

NOTE: The following information is to only be used for initial abutment design sizing and planning study assumptions. Final design of abutments shall be based on current Bridge Design Specifications.

Figure 6A.B.1 High Cantilever Abutment on Spread Footing Details



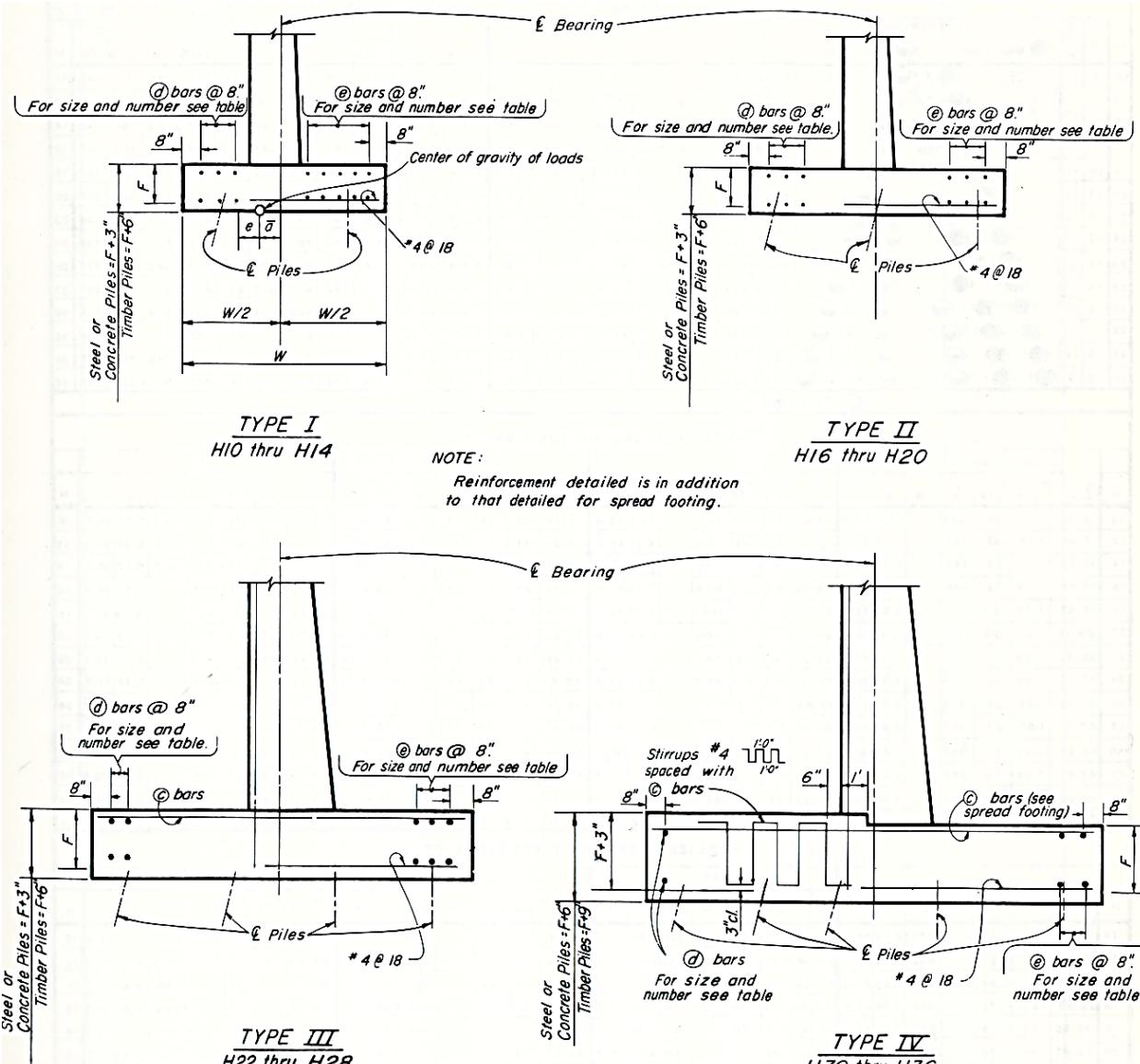
H	W	F	$\sum M$ at Gage	$\sum V$ with 0 Supstr	Shaft # top of ftg.	APPLIED SUPERSTRUCTURE LOAD IN KIPS PER FT.																		
						0				5				7.5				10						
						toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	H		
10	6	1.5	-9.40	5.42	9.60	0.42 #8@18			0.19	3.31	-3.89	+1.21 #4@18	3.72	-4.52	-1.84 #4@18	4.14	-5.17	-3.44 #5@18	0.15 10					
12	7	1.5	-13.7	7.72	15.55	#9@18			2.78	-4.88	+7.58 #7@18	3.50	-6.70	+3.99 #5@18	3.85	-7.59	+2.22 #4@18	4.21	-8.50	-2.01 #4@18	0.09 12			
14	8	1.5	-19.0	10.25	23.50	#11@18			3.06	-8.33	+11.35 #8@18	3.69	-10.70	+7.33 #7@18	4.00	-11.89	+5.37 #6@18	4.31	-13.06	+3.33 #5@18	0.14 14			
16	9	1.5	-25.4	13.05	33.80	#11@15			3.33	-12.66	+16.03 #9@15	3.89	-15.60	+11.57 #8@15	4.16	-17.04	+9.39 #7@15	4.44	-18.51	+7.05 #6@15	0.31 16			
18	10	1.5	-32.9	16.08	46.65	#11@11½			3.59	-18.19	+21.73 #9@11½	4.08	-21.72	+16.84 #8@11½	4.34	-23.50	+14.41 #7@11½	4.59	-25.30	+11.94 #7@11½	0.52 18			
