

04-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; 5 BEAMS; 132' SPAN; 50' TALL; BRIDGE 7A ; PIER 3

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 SIZ	MAX TOP	MAX BOT	MIN SIZE	MIN NO.	TOP CL.	MIN S.SP	DEPTH INCR.	BOT CL.		
D	D	D	L	2	1	8	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	18.87	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	17.625	4.000	4.000	6.000	6.000	4.000	13.625	14.000	7.000	3.000					
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		50.000	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.	WIND LONG.	WIND FT1	WIND FT2	WIND FT3	WIND FT4	WIND FT5	WIND FT6	WIND FT7	WIND FT8	WIND FT9	WIND FT10	WIND FT11	WIND FT12	WIND FT13	WIND FT14	WIND FT15	WIND FT16	WIND FT17	WIND FT18	WIND FT19	WIND FT20	WIND FT21	WIND FT22	WIND FT23	WIND FT24	WIND FT25	WIND FT26	WIND FT27	WIND FT28	WIND FT29	WIND FT30	WIND FT31	WIND FT32	WIND FT33	WIND FT34	WIND FT35	WIND FT36	WIND FT37	WIND FT38	WIND FT39	WIND FT40	WIND FT41	WIND FT42	WIND FT43	WIND FT44	WIND FT45	WIND FT46	WIND FT47	WIND FT48	WIND FT49	WIND FT50
1287.	2574.	1	50	0	44	6	41	12	33	16	17	19	7.375	7.375	6.475	15.027																																			

GROUP III WIND INTENSITIES

STD. WIND FT1	STD. WIND FT2	STD. WIND FT3	STD. WIND FT4	STD. WIND FT5	STD. WIND FT6	STD. WIND FT7	STD. WIND FT8	STD. WIND FT9	STD. WIND FT10	STD. WIND FT11	STD. WIND FT12	STD. WIND FT13	STD. WIND FT14	STD. WIND FT15	STD. WIND FT16	STD. WIND FT17	STD. WIND FT18	STD. WIND FT19	STD. WIND FT20	STD. WIND FT21	STD. WIND FT22	STD. WIND FT23	STD. WIND FT24	STD. WIND FT25	STD. WIND FT26	STD. WIND FT27	STD. WIND FT28	STD. WIND FT29	STD. WIND FT30	STD. WIND FT31	STD. WIND FT32	STD. WIND FT33	STD. WIND FT34	STD. WIND FT35	STD. WIND FT36	STD. WIND FT37	STD. WIND FT38	STD. WIND FT39	STD. WIND FT40	STD. WIND FT41	STD. WIND FT42	STD. WIND FT43	STD. WIND FT44	STD. WIND FT45	STD. WIND FT46	STD. WIND FT47	STD. WIND FT48	STD. WIND FT49	STD. WIND FT50
1	50	0	44	6	41	12	33	16	17	19	1	100	0	88	12	82	24	66	32	34	38	132.0	264.0	15.583	15.583																								

MISCELLANEOUS FORCES

CENTRI. FT	TRACTION FL	FORCE APT	AND ARMS APL	EXPANSION COEFFICIENT	SHRINKAGE COEFFICIENT	STREAM PT	FLOW PL
0.000	9.348	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	250.842	282.782	0.000	282.782	0.000	282.782	250.842					
LL 1	1	75.498	56.623	0.000	0.000	0.000	0.000	0.000					
LL 2	2	75.498	94.372	0.000	75.498	0.000	18.874	0.000					
LL 3	1	0.000	0.000	0.000	0.000	0.000	56.623	75.498					
LL 4	2	0.000	18.874	0.000	75.498	0.000	94.372	75.498					
LL 5	1	0.000	28.311	0.000	75.498	0.000	28.311	0.000					
LL 6	2	56.623	103.810	0.000	75.498	0.000	28.311	0.000					
LL 7	2	9.437	75.498	0.000	94.372	0.000	75.498	9.437					
LL 8	2	75.498	56.623	0.000	0.000	0.000	56.623	75.498					

