990	4959.185	39.276-4040.244	-65.412	261.488	159.162	279.516	381.842	116.136	0.000	37.617	MAX.VP	
1	3	LL 3	4.1				3935.990	4523.859	32.105-4475.570	-72.582	272.529	159.162	268.475	381.842	365.804	54.476	37.617	MAX.ML	
1	3	LL 3	4.1				3935.990	4523.859	32.105-4475.570	-72.582	272.529	159.162	268.475	381.842	365.804	54.476	37.617	MAX.VL	
1	3	LL 2	3.1				2946.766	4241.401	30.212-2655.226	-43.415	185.719	118.417	220.918	288.221	89.411	0.000	28.153	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	
21.850	21.850	5.500	1.000	0.72	51 # 5	@ 5.125	TOP TRAN	158.471	59.472	118.944	49.278	0.000	
				1.66	24 #11	@10.875	BOT.LONG	376.710	60.700	121.400	50.295	0.000	

NUMBER OF PILES = 17 BP = 3.225 DP = 3.225