20	11	1.75-44.3	19.76	62.40	#11@9				3.99	-26.60	+29.46 #9@9	4.44	-30.66	+24.15 #8@9	4.67	-32.75	+21.50 #7@9	4.90	-34.83	+18.88 #7@9	0.69 20			
22	12	1.75	-55.8	23.33	81.30	#11@7			4.27	-35.42	+37.70 #9@7	4.68	-40.14	+31.93 #11@14	4.90	-42.56	+28.97 #11@14	5.10	-44.84	+26.21 #10@14	1.06 22			
24	13	2.00	-71.7	27.62	103.7	#11@5½			4.67	-47.39	+48.85 #11@11½	5.06	-52.73	+42.62 #11@11½	5.25	-55.31	+39.60 #10@11½	5.44	-57.95	+43.52 #10@11½	1.25 24			
26	14	2.00	-86.2	31.77	129.8	#11@7			4.90	-60.51	+53.7 #9@7	5.26	-66.44	+49.0 #9@7	5.44	-69.37	+45.8 #9@7	5.61	-72.28	+42.0 #9@7	1.40 26			
28	15	2.25	-107.2	36.74	159.3	#11@7			5.32	-77.10	+67.2 #10@7	5.65	-83.62	+61.0 #9@7	5.82	-86.88	+59.2 #9@7	5.98	-90.09	+56.5 #9@7	1.73 28			
30	16	2.25	-126.1	41.48	194.4	#11@7			5.55	-94.25	+70.1 #10@7	5.86	-101.39	+64.3 #10@7	6.01	-104.91	+61.7 #10@7	6.17	-108.69	+59.7 #10@7	1.86 30			
32	17	2.50	-152.5	47.21	233.5	#11@7			5.94	-116.15	+83.3 #10@7	6.23	-123.80	+77.4 #10@7	6.38	-127.73	+74.3 #10@7	6.52	-131.63	+71.4 #10@7	1.85 32			
34	18	2.50	-176.5	52.58	277.4	#11@7			6.19	-139.21	+96.5 #11@7	6.47	-147.62	+89.6 #11@7	6.61	-151.82	+87.2 #11@7	6.75	-156.02	+84.1 #10@7	2.17 34			
36	19	2.75	-209.1	58.94	326.6	#11@6½			6.55	-166.91	+111.6 #11@6½	6.82	-175.92	+105.1 #11@6½	6.95	-180.35	+103.5 #11@6½	7.09	-184.94	+101.2 #10@6½	2.28 36			

