

12-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
36' CURB-CURB; 5 BEAMS; 140' SPAN; 40' TALL; BRIDGE 17 ; PIER 22,23

PROB. NO. 0001

DESIGN DATA												DESIGN DATA														
DESIGN NO.	NO. CAN	NO. COL	NO. LLC	SKEW D	ANG M	F'C PSI	FC PSI	N	FY PSI	FS PSI	DESIGN EC KSI	ES KSI	CONC. STRAIN	Z FACT	* MAIN SIZE	* STR TOP	* CAP MAX	REINFORCING MAX	STEEL MIN	* TOP	* CAP MIN	* CAP INCR.	* CAP BOT			
D	D	D	L	2	1	12	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 MIN.P	REINFORCING MAX.P	STEEL CL.SP.	STEEL CLEAR	R MODE	KL COEF	OC	OF	CM	BD1	BD2	IMPACT %	SOIL KCF	WT KSF	ALL.S.P.	MIN PL	MAX SP	EDGE DIST	PILE DEPTH	REBAR CLEAR	ALL.PILE CAPACITY	PILE UPLIFT	ALL.PILE INCR.	PILE I P			
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	19.625	4.000	4.000	6.000	6.000	4.000	15.625	16.000	8.000	4.000					
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		40.000	0.000	8.000	6.000	8.000	6.000	6.000	0.000	8	6	11	8	6	11	22	16	11	22	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	10.000	10.000	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 INTENSITIES																
WIND TRANS.	FT1	FT2	FT3	FT4	FT5	FT1	FT2	FT3	FT4	FT5	WIND ON PIER	ARM APL	WIND ON PIER	PT	PL	
1365.	2730.	1	50	0	44	6	41	12	33	16	17	19	7.375	7.375	5.273	14.323

GROUP III WIND

STD. WIND	FT1	FT2	FT3	FT4	FT5	STD. WIND	FT1	FT2	FT3	FT4	FT5	LENGTHS OF TRANS.	LL LONGI.	WIND ON PIER	LL ARMS 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. FT	TRACTION FL	FORCE APT	AND ARMS APL	EXPANSION COEFFICIENT	SHRINKAGE COEFFICIENT	STREAM PT	FLOW PL
10.984	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	281.621	325.334	0.000	325.334	0.000	325.334	281.621					
LL 1	1	85.882	51.529	0.000	0.000	0.000	0.000	0.000					
LL 2	2	85.882	103.059	0.000	85.882	0.000	0.000	0.000					
LL 3	3	85.882	103.059	0.000	120.235	0.000	85.882	17.176					
LL 4	1	0.000	0.000	0.000	0.000	0.000	51.529	85.882					
LL 5	2	0.000	0.000	0.000	85.882	0.000	103.059	85.882					
LL 6	3	17.176	85.882	0.000	120.235	0.000	103.059	85.882					
LL 7	1	0.000	25.764	0.000	85.882	0.000	25.764	0.000					
LL 8	2	42.941	111.647	0.000	94.470	0.000	25.764	0.000					
LL 9	3	42.941	111.647	0.000	103.059	0.000	111.647	42.941					
LL10	2	0.000	85.882	0.000	103.059	0.000	85.882	0.000					
LL11	2	85.882	51.529	0.000	0.000	0.000	51.529	85.882					
LL12	3	85.882	103.059	0.000	85.882	0.000	51.529	85.882					

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	40.000	0.000	0.000	0.000	6.000	1.000	40.000	40.000
DEAD LOAD TOTAL	1	1765.594	2010.394	0.000	0.000	0.000	2010.394	8089.646	-8089.646	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	-548.048	-548.048
CENT. FORCE 1 LN	1	0.000	-237.068	10.984	610.524	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WIND ON SUBSTR.	1	0.000	-31.638	5.273	210.920	0.000	0.000	0.000	-85.938	-14.323	-572.920	-572.920
GROUP 2 WIND 1 1	1	0.000	-944.482	73.523	3444.264	0.000	0.000	0.000	-85.938	-14.323	-572.920	-572.920
GROUP 2 WIND 1 2	1	0.000	-944.482	73.523	3444.264	0.000	0.000	0.000	85.938	14.323	572.920	572.920
GROUP 2 WIND 2 1	1	0.000	-834.940	65.333	3056.262	0.000	0.000	0.000	-305.021	-30.703	-1348.923	-1348.923

