

29-OCT-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  
40' CURB-CURB; 6 BEAMS; 143' SPAN; 60' TALL; BRIDGE 25 ; PIER 21

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 EC KSI	ES KSI	CONC. STRAIN	Z FACT	* MAIN SIZE	* STR TOP	* CAP MAX TOP	REINFORCING MAX BOT	STEEL MIN	* MIN TOP	* MIN CL.	* CAP MIN	* CAP DEPTH	* CAP 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 MIN.P	REINFORCING MAX.P	STEEL CL.SP.	R CLEAR	KL MODE	OC COEF	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 I P
1.00	8.00	2.50	3.750	2	2.00	0.70	0.90	1.00	1.00	0.75	18.45	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	21.625	6.000	4.000	6.000	6.000	4.000	15.625	18.060	7.224	4.836					
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		60.000	0.000	12.000	6.000	12.000	6.000	6.000	0.000	12	6	11	12	6	11	34	16	11	34	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	14.000	14.000	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 ON SUPERSTRUCTURE TRANS.	WIND FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	* WIND ON PIER PL	ARM APL	WIND ON PIER PL	LENGTHS OF LL TRANS.	LL LONGI.	* WIND ON LL APT	LL ARMS APL	
1394.	2789.	1	50	0	44	6	41	12	33	16	17	19	7.375	7.375	7.676	22.712			

GROUP III WIND INTENSITIES	* WIND ON SUPERSTRUCTURE TRANS.	WIND FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	* WIND ON LIVE LOAD INTENSITIES	WIND FT1	FL1	FT2	FL2	FT3	FL3	FT4	FL4	FT5	FL5	* LENGTHS OF LL TRANS.	LL LONGI.	* WIND ON LL APT	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	143.0	286.0	15.583	15.583	

CENTRI. FT	TRACTION FL	FORCE APT	MISCELLANEOUS FORCES AND ARMS APL	EXPANSION COEFFICIENT	SHRINKAGE COEFFICIENT	STREAM PT	FLOW PL
4.054	10.052	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	271.189	308.007	0.000	616.014	0.000	308.007	271.189					
LL 1	1	80.408	59.089	0.000	0.000	0.000	0.000	0.000					
LL 2	2	80.408	101.456	0.000	97.130	0.000	0.000	0.000					
LL 3	3	80.408	101.456	0.000	194.262	0.000	42.366	0.000					
LL 4	1	0.000	0.000	0.000	0.000	0.000	59.089	80.408					
LL 5	2	0.000	0.000	0.000	97.130	0.000	101.456	80.408					
LL 6	3	0.000	42.366	0.000	194.262	0.000	101.456	80.408					
LL 7	1	0.000	28.965	0.000	110.531	0.000	0.000	0.000					
LL 8	2	55.768	110.532	0.000	112.694	0.000	0.000	0.000					
LL 9	3	55.768	110.532	0.000	196.424	0.000	55.768	0.000					
LL10	2	0.000	42.366	0.000	194.262	0.000	42.366	0.000					
LL11	3	80.408	101.456	0.000	194.262	0.000	42.366	0.000					
LL12	2	80.408	59.089	0.000	0.000	0.000	59.089	80.408					
LL13	3	80.408	101.456	0.000	97.130	0.000	59.089	80.408					

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

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	60.000	0.000	0.000	0.000	6.000	1.000	60.000	60.000
DEAD LOAD TOTAL	1	2029.556	2612.756	0.000	0.000	0.000	2612.756	9457.024	-9457.024	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	-216.952	-10.052	-759.760	-759.760
CENT. FORCE 1 LN	1	0.000	-87.497	4.054	306.413	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WIND ON SUBSTR.	1	0.000	-46.056	7.676	460.560	0.000	0.000	0.000	-136.272	-22.712	-1362.720	-1362.720
GROUP 2 WIND 1 1	1	0.000	-978.294	77.376	5156.598	0.000	0.000	0.000	-136.272	-22.712	-1362.720	-1362.720
GROUP 2 WIND 1 2	1	0.000	-978.294	77.376	5156.598	0.000	0.000	0.000	136.272	22.712	1362.720	1362.720