H	W	F	$\sum M$ at Gage	$\sum V$ with 0 Supstr	Shaft # top of ftg.	APPLIED SUPERSTRUCTURE LOAD IN KIPS PER FT.																QUANTITIES									
						12.5				15				17.5				20				Bar Reinforcing Steel (lbs./ft.)									
						toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	toe Pr.	toe Mom.	heel Mom.	heel A _s c bars	Canc cf/ft	0	5	7.5	10	12.5	15	17.5	20	H
10	4.56	-5.80	-4.99	#8@18	4.97	-6.45	-6.61	0.31	5.39	-7.09	-8.17	#7@18	5.81	-7.73	-9.74	#8@18	24.5	57	55	57	58	59	61	61	63	10					
12	4.57	-9.41	-3.74	#5@18	4.93	-10.31	-5.55	0.15	5.28	-11.21	-7.32	#7@18	5.64	-12.12	-9.13	#8@18	29.1	74	69	68	70	71	72	74	76	12					
14	4.62	-14.23	-1.98	#4@18	4.94	-15.44	-4.05	0.09	5.25	-16.60	-6.01	#6@18	5.56	-17.78	-8.01	#7@18	33.8	102	99	96	93	94	95	96	98	14					
16	4.72	-20.00	+4.92	#5@15	5.00	-21.47	+2.68	0.22	5.27	-22.90	-3.98	#5@15	5.55	-24.40	-6.25	#6@15	38.9	129	124	119	115	112	109	113	115	16					
18	4.84	-27.06	+9.52	#6@11½	5.09	-28.84	+7.10	0.41	5.34	-30.24	+4.63	#4@11½	5.59	-32.37	-3.80	#4@11½	43.8	172	164	158	152	147	143	145	18						
20	5.13	-36.78	+16.25	#6@9	5.36	-38.89	+13.06	0.83	5.59	-40.98	+10.92	#5@9	5.81	-42.97	+8.29	#5@9	51.7	231	220	211	203	203	196	196	20						
22	5.31	-47.11	+22.87	#9@14	5.52	-49.53	+20.49	0.75	5.72	-51.89	+17.62	#8@14	5.94	-54.27	+14.69	#8@14	57.4	307	291	281	271	271	264	264	22						
24	5.64	-60.67	+33.31	#10@11½	5.83	-63.21	+30.19	1.05	6.02	-65.94	+27.21	#9@11½	6.21	-68.65	+24.13	#8@11½	66.5	366	366	353	353	341	341	331	24						
26	5.80	-75.32	+40.3	#11@14	5.98	-78.30	+36.9	1.35	6.16	-81.29	+33.6	#11@14	6.34	-84.23	+31.4	#10@14	77.8	400	400	400	400	382	382	371	26						
28	6.14	-93.30	+53.1	#9@7	6.32	-96.66	+50.2	1.55	6.48	-99.85	+46.8	#11@14	6.64	-103.14	+43.9	#10@14	90.8	492	470	470	470	470	451	451	28						
30	6.33	-112.04	+56.0	#9@7	6.49	-115.69	+52.8	1.63	6.65	-119.29	+49.9	#9@7	6.80	-122.80	+46.9	#9@7	103.6	543	543	543	543	518	518	518	518	30					
32	6.67	-135.31	+68.3	#10@7	6.82	-139.31	+65.4	2.08	6.97	-143.23	+62.2	#9@7	7.11	-147.00	+59.3	#9@7	117.3	620	620	620	620	594	594	594	594	32					
34	6.89	-160.12	+80.4	#10@7	7.03	-163.83	+77.1	2.20	7.16	-168.32	+74.0	#10@7	7.30	-172.53	+70.8	#10@7	126.7	776	776	745	745	745	745	745	34						
36	7.22	-189.28	+99.1	#10@6½	7.35	-193.77	+96.2	2.30	7.48	-198.21	+88.6	#10@6½	7.61	-202.63	+85.1	#10@6½	141.4	854	854	820	820	820	820	820	36						

NOTE: For walls with seats less than 7'-0", the concrete quantity shall be increased by 2% per foot of variation.

NOTE: The following information is to only be used for initial abutment design sizing and planning study assumptions. Final design of abutments shall be based on current Bridge Design Specifications.