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	1554.780	1871.580	0.000	0.000	0.000	1871.580	6288.699	-6288.700	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	-201.758	-9.348	-613.070	-613.070
WIND ON SUBSTR.	1	0.000	-38.850	6.475	323.750	0.000	0.000	0.000	-90.162	-15.027	-751.350	-751.350
GROUP 2 WIND 1 1	1	0.000	-899.531	70.825	4015.831	0.000	0.000	0.000	-90.162	-15.027	-751.350	-751.350
GROUP 2 WIND 1 2	1	0.000	-899.531	70.825	4015.831	0.000	0.000	0.000	90.162	15.027	751.350	751.350
GROUP 2 WIND 2 1	1	0.000	-796.249	63.103	3572.781	0.000	0.000	0.000	-296.726	-30.471	-1637.449	-1637.449
GROUP 2 WIND 2 2	1	0.000	-796.249	63.103	3572.781	0.000	0.000	0.000	296.726	30.471	1637.449	1637.449
GROUP 2 WIND 3 1	1	0.000	-744.609	59.242	3351.257	0.000	0.000	0.000	-503.289	-45.915	-2523.549	-2523.549
GROUP 2 WIND 3 2	1	0.000	-744.609	59.242	3351.257	0.000	0.000	0.000	503.289	45.915	2523.549	2523.549
GROUP 2 WIND 4 1	1	0.000	-606.900	48.946	2760.524	0.000	0.000	0.000	-640.998	-56.211	-3114.282	-3114.282
GROUP 2 WIND 4 2	1	0.000	-606.900	48.946	2760.524	0.000	0.000	0.000	640.998	56.211	3114.282	3114.282

										PIER-32-5-132-50.OUT					
GROUP	WIND	5	1	1	0.000	-331.482	28.354	1579.058	0.000	0.000	0.000	-744.280	-63.933	-3557.332	-3557.332
GROUP 2	WIND 5 2	1	1	1	0.000	-331.482	28.354	1579.058	0.000	0.000	0.000	744.280	63.933	3557.332	3557.332
GROUP 3	WIND 1 1	1	1	1	0.000	-554.755	34.448	2070.445	0.000	0.000	0.000	-27.049	-4.508	-225.405	-225.405
GROUP 3	WIND 1 2	1	1	1	0.000	-554.755	34.448	2070.445	0.000	0.000	0.000	27.049	4.508	225.405	225.405
GROUP 3	WIND 2 1	1	1	1	0.000	-489.583	30.547	1833.646	0.000	0.000	0.000	-157.393	-12.309	-699.002	-699.002
GROUP 3	WIND 2 2	1	1	1	0.000	-489.583	30.547	1833.646	0.000	0.000	0.000	157.393	12.309	699.002	699.002
GROUP 3	WIND 3 1	1	1	1	0.000	-456.997	28.597	1715.247	0.000	0.000	0.000	-287.737	-20.111	-1172.599	-1172.599
GROUP 3	WIND 3 2	1	1	1	0.000	-456.997	28.597	1715.247	0.000	0.000	0.000	287.737	20.111	1172.599	1172.599
GROUP 3	WIND 4 1	1	1	1	0.000	-370.101	23.396	1399.516	0.000	0.000	0.000	-374.633	-25.311	-1488.330	-1488.330
GROUP 3	WIND 4 2	1	1	1	0.000	-370.101	23.396	1399.516	0.000	0.000	0.000	374.633	25.311	1488.330	1488.330
GROUP 3	WIND 5 1	1	1	1	0.000	-196.309	12.994	768.054	0.000	0.000	0.000	-439.805	-29.212	-1725.128	-1725.128
GROUP 3	WIND 5 2	1	1	1	0.000	-196.309	12.994	768.054	0.000	0.000	0.000	439.805	29.212	1725.128	1725.128
LIVE LOAD	LL 1	1	1	1	132.121	-1453.333	0.000	1453.333	132.121	1453.333	0.000	0.000	0.000	0.000	0.000
LIVE LOAD	LL 2	1	1	1	264.242	-1585.458	0.000	1585.458	264.242	1717.576	-132.118	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	132.121	1453.333	0.000	-1453.333	132.121	0.000	-1453.333	0.000	0.000	0.000	0.000						
LIVE LOAD LL 4	1	264.242	1585.458	0.000	-1585.458	264.242	132.118	-1717.576	0.000	0.000	0.000	0.000						
LIVE LOAD LL 5	1	132.120	0.000	0.000	0.000	132.120	198.177	-198.177	0.000	0.000	0.000	0.000						
LIVE LOAD LL 6	1	264.242	-1321.215	0.000	1321.215	264.242	1519.392	-198.177	0.000	0.000	0.000	0.000						
LIVE LOAD LL 7	1	264.242	0.000	0.000	0.000	264.242	660.604	-660.604	0.000	0.000	0.000	0.000						
LIVE LOAD LL 8	1	264.242	0.000	0.000	0.000	264.242	1453.333	-1453.333	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	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-19.222	-345.316	-19.222	-345.316	-19.222	-509.223							
P 2	-2615.493	-2615.493	-3762.836	-2615.493	-2615.493	-2615.493	-3302.524	-395.208	-762.824	-395.208	-762.824	-559.114	-1131.612							
P 3	-4942.995	-4942.995	-7196.701	-4942.995	-4942.995	-4942.995	-6292.519	-789.359	-789.359	-789.359	-789.359	-1158.146	-1158.146							
C 1L	-8175.309	-8175.309	-11904.166	-8175.309	-8175.309	-8175.309	-10408.157	-826.799		-826.799		-1195.586								
C 1R	-8175.309	-8175.309	-11904.167	-8175.309	-8175.309	-8175.309	-10408.158		826.799		1195.586		826.799							
P 5	-4942.995	-4942.995	-7196.701	-4942.995	-4942.995	-4942.995	-6292.520	789.359	789.359	1158.146	1158.146	789.359	789.359							
P 6	-2615.493	-2615.493	-3762.836	-2615.493	-2615.493	-2615.493	-3302.525	762.824	395.208	1131.612	559.114	762.824	395.208							
P 7	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	-33.476	345.316	19.222	509.223	19.222	345.316	19.222							

