

06-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; 145' SPAN; 90' TALL; BRIDGE 2B ; PIER 5

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	TOP	MIN	TOP	MIN	TOP	MIN	TOP
D	D	D	L	2	1	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																									
1.00	8.00	2.50	3.750	2	2.00	0.70	0.90	1.00	1.00	0.75	18.18	0.120	0.000	3.00	9.00	1.250	1.000	3.000	235.000											

CAP DATA

CN	C	L	A	DE	BC	BE	DH	LH	XB1	XB2	XB3	XB4	XB5	XB6	XB7	XB8
11	L	17.625	4.000	4.000	6.000	6.000	4.000	13.625	14.000	9.333	0.667					
12	2	SAME AS CANTILEVER 1														

COLUMN DATA

CN	P	I	T	S	HT	A	DT	BT	DB	BB	DL	FLEX	ND	NB	SZ	SLOPE	EP	AP									
21	0	V	T		90.000	6.000	8.000	6.000	11.500	6.000	6.000	0.000	8	6	11	11	6	11	22	16	11	32	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	13.500	13.500	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 FT2 FL2 FT3 FL3 FT4 FL4 FT5 FL5 * WIND FORCE ARM APT * WIND ON PIER PL

1529.	1529.	1	50	0	44	6	41	12	33	16	17	19	7.771	7.771	11.277	23.299
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GROUP III WIND
STD. * WIND ON SUPERSTRUCTURE INTENSITIES * STD. * WIND ON LIVE LOAD INTENSITIES * LENGTHS OF LL * 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 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	145.0	145.0	16.375	16.375
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MISCELLANEOUS FORCES

CENTRI.	TRACTION	FORCE	AND	EXPANSION	SHRINKAGE	STREAM	FLOW
FT	FL	APT	ARMS	COEFFICIENT	COEFFICIENT	PT	PL
14.624	5.540	16.375	16.375	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	171.810	207.250	0.000	0.000	230.750	247.470						
LL01	1	13.170	60.570	0.000	0.000	77.040	129.660						
LL02	1	107.310	91.360	0.000	0.000	75.140	35.740						
LL03	2	13.170	78.350	0.000	0.000	100.560	165.400						
LL04	2	3.860	81.210	0.000	0.000	152.180	95.120						
LL05	2	65.640	151.930	0.000	0.000	99.100	18.060						
LL06	2	120.490	94.610	0.000	0.000	64.320	38.390						

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	90.000	0.000	0.000	0.000	6.000	1.000	90.000	90.000			
DEAD LOAD TOTAL	1	1062.030 1799.130	1168.915	0.000	-1168.915	1799.130	4170.013	-5338.928	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	-123.957	-5.540	-589.318	-589.318			
CENT. FORCE 1 LN	1	0.000	-327.212	14.624	1555.628	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
WIND ON SUBSTR.	1	0.000	-67.662	11.277	1014.930	0.000	0.000	0.000	-139.794	-23.299	-2096.910	-2096.910			
GROUP 2 WIND 1 1	1	0.000	-1120.455	87.727	8489.523	0.000	0.000	0.000	-139.794	-23.299	-2096.910	-2096.910			
GROUP 2 WIND 1 2	1	0.000	-1120.455	87.727	8489.523	0.000	0.000	0.000	139.794	23.299	2096.910	2096.910			
GROUP 2 WIND 2 1	1	0.000	-994.120	78.553	7592.572	0.000	0.000	0.000	-266.129	-32.473	-2993.861	-2993.861			
GROUP 2 WIND 2 2	1	0.000	-994.120	78.553	7592.572	0.000	0.000	0.000	266.129	32.473	2993.861	2993.861			
GROUP 2 WIND 3 1	1	0.000	-930.952	73.966	7144.097	0.000	0.000	0.000	-392.464	-41.647	-3890.812	-3890.812			
GROUP 2 WIND 3 2	1	0.000	-930.952	73.966	7144.097	0.000	0.000	0.000	392.464	41.647	3890.812	3890.812			
GROUP 2 WIND 4 1	1	0.000	-762.505	61.734	5948.162	0.000	0.000	0.000	-476.688	-47.763	-4488.780	-4488.780			
GROUP 2 WIND 4 2	1	0.000	-762.505	61.734	5948.162	0.000	0.000	0.000	476.688	47.763	4488.780	4488.780			
GROUP 2 WIND 5 1	1	0.000	-425.612	37.270	3556.292	0.000	0.000	0.000	-539.855	-52.350	-4937.255	-4937.255			