PIER-40-6-143-60.OUT															
GROUP	WIND	2	1	1	0.000	-866.425	69.012	4593.073	0.000	0.000	0.000	-360.089	-39.446	-2490.173	-2490.173
GROUP 2	WIND 2	2	1	1	0.000	-866.425	69.012	4593.073	0.000	0.000	0.000	360.089	39.446	2490.173	2490.173
GROUP 2	WIND 3	1	1	1	0.000	-810.491	64.830	4311.311	0.000	0.000	0.000	-583.906	-56.180	-3617.626	-3617.626
GROUP 2	WIND 3	2	1	1	0.000	-810.491	64.830	4311.311	0.000	0.000	0.000	583.906	56.180	3617.626	3617.626
GROUP 2	WIND 4	1	1	1	0.000	-661.333	53.678	3559.945	0.000	0.000	0.000	-733.118	-67.336	-4369.262	-4369.262
GROUP 2	WIND 4	2	1	1	0.000	-661.333	53.678	3559.945	0.000	0.000	0.000	733.118	67.336	4369.262	4369.262
GROUP 2	WIND 5	1	1	1	0.000	-363.017	31.374	2057.213	0.000	0.000	0.000	-845.027	-75.703	-4932.988	-4932.988
GROUP 2	WIND 5	2	1	1	0.000	-363.017	31.374	2057.213	0.000	0.000	0.000	845.027	75.703	4932.988	4932.988
GROUP 3	WIND 1	1	1	1	0.000	-602.125	37.513	2627.816	0.000	0.000	0.000	-40.882	-6.814	-408.816	-408.816
GROUP 3	WIND 1	2	1	1	0.000	-602.125	37.513	2627.816	0.000	0.000	0.000	40.882	6.814	408.816	408.816
GROUP 3	WIND 2	1	1	1	0.000	-531.528	33.288	2329.058	0.000	0.000	0.000	-182.100	-15.266	-1006.453	-1006.453
GROUP 3	WIND 2	2	1	1	0.000	-531.528	33.288	2329.058	0.000	0.000	0.000	182.100	15.266	1006.453	1006.453
GROUP 3	WIND 3	1	1	1	0.000	-496.230	31.175	2179.679	0.000	0.000	0.000	-323.318	-23.718	-1604.090	-1604.090
GROUP 3	WIND 3	2	1	1	0.000	-496.230	31.175	2179.679	0.000	0.000	0.000	323.318	23.718	1604.090	1604.090
GROUP 3	WIND 4	1	1	1	0.000	-402.100	25.541	1781.336	0.000	0.000	0.000	-417.463	-29.353	-2002.514	-2002.514
GROUP 3	WIND 4	2	1	1	0.000	-402.100	25.541	1781.336	0.000	0.000	0.000	417.463	29.353	2002.514	2002.514
GROUP 3	WIND 5	1	1	1	0.000	-213.842	14.274	984.648	0.000	0.000	0.000	-488.072	-33.579	-2301.333	-2301.333
GROUP 3	WIND 5	2	1	1	0.000	-213.842	14.274	984.648	0.000	0.000	0.000	488.072	33.579	2301.333	2301.333
LIVE LOAD LL	1	1	1	1	139.497	-2092.457	0.000	2092.457	139.497	2092.457	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	278.994	-2551.545	0.000	2551.545	278.994	2551.545	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 3	1	376.643	-1883.221	0.000	1883.221	376.643	2296.391	-413.170	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 4	1	139.497	2092.457	0.000	-2092.457	139.497	0.000	-2092.457	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 5	1	278.994	2551.546	0.000	-2551.546	278.994	0.000	-2551.546	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 6	1	376.643	1883.221	0.000	-1883.221	376.643	413.170	-2296.391	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 7	1	139.496	-313.865	0.000	313.865	139.496	313.865	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 8	1	278.994	-2204.895	0.000	2204.895	278.994	2204.895	0.000	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL 9	1	376.643	-1440.533	0.000	1440.533	376.643	1984.405	-543.872	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL10	1	278.994	0.000	0.000	0.000	278.994	459.078	-459.078	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL11	1	376.643	-1883.221	0.000	1883.221	376.643	2296.391	-413.170	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL12	1	278.994	0.000	0.000	0.000	278.994	2092.457	-2092.457	0.000	0.000	0.000	0.000	0.000
LIVE LOAD LL13	1	376.642	-413.180	0.000	413.180	376.642	2296.391	-1883.211	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	-32.001	-32.001	-32.001	-32.001	-32.001	-32.001	-32.001	-18.588	-371.133	-18.588	-371.133	-18.588	-545.699
P 2	-2881.865	-2881.865	-4142.928	-2881.865	-2881.865	-2881.865	-3636.992	-420.471	-820.880	-420.471	-820.880	-595.036	-1215.706
P 3	-6949.798	-6949.798	-10120.243	-6949.798	-6949.798	-6949.798	-8848.269	-862.642	-862.642	-862.642	-862.642	-1257.469	-1257.469
C 1L	-12294.131	-12294.131	-17833.537	-12294.131	-12294.131	-12294.131	-15611.141	-918.802		-918.802		-1313.629	
C 1R	-12294.131	-12294.131	-17833.537	-12294.131	-12294.131	-12294.131	-15611.141		918.802		1313.629		918.802
P 5	-6949.798	-6949.798	-10120.244	-6949.798	-6949.798	-6949.798	-8848.269	862.642	862.642	1257.469	1257.469	862.642	862.642
P 6	-2881.865	-2881.865	-4142.928	-2881.865	-2881.865	-2881.865	-3636.993	820.880	420.471	1215.706	595.036	820.880	420.471
P 7	-32.001	-32.001	-32.002	-32.001	-32.001	-32.001	-32.001	371.133	18.588	545.699	18.588	371.133	18.588