Figure 6A.B.2 High Cantilever Abutment on Spread Footing Information



N = number of piles per line.
 S = pile spacing in feet between lines.
 \bar{a} = distance from £ bearing to center of gravity of pile pattern.
 e = eccentricity from center gravity of pile pattern.
 I = moment of inertia of one line of piles.
 I/C_t = section modulus one pile line, toe pile.
 I/C_h = section modulus one pile line, heel pile.

$$S = \frac{L}{(N + \frac{e}{I/C_t})}$$

$$A = \frac{I}{(N + \frac{e}{I/C_t})} \text{ toe pile, } 36 \text{ lbs. fl. pressure}$$

$$B = \frac{I}{(N - \frac{e}{I/C_h})} \text{ heel pile, } 27 \text{ lbs. fl. pressure}$$

$$T = \text{horizontal thrust in kips per line of piles.}$$

L = Allowable pile loading.
 For 45 ton piles: L = 85.5 kips battered toe pile.
 90.0 kips plumb heel pile.
 All values on this sheet are based on 45 ton piles.
 Lateral resistance of each vertical pile in bending is limited to 15% of the axial load. Balance of lateral forces taken by the battered piles.
 In cases of special foundation situations, values should be subject to review.

Figure 6A.B.3 High Cantilever Abutment on Pile Footing Details

NOTE: The following information is to only be used for initial abutment design sizing and planning study assumptions. Final design of abutments shall be based on current Bridge Design Specifications.