PIER-36-5-140-40.OUT																
GROUP	WIND	2	2	1	0.000	-834.940	65.333	3056.262	0.000	0.000	0.000	305.021	30.703	1348.923	1348.923	
GROUP 2	WIND	3	1	1	0.000	-780.170	61.238	2862.262	0.000	0.000	0.000	-524.103	-47.083	-2124.925	-2124.925	
GROUP 2	WIND	3	2	1	0.000	-780.170	61.238	2862.262	0.000	0.000	0.000	524.103	47.083	2124.925	2124.925	
GROUP 2	WIND	4	1	1	0.000	-634.115	50.318	2344.927	0.000	0.000	0.000	-670.158	-58.003	-2642.260	-2642.260	
GROUP 2	WIND	4	2	1	0.000	-634.115	50.318	2344.927	0.000	0.000	0.000	670.158	58.003	2642.260	2642.260	
GROUP 2	WIND	5	1	1	0.000	-342.005	28.478	1310.257	0.000	0.000	0.000	-779.699	-66.193	-3030.261	-3030.261	
GROUP 2	WIND	5	2	1	0.000	-342.005	28.478	1310.257	0.000	0.000	0.000	779.699	66.193	3030.261	3030.261	
GROUP 3	WIND	1	1	1	0.000	-585.507	36.057	1811.441	0.000	0.000	0.000	-25.781	-4.297	-171.876	-171.876	
GROUP 3	WIND	1	2	1	0.000	-585.507	36.057	1811.441	0.000	0.000	0.000	25.781	4.297	171.876	171.876	
GROUP 3	WIND	2	1	1	0.000	-516.385	31.920	1601.661	0.000	0.000	0.000	-164.025	-12.571	-591.436	-591.436	
GROUP 3	WIND	2	2	1	0.000	-516.385	31.920	1601.661	0.000	0.000	0.000	164.025	12.571	591.436	591.436	
GROUP 3	WIND	3	1	1	0.000	-481.824	29.851	1496.771	0.000	0.000	0.000	-302.269	-20.845	-1010.995	-1010.995	
GROUP 3	WIND	3	2	1	0.000	-481.824	29.851	1496.771	0.000	0.000	0.000	302.269	20.845	1010.995	1010.995	
GROUP 3	WIND	4	1	1	0.000	-389.661	24.335	1217.065	0.000	0.000	0.000	-394.431	-26.361	-1290.702	-1290.702	
GROUP 3	WIND	4	2	1	0.000	-389.661	24.335	1217.065	0.000	0.000	0.000	394.431	26.361	1290.702	1290.702	
GROUP 3	WIND	5	1	1	0.000	-205.337	13.303	657.652	0.000	0.000	0.000	-463.553	-30.498	-1500.481	-1500.481	
GROUP 3	WIND	5	2	1	0.000	-205.337	13.303	657.652	0.000	0.000	0.000	463.553	30.498	1500.481	1500.481	
LIVE LOAD	LL	1	1	1	137.411	-1786.344	0.000	1786.344	137.411	1786.344	0.000	0.000	0.000	0.000	0.000	0.000

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

LOAD	COL	TRANSVERSE								LONGITUDINAL				
		PC	MT	V	MB	RF	ML	MR	MT	V	MB	MF		
LIVE LOAD	LL 2	1	274.823	-2198.584	0.000	2198.584	274.823	2198.584	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 3	1	371.011	-1113.041	0.000	1113.041	371.011	1978.726	-865.685	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 4	1	137.411	1786.344	0.000	-1786.344	137.411	0.000	-1786.344	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 5	1	274.823	2198.584	0.000	-2198.584	274.823	0.000	-2198.584	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 6	1	371.011	1113.041	0.000	-1113.041	371.011	865.685	-1978.726	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 7	1	137.410	0.000	0.000	0.000	137.410	206.112	-206.112	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 8	1	274.822	-1374.120	0.000	1374.120	274.822	1580.232	-206.112	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 9	1	371.011	0.000	0.000	0.000	371.011	1422.209	-1422.209	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL10	1	274.823	0.000	0.000	0.000	274.823	687.056	-687.056	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL11	1	274.822	0.000	0.000	0.000	274.822	1786.344	-1786.344	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL12	1	371.011	-371.016	0.000	371.016	371.011	1978.726	-1607.710	0.000	0.000	0.000	0.000	0.000