GROUP	WIND	5	2	1	0.000	-425.612	37.270	3556.292	0.000	PIER-32-4-145-90.OUT	0.000	0.000	539.855	52.350	4937.255	4937.255
GROUP 3	WIND 1	1	1	1	0.000	-660.574	40.818	4089.294	0.000	0.000	0.000	-41.938	-6.990	-629.073	-629.073	
GROUP 3	WIND 1	2	1	1	0.000	-660.574	40.818	4089.294	0.000	0.000	0.000	41.938	6.990	629.073	629.073	
GROUP 3	WIND 2	1	1	1	0.000	-583.741	36.326	3635.117	0.000	0.000	0.000	-118.771	-11.482	-1083.251	-1083.251	
GROUP 3	WIND 2	2	1	1	0.000	-583.741	36.326	3635.117	0.000	0.000	0.000	118.771	11.482	1083.251	1083.251	
GROUP 3	WIND 3	1	1	1	0.000	-545.324	34.080	3408.028	0.000	0.000	0.000	-195.604	-15.974	-1537.429	-1537.429	
GROUP 3	WIND 3	2	1	1	0.000	-545.324	34.080	3408.028	0.000	0.000	0.000	195.604	15.974	1537.429	1537.429	
GROUP 3	WIND 4	1	1	1	0.000	-442.880	28.090	2802.457	0.000	0.000	0.000	-246.826	-18.969	-1840.214	-1840.214	
GROUP 3	WIND 4	2	1	1	0.000	-442.880	28.090	2802.457	0.000	0.000	0.000	246.826	18.969	1840.214	1840.214	
GROUP 3	WIND 5	1	1	1	0.000	-237.992	16.111	1591.316	0.000	0.000	0.000	-285.243	-21.215	-2067.303	-2067.303	
GROUP 3	WIND 5	2	1	1	0.000	-237.992	16.111	1591.316	0.000	0.000	0.000	285.243	21.215	2067.303	2067.303	
LIVE LOAD	LL01		1		280.440	1707.725	0.000	-1707.725	280.440	467.060	-2174.786	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 LL02	1	309.550	-1077.679	0.000	1077.679	309.550	1928.717	-851.038	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL03	1	357.480	2234.874	0.000	-2234.874	357.480	550.039	-2784.913	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL04	1	332.370	1608.857	0.000	-1608.857	332.370	433.047	-2041.904	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL05	1	334.730	-912.678	0.000	912.678	334.730	1628.017	-715.340	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL06	1	317.810	-1290.763	0.000	1290.763	317.810	2128.405	-837.641	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	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-19.222	-242.575	-19.222	-242.575	-19.222	-504.159
P 2	-2602.020	-2602.020	-5043.382	-2602.020	-2602.020	-2602.020	-4063.914	-312.834	-582.259	-312.834	-582.259	-574.418	-1054.603		
P 3	-2992.435	-2992.435	-5745.273	-2992.435	-2992.435	-2992.435	-4640.841	-588.425	-588.425	-588.425	-588.425	-1060.770	-1060.770		
C 1L	-5421.016	-5421.016	-10041.782	-5421.016	-5421.016	-5421.016	-8187.942	-625.865		-625.865		-1098.210			
C 1R	-6940.606	-6940.606	-12986.651	-6940.606	-6940.606	-6940.606	-10560.993		754.773		1332.173		754.773		
P 4	-3996.392	-3996.392	-7732.842	-3996.392	-3996.392	-3996.392	-6233.787	717.333	717.333	1294.733	1294.733	717.333	717.333		
P 5	-3519.996	-3519.996	-6871.321	-3519.996	-3519.996	-3519.996	-5526.777	711.167	411.192	1288.566	770.275	711.167	411.192		
P 6	-33.476	-33.476	-33.477	-33.476	-33.476	-33.476	-33.476	340.933	19.222	700.016	19.222	340.933	19.222		