PILE LOADINGS FOR ABUTMENT PILE FOOTINGS

PILE PATTERN LAYOUT												PILE PATTERN PROPERTIES						QUANTITIES				BAR REINFORCING STEEL (LBS/FT)																										
H	W	Type	SINGLE SPACING				DOUBLE SPACING				N	1/N	-a	I	I/C _t	I/C _h	d	e	Bars	c _{spac}	O	5	7.5	10	12.5	15	17.5	20	H																			
10	6	I	TOE	1'-6"	1'-6"	HEEL	1.5	0.667	0.50	3.00	3.00	1.56	6-#10	10-#11	26.0	139	137	136	137	138	140	140	140	142	142	10																						
12	7	I		2'-0"	2'-0"		1.5	0.667	.67	5.33	4.00	2.00	6-#9	10-#11	30.8	140	135	134	133	134	135	137	139	12																								
14	8	I		2'-6"	2'-6"		1.5	0.667	.83	8.34	5.00	2.51	6-#8	6-#11	35.8	154	151	148	145	142	143	144	146	14																								
16	9	II		3'-0"	3'-0"		2.0	0.500	.75	12.37	5.50	3.30	6-#8	6-#11	41.1	181	176	171	167	164	161	161	163	16																								
18	10	II		3'-6"	3'-6"		2.0	0.500	.87	16.85	6.41	3.86	4-#9	6-#10	46.3	216	208	202	196	191	187	185	18																									
20	11	II		4'-0"	4'-0"		2.0	0.500	1.00	22.00	7.33	4.40	2-#10	4-#10	54.5	262	251	242	242	234	234	227	227	20																								
22	12	III		5'-0"	4'-6"	1'-6"	3'-0"	3.0	0.333	1.00	30.7	8.76	5.58	4-#8	6-#10	60.4	349	333	333	323	313	313	306	306	22																							
24	13	III		5'-4"	1'-6"	1'-8"	3'-4"	3.0	0.333	1.11	38.0	9.78	6.22	2-#10	6-#8	69.7	397	397	384	384	372	372	362	24																								
26	14	III		3'-8"	1'-10"	1'-10"	3'-8"	3.0	0.333	1.22	45.9	10.72	6.82	2-#9	4-#9	77.8	400	400	400	400	382	382	382	371	26																							
28	15	III		4'-0"	2'-0"	2'-0"	4'-0"	3.0	0.333	1.33	54.6	11.70	7.45	2-#8	4-#8	90.8	492	470	470	470	470	470	451	451	28																							
30	16	IV		5'-0"	5'-0"	5'-0"	3'-0"	3.5	0.286	1.57	71.6	14.52	8.88	2-#8	4-#8	103.6	543	543	543	543	518	518	518	518	30																							
32	17	IV		5'-0"	5'-0"	1'-0"	3'-0"	3.5	0.286	1.86	82.4	16.02	9.30	2-#8	2-#10	117.3	620	620	620	620	594	594	594	594	32																							
34	18	IV		3'-0"	3'-0"	1'-6"	2'-6"	3.5	0.286	2.21	91.6	17.30	9.44	2-#8	2-#10	126.7	776	776	745	745	745	745	745	34																								
36	19	IV		3'-0"	3'-0"	2'-0"	6'-0"	3.5	0.286	2.57	101.6	18.70	9.62	2-#7	2-#10	141.4	854	854	820	820	820	820	820	36																								
			BEARING																																													
APPLIED SUPERSTRUCTURE LOAD (K/FT.)																																																
H	0												5												7.5												10											
	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	H																			
10	5.64	1.17	.56	1.058	12.0	46.0	10.64	.38	.06	.794	10.1	32.4	13.14	.22	.04	.740	8.80	28.2	15.64	.10	.12	.744	7.74	24.8	10																							
12	7.98	1.05	.37	.930	11.5	49.1	12.98	.39	-.03	.765	8.61	39.6	15.48	.21	-.13	.719	7.68	32.6	17.98	.09	-.21	.772	6.48	27.5	12																							
14	10.55	.97	.23	.861	9.41	51.2	15.55	.39	-.11	.745	7.38	40.2	18.05	.22	-.21	.751	6.65	36.2	20.55	.03	-.28	.779	5.62	30.6	14																							
16	13.39	1.14	.34	.709	9.02	61.2	18.39	.63	.04	.616	7.55	51.1	20.89	.46	.05	.584	6.99	47.3	23.39	.34	-.13	.562	6.50	44.0	16																							
18	16.45	1.13	.25	.676	7.68	63.3	21.45	.66	-.01	.603	6.60	54.4	23.95	0.50	-.10	.578	6.17	51.0	26.45	.37	-.17	.558	5.79	47.7	18																							
20	20.17	1.20	.23	.664	6.40	64.4	25.17	.76	-.01	.604	5.63	56.9	27.67	.61	-.10	.583	5.30	53.5	30.17	.47	-.18	.564	5.03	50.8	20																							
22	23.78	1.35	.28	.487	7.39	88.1	28.78	.94	.05	.440	6.75	80.4	31.28	.78	-.03	.422	6.47	77.0	33.78	.65	-.10	.407	6.21	73.6	22																							
24	28.11	1.44	.27	.480	6.34	89.0	33.11	1.05	.07	.440	5.86	82.3	35.61	.91	-.02	.426	5.63	79.0	38.11	.77	-.09	.412	5.45	76.4	24																							
26	32.29	1.45	.21	.468	5.66	91.8	37.29	1.09	.02	.435	5.26	85.2	39.79	.94	-.06	.421	5.10	82.6	42.29	.82	-.13	.409	4.95	80.2	26																							