PT.	UNF. K-FT.		TOP REINFORCE.		BOT. REINFORCE.		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	RIGHT STIRRUPS						
P 1	-24.616	-24.616	3.12	2 # 11	3.12	2 # 11	0.00	0.000	#5@ 0.00	24.00	0.060	#5@10.33	58.96	0.08	0.000	0.096
P 2	-2216.819	-2797.687	12.10	8 # 11	3.12	2 # 11	24.00	0.060	#5@10.33	24.00	0.164D	#5@ 7.54	81.14	0.23	0.554	1.259
P 3	-5345.999	-6806.360	25.16	17 # 11	3.12	2 # 11	24.00	0.124	#5@ 4.99	24.00	0.124	#5@ 4.99	96.00	0.41	0.549	0.975
C 1	-9457.024	-12008.570	46.01	30 # 11	3.12	2 # 11	24.00	0.138	#5@ 4.49	24.00	0.138	#5@ 4.49	96.00	0.74	0.571	0.921
P 5	-5345.999	-6806.361	25.16	17 # 11	3.12	2 # 11	24.00	0.124	#5@ 4.99	24.00	0.124	#5@ 4.99	96.00	0.41	0.549	0.975
P 6	-2216.819	-2797.687	12.10	8 # 11	3.12	2 # 11	24.00	0.164D	#5@ 7.54	24.00	0.060	#5@10.33	81.14	0.23	0.554	1.259

P 7 -24.616 -24.616 3.12 2 # 11 3.12 2 # 11 24.00 0.060 #5@10.33 0.00 0.000 #5@ 0.00 58.96 0.08 0.000 0.096

PIER-40-6-143-60.OUT

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	PF	MTF	MLF	PM	MTM	MLM	PU	MTU	MLU	PU/PM	B	D
1	T	1	LL	2	0.0			C		3244.1	-5766.9	0.0	3244.1	6220.2	2652.3	14442.7	27716.9	11818.4	4.455	72.00	144.00
1	B	3	LL	3	5.1			C		3886.2	4803.7	-5658.5	3886.2	5168.3	7621.8	10335.1	13744.1	20268.5	2.659	72.00	144.00

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	18	# 11	18	# 11	106.08	1.023	1.00	0.000	3623.	49720.	1.079	1.363	1.000	2	0.70
1	B	16	# 11	16	# 11	18	# 11	18	# 11	106.08	1.023	1.00	0.000	3507.	49720.	1.076	1.347	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		2930.732	4596.883	42.121-3655.442	-50.858	169.281	78.349	199.589	290.521	99.632	0.000	31.935	MAX.P1	
1	3	LL 3	1.1		C		3809.952	6558.525	62.996-3198.219	-44.140	192.814	113.305	286.717	366.226	132.938	0.000	41.516	MAX.MT	
1	3	LL 3	3.1		C		3809.952	5975.947	54.757-4752.075	-66.116	220.065	101.854	259.466	377.678	129.522	0.000	41.516	MAX.VT	
1	3	LL 3	3.1		C		3809.952	5975.947	54.757-4752.075	-66.116	220.065	101.854	259.466	377.678	129.522	0.000	41.516	MAX.VP	
1	3	LL 3	4.1		C		3809.952	5458.101	47.433-5270.027	-73.441	233.538	102.426	245.993	377.106	382.128	62.080	41.516	MAX.ML	
1	3	LL 3	4.1		C		3809.952	5458.101	47.433-5270.027	-73.441	233.538	102.426	245.993	377.106	382.128	62.080	41.516	MAX.VL	
1	3	LL 2	3.1		C		2848.293	4946.618	39.283-3123.610	-43.822	153.952	76.200	205.758	283.510	99.450	0.000	31.054	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	
18.500	18.500	6.000	0.989	0.72	43 # 5	@ 5.125	TOP TRAN	177.270	66.713	133.427	55.278	0.000	
				1.54	19 #11	@11.625	BOT.LONG	396.165	67.941	135.883	56.295	0.000	

NUMBER OF PILES = 18 BP = 2.667 DP = 4.000