PT.	M+ UNF. K-FT.	M- UNF. K-FT.	TOP REINFORCE.		BOT. REINFORCE.		CAP DESIGN DATA LEFT STIRRUPS		RIGHT STIRRUPS		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	-25.751	-25.751	3.12	2 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	60.77	0.08	0.000	0.098
P 2	-2001.554	-3126.087	12.66	9 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.087	#5@ 7.13	93.65	0.21	0.674	1.035
P 3	-2301.873	-3569.878	14.07	10 # 11	3.12	2 # 11	24.00	0.082	#5@ 7.52	24.00	0.082	#5@ 7.52	96.00	0.23	0.671	1.003
C 1	-4170.013	-8123.841	32.72	21 # 11	3.12	2 # 11	24.00	0.091	#5@ 6.79	24.00	0.141	#5@ 4.40	96.00	0.54	0.980	0.939
P 4	-3074.148	-4795.221	19.06	13 # 11	3.12	2 # 11	24.00	0.132	#5@ 4.70	24.00	0.132	#5@ 4.70	96.00	0.31	0.716	0.957
P 5	-2707.689	-4251.367	17.35	12 # 11	3.12	2 # 11	24.00	0.138	#5@ 4.50	24.00	0.060	#5@10.33	93.65	0.29	0.706	0.967
P 6	-25.751	-25.751	3.12	2 # 11	3.12	2 # 11	24.00	0.097	#5@ 6.39	0.00	0.000	#5@ 0.00	60.77	0.08	0.000	0.098

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

COLUMN ANALYSIS AND DESIGN OUTPUT

CN	T B	CRITICAL COLUMN LOADS																		
		GR	LLC	WC	R	E S	C F	S F	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	T	1	LL03	0.0				C	2156.7	5520.7	0.0	2156.7	7740.1	2701.9	4692.5	16909.0	5902.5	2.184	72.00	96.00
1	B	2		4.1	R				2338.9	-9252.2	5835.4	2338.9	11441.3	9228.0	3651.9	17796.6	14353.9	1.556	72.00	138.00

CN	T B	COLUMN DESIGN DATA														
		B FACE 1 NO. SIZE	B FACE 2 NO. SIZE	D FACE 3 NO. SIZE	D FACE 4 NO. SIZE	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	0.464	2636.	9193.	1.402	2.088	1.000	2	0.70
1	B	16 # 11	16 # 11	16 # 11	16 # 11	99.84	1.005	1.00	0.385	1860.	9720.	1.237	1.581	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
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PIER-32-4-145-90.OUT													
1 2	3.1R	1799.130-8313.012	-73.966	3890.812	41.647	90.024	-4.569	195.804	290.398	162.330	32.924	27.310	MAX.P1
1 2	1.1R	2338.869*****-114.045	2725.983	30.289	67.534	1.132	304.044	370.446	226.458	45.814	35.503	MAX.MT	
1 2	1.1R	2338.869*****-114.045	2725.983	30.289	67.534	1.132	304.044	370.446	226.458	45.814	35.503	MAX.VT	
1 2	1.1R	2338.869*****-114.045	2725.983	30.289	67.534	1.132	304.044	370.446	226.458	45.814	35.503	MAX.VP	
1 2	4.1R	2338.869-9252.199	-80.254	5835.414	62.092	145.316	3.489	226.261	368.089	280.884	40.829	35.503	MAX.ML
1 2	4.1R	2338.869-9252.199	-80.254	5835.414	62.092	145.316	3.489	226.261	368.089	280.884	40.829	35.503	MAX.VL
1 2	3.1R	1799.130-8313.012	-73.966	3890.812	41.647	90.024	-4.569	195.804	290.398	162.330	32.924	27.310	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
22.000	22.000	5.000	0.989	1.19	27 # 9	@ 9.750	TOP TRAN	232.698	52.096	104.192	43.166	0.000
				1.45	26 #10	@10.125	BOT.LONG	291.127	53.543	107.086	44.365	0.000

NUMBER OF PILES = 16 BP = 3.250 DP = 3.250