28	37.30	1.55	.21	.466	4.91	91.8	42.30	1.21	.03	.436	4.63	86.5	44.80	1.07	-.05	.425	4.50	84.1	47.30	.94	-.12	.413	4.38	81.9	28																							
30	42.08	1.42	.01	.384	5.29	111.5	47.08	1.11	.16	.362	5.01	105.0	49.58	.97	-.23	.353	4.88	102.0	52.08	.85	-.29	.345	4.76	100.0	30																							
32	47.85	1.33	+.18	.369	4.83	115.7	52.85	1.03	.35	.350	4.62	110.5	55.35	.90	-.41	.342	4.52	108.0	57.85	.78	-.47	.335	4.41	105.0	32																							
34	53.25	1.11	+.49	.350	4.58	122.1	58.25	.82	-.64	.333	4.41	117.5	60.75	-.71	.361	4.10	109.0	63.25	.58	-.76	.367	3.87	103.0	34																								
36	59.65	.93	-.72	.336	4.26	127.0	64.65	.66	-.89	.379	3.68	110.0	67.15	-.95	.385	3.48	104.0	69.65	.43	-.101	.391	3.30	98.4	36																								
APPLIED SUPERSTRUCTURE LOAD (K/FT.)																																																
H	12.5												15												17.5												20											
	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	ΣV	e _{36#}	e _{27#}	A	B	S	T	H																			
10	18.14	.02	-.17	.776	6.39	20.5	20.64	.05	-.21	.802	5.44	17.5	23.14	-.09	-.24	.821	4.74	15.2	25.64	-.13	-.27	.840	4.18	13.4	10																							
12	20.48	0.00	-.27	.802	5.48	23.3	22.98	-.07	-.31	.822	4.76	20.2	25.48	-.13	-.34	.837	4.21	17.9	27.98	-.18	-.37	.852	3.78	16.1	12																							
14	23.05	-.01	-.34	.804	4.85	26.5	25.55	-.09	-.39	.822	4.29	23.4	28.05	-.15	-.43	.838	3.82	20.8	30.55	-.21	-.46	.850	3.47	18.9	14																							
16	25.89	.23	-.19	.588	6.09	41.2	28.39	.14	-.24	.573	5.54	37.5	30.89	.07	-.28	.585	4.98	33.7	33.39	-.01	-.31	.594	4.53	30.7	16																							
18	28.95	.27	-.23	.560	5.44	44.8	31.45	.18	-.28	.573	4.99	41.1	33.95	.07	-.32	.583	4.55	37.5	36.45	0.00	-.36	.593	4.16	34.3	18																							
20	32.67	.36	-.24	.555	4.76	48.3	35.17	.26	-.29	.566	4.52	45.6	37.67	.18	-.34	.577	4.14	41.8	40.17	.08	-.38	.586	3.82	38.6	20																							
22	36.28	.54	-.17	.395	5.96	71.0	38.78	.44	-.22	.383	5.76	68.6	41.28	.35	-.27	.381	5.55	66.1	43.78	.28	-.31	.389	5.28	62.9	22																							
24	40.61	.66	-.15	.400	5.26	73.6	43.11	.55	-.20	.389	5.09	71.2	45.61	.46	-.26	.380	4.94	69.1	48.11	.38	-.30	.381	4.77	66.8	24																							
26	44.79	.70	-.19	.398	4.79	77.6	47.29	.60	-.26	.388	4.65	75.3	49.79	.51	-.29	.381	4.51	73.0	52.29	.43	-.34	.383	4.37	70.8	26																							
28	49.80	.83	-.18	.404	4.26	79.5	52.30	.73	-.23	.395	4.14	77.4	54.80	.63	-.28	.387	4.04	75.5	57.30	.54	-.33	.379	3.94	73.6	28																							
30	54.58	.74	-.35	.337	4.64	97.4	57.08	.63	-.40	.331	4.53	95.2	59.58	.54	-.45	.337	4.42	93.0	62.08	.46	-.51	.343	4.23	88.9	30																							
32	60.35	.67	-.53	.343	4.33	103.0	62.85	.57	-.58	.348	4.10	98.0	65.35	.48	-.63	.354	3.89	93.1	67.85	.39	-.67	.358	3.71	88.8	32																							
34	65.75	.47	-.82	.373	3.68	98.2	68.25	.37	-.87	.378	3.49	92.7	70.75	.29	-.92	.383	3.32	88.3	73.25	.20	-.96	.388	3.17	84.3	34																							
36	72.15	.33	-.106	.397	3.15	93.9	74.65	.23	-.11	.402	2.99	89.1	77.15	.11	-.16	.407	2.87	85.4	79.65	.06	-.121	.412	2.75	81.9	36																							

NOTES: The values of "S" given are maximum allowable. Where only values of "A" are listed the toe pile governs. When "B" values only are listed the heel pile governs.
For other pile loadings obtain the required spacing by proportion, for example: allowable pile loading - 60 tons, multiply values of "S" in the table by 60/45.

BAR REINFORCING QUANTITIES ARE
TOTAL QUANTITIES INCLUDING STEEL
IN ABUTMENT AND FOOTING.

NOTE: The following information is to only be used for initial abutment design sizing and planning study assumptions. Final design of abutments shall be based on current Bridge Design Specifications.

Figure 6A.B.4 High Cantilever Abutment on Pile Footing Information