□ CAP ANALYSIS AND DESIGN DATA

POINT	MOMENTS (KIP-FEET)								SHEARS (KIPS)							
	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	-33.127	-33.127	-33.127	-33.127	-33.127	-33.127	-33.127	-18.933	-385.040	-18.933	-385.040	-18.933	-571.490			
P 2	-3323.512	-3323.512	-4815.111	-3323.512	-3323.512	-3323.512	-4216.685	-440.751	-863.685	-440.751	-863.685	-627.201	-1273.876			
P 3	-6846.743	-6846.743	-9979.105	-6846.743	-6846.743	-6846.743	-8722.409	-898.729	-898.729	-898.729	-898.729	-1308.920	-1308.920			
C 1L	-10516.539	-10516.539	-15289.665	-10516.539	-10516.539	-10516.539	-13374.699	-936.169		-936.169		-1346.360				
C 1R	-10516.539	-10516.539	-15289.665	-10516.539	-10516.539	-10516.539	-13374.699		936.169		1346.360		936.169			
P 5	-6846.743	-6846.743	-9979.104	-6846.743	-6846.743	-6846.743	-8722.409	898.729	898.729	1308.920	1308.920	898.729	898.729			
P 6	-3323.512	-3323.512	-4815.110	-3323.512	-3323.512	-3323.512	-4216.685	863.685	440.751	1273.876	627.201	863.685	440.751			
P 7	-33.127	-33.127	-33.127	-33.127	-33.127	-33.127	-33.127	385.040	18.933	571.490	18.933	385.040	18.933			

PT.	UNF. K-FT.		TOP REINFORCE. AS NO. SIZE		BOT. REINFORCE. AS NO. SIZE		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 BAR&SPAC	RIGHT STIRRUPS BAR&SPAC						
P 1	-25.482	-25.482	3.12	2 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	59.14	0.08	0.000	0.099
P 2	-2556.548	-3243.604	13.63	9 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.169D#5@ 7.35	83.71		0.25	0.563	1.210
P 3	-5266.726	-6709.546	24.80	16 # 11	3.12	2 # 11	24.00	0.135	#5@ 4.59	24.00	0.135	#5@ 4.59	96.00	0.41	0.593	1.040
C 1	-8089.646	-10288.230	38.97	25 # 11	3.12	2 # 11	24.00	0.145	#5@ 4.29	24.00	0.145	#5@ 4.29	96.00	0.63	0.593	0.977
P 5	-5266.726	-6709.545	24.80	16 # 11	3.12	2 # 11	24.00	0.135	#5@ 4.59	24.00	0.135	#5@ 4.59	96.00	0.41	0.593	1.040
P 6	-2556.548	-3243.604	13.63	9 # 11	3.12	2 # 11	24.00	0.169D#5@ 7.35	24.00	0.060	#5@10.33	83.71		0.25	0.563	1.210
P 7	-25.482	-25.482	3.12	2 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	0.00	0.000	#5@ 0.00	59.14	0.08	0.000	0.099

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

PIER-36-5-140-40.OUT

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 2	0.0			C		2891.9	-5389.5	0.0	2891.9	5925.0	2041.3	8083.6	16563.8	5706.7	2.796	72.00	96.00
1	B		3	LL 2	4.1			C		2970.8	6027.7	-3102.8	2970.8	6575.4	3600.5	6625.1	14636.5	8014.6	2.227	72.00	96.00

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		15 # 11		15 # 11		8 # 11		8 # 11	71.76	1.038	1.00	0.000	3051.	33756.	1.099	1.176	1.000	2	0.70
1	B		15 # 11		15 # 11		8 # 11		8 # 11	71.76	1.038	1.00	0.000	2812.	33756.	1.091	1.160	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		2322.509	4081.537	59.508-2490.726	-47.467	176.986	106.122	222.536	293.399	228.970	48.264	44.912	MAX.P1	
1	3	LL 2	1.1		C		2914.067	6346.676	75.432-1648.364	-31.222	186.394	139.525	317.956	364.825	303.548	63.921	56.420	MAX.MT	
1	3	LL 2	1.1		C		2914.067	6346.676	75.432-1648.364	-31.222	186.394	139.525	317.956	364.825	303.548	63.921	56.420	MAX.VT	
1	3	LL 3	3.1		C		3019.261	5305.998	77.361-3237.943	-61.707	230.081	137.959	289.297	381.419	297.662	62.744	58.385	MAX.VP	
1	3	LL 3	5.1		C		3019.261	4215.142	55.848-3874.275	-74.256	255.145	144.857	264.232	374.521	328.867	57.228	58.385	MAX.ML	
1	3	LL 3	5.1		C		3019.261	4215.142	55.848-3874.275	-74.256	255.145	144.857	264.232	374.521	328.867	57.228	58.385	MAX.VL	
1	3	LL 2	3.1		C		2241.590	4567.389	51.819-2107.092	-40.565	159.967	99.959	227.994	288.003	229.001	48.270	43.400	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	
20.500	20.500	5.750	0.999	1.32	22 #10	@11.125	TOP TRAN	312.483	62.872	125.745	52.095	0.000	
				1.40	23 #10	@10.625	BOT.LONG	334.496	64.405	128.810	53.365	0.000	

NUMBER OF PILES = 14 BP = 3.000 DP = 3.000