PT.	M+ UNF. K-FT.		M- UNF. K-FT.		TOP REINFORCE. AS NO.SIZE		BOT. REINFORCE. AS NO.SIZE		CAP DESIGN DATA LEFT STIRRUPS M.SP. AV/IN BAR&SPAC				RIGHT STIRRUPS M.SP. AV/IN BAR&SPAC		D IN.	FC PSI	PS %	FS/FF RATIO	FS/FZ RATIO
	M+	UNF.	M-	UNF.	AS	NO.SIZE	AS	NO.SIZE	M.SP.	AV/IN	BAR&SPAC	M.SP.	AV/IN	BAR&SPAC					
P 1	-25.751	-25.751	3.12	2 # 11	3.12	2 # 11	0.00	0.00	#5@ 0.00	24.00	0.060	#5@10.33	60.77			0.08	0.000	0.098	
P 2	-2011.917	-2540.404	10.71	7 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.128	#5@ 4.83	85.43			0.18	0.535	1.288	
P 3	-3802.304	-4840.399	17.71	12 # 11	3.12	2 # 11	24.00	0.103	#5@ 6.02	24.00	0.103	#5@ 6.02	96.00			0.29	0.545	1.072	
C 1	-6288.699	-8006.276	29.84	20 # 11	3.12	2 # 11	24.00	0.112	#5@ 5.55	24.00	0.112	#5@ 5.55	96.00			0.49	0.556	0.967	
P 5	-3802.304	-4840.400	17.71	12 # 11	3.12	2 # 11	24.00	0.103	#5@ 6.02	24.00	0.103	#5@ 6.02	96.00			0.29	0.545	1.072	
P 6	-2011.918	-2540.404	10.71	7 # 11	3.12	2 # 11	24.00	0.128	#5@ 4.83	24.00	0.060	#5@10.33	85.43			0.18	0.535	1.288	
P 7	-25.751	-25.751	3.12	2 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	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

CRITICAL COLUMN LOADS																						
CN	T	B	GR	LLC	WC	R	E	C	S	F	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	T	1	LL	4	0.0						2594.9	3442.0	0.0	2594.9	3943.6	1973.4	9208.5	14002.4	7007.1	3.550	72.00	96.00
1	B	2		4.1	R						2433.1	-3588.7	4048.6	2433.1	3992.5	4865.1	5725.2	9428.6	11489.3	2.360	72.00	96.00

COLUMN DESIGN DATA																				
CN	T	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	0.000	2801.	22021.	1.146	1.268	1.000	2	0.70
1	B	15	# 11	15	# 11	8	# 11	8	# 11	71.76	1.038	1.00	0.000	2227.	22021.	1.113	1.202	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 4	4.1R				2093.875-2733.291	-23.396	2714.470	44.007	187.402	78.515	184.276	293.163	135.169	17.961	29.618		MAX.P1
1	2		1.1R				2433.054-5220.581	-92.072	976.755	19.535	133.897	94.029	304.825	344.693	184.664	24.513	34.355		MAX.MT
1	3	LL 4	3.1R				2722.037-3963.729	-37.176	3118.360	50.448	227.138	102.069	256.043	381.112	180.831	24.015	38.503		MAX.VT
1	3	LL 2	3.1				2722.037 3963.728	37.176-3118.360	-50.448	227.138	102.069	256.043	381.112	180.831	24.015	38.503			MAX.VP
1	3	LL 2	4.1				2722.037 3553.277	30.415-3528.811	-57.209	243.622	102.069	239.559	381.112	248.198	49.306	38.503			MAX.ML
1	2		5.1				2433.054 2052.774	36.860-4624.531	-83.113	271.365	84.349	167.357	354.373	247.561	49.391	34.355			MAX.VL
1	2		3.1R				1871.580-3351.257	-59.242	2523.549	45.915	152.147	49.990	185.332	287.489	133.737	17.775	26.427		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
17.900	17.900	5.000	0.998	1.07	25	# 8	@ 8.500	TOP TRAN	210.742	52.345	104.690	43.372	0.000
				1.27	23	# 9	@ 9.250	BOT.LONG	250.691	53.629	107.258	44.436	0.000

NUMBER OF PILES = 13 BP = 3.850 DP = 3.850