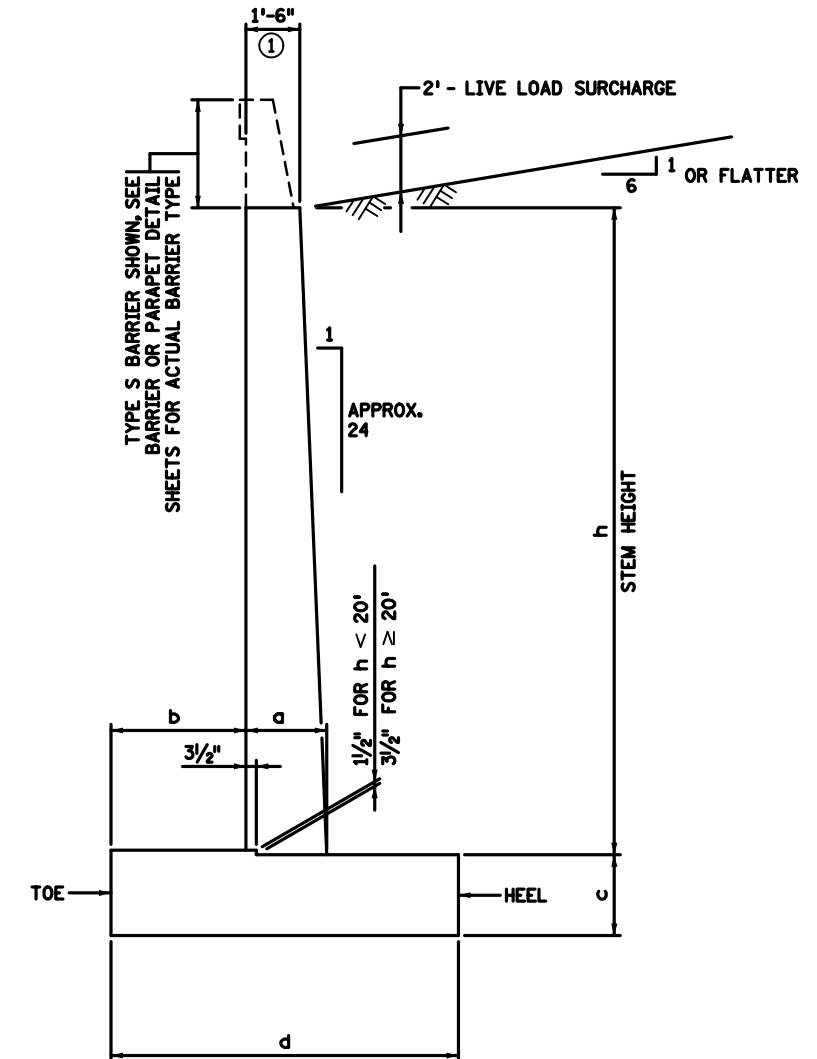


**WALL LOADING CASE:
LIVE LOAD SURCHARGE**

SHORT WALL (5'-9')
MEDIUM WALL (10'-16')
TALL WALL (17'-27')

WALL GEOMETRICS AND DATA - SPREAD FOOTING					QUANTITIES PER FOOT - SPREAD FOOTING				WALL DETAILING SCHEME	EQUIVALENT UNIFORM BEARING STRESS				EQUIVALENT VARIABLE (TRAPEZOIDAL) BEARING STRESS	
STEM HEIGHT DIM. h	STEM WIDTH DIM. a	TOE WIDTH DIM. b	FOOTING THICKNESS DIM. c	FOOTING WIDTH DIM. d	STRUCTURAL CONCRETE		REINFORCEMENT			SERVICE		STRENGTH 1		STRENGTH	
					1G52 FOOTING (CU. YD.)	3G52 STEM (CU. YD.)	PLAIN (POUND)	EPOXY (POUND)		EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF	EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF	STRESS AT TOE KSF	STRESS AT HEEL KSF
5	1'-8 1/2"	2'-7"	1'-5"	8'-6"	0.46	0.30	37	40	SHORT	7'-10 7/8"	1.10	7'-9 5/8"	1.53	1.06	1.75
6	1'-9"	2'-7"	1'-5"	8'-6"	0.46	0.36	37	43	SHORT	7'-11 3/8"	1.21	7'-10 5/8"	1.67	1.21	1.88
7	1'-9 1/2"	2'-7"	1'-5"	8'-6"	0.46	0.43	37	48	SHORT	8'-0 3/8"	1.31	8'-0"	1.79	1.39	1.98
8	1'-10"	2'-7"	1'-5"	8'-6"	0.46	0.49	37	51	SHORT	8'-1 1/8"	1.40	8'-2"	1.91	1.61	2.05
9	1'-10 1/2"	2'-7"	1'-5"	8'-6"	0.46	0.56	37	58	SHORT	8'-3 3/8"	1.48	8'-4 1/4"	2.01	1.88	2.08
10	1'-11"	2'-7"	1'-5"	8'-6"	0.46	0.63	37	66	MEDIUM	8'-5 7/8"	1.56	8'-5"	2.14	2.18	2.06
11	1'-11 1/2"	2'-7"	1'-5"	8'-6"	0.46	0.70	37	70	MEDIUM	8'-3 5/8"	1.71	8'-2"	2.37	2.54	2.01
12	2'-0"	2'-7"	1'-5"	8'-6"	0.46	0.78	41	74	MEDIUM	8'-0 3/4"	1.88	7'-10 5/8"	2.62	2.96	1.90
13	2'-0 1/2"	2'-7"	1'-5"	8'-6"	0.46	0.85	41	78	MEDIUM	7'-9 5/8"	2.07	7'-6 7/8"	2.90	3.43	1.74
14	2'-1"	2'-7"	1'-7"	8'-6"	0.51	0.93	41	86	MEDIUM	7'-5 3/4"	2.32	7'-2 1/4"	3.28	4.05	1.49
15	2'-1 1/2"	2'-7"	1'-7"	8'-6"	0.51	1.01	45	96	MEDIUM	7'-2"	2.56	6'-10"	3.65	4.66	1.21
16	2'-2"	2'-7"	1'-9"	8'-6"	0.57	1.09	45	109	MEDIUM	6'-9 3/8"	2.88	6'-4 5/8"	4.16	5.46	0.80
17	2'-2 1/2"	2'-9"	1'-9"	9'-0"	0.60	1.17	55	120	TALL	7'-2 7/8"	2.98	6'-10"	4.30	5.62	0.90
18	2'-3"	3'-0"	1'-9"	9'-6"	0.63	1.25	56	128	TALL	7'-8 5/8"	3.05	7'-3 1/2"	4.39	5.72	1.02
19	2'-3 1/2"	3'-2"	1'-9"	10'-0"	0.67	1.33	68	141	TALL	8'-2 1/8"	3.15	7'-8 3/4"	4.53	5.89	1.12
20	2'-4"	3'-4"	1'-11"	10'-7"	0.79	1.42	70	156	TALL	8'-8 1/2"	3.28	8'-3"	4.72	6.11	1.24
21	2'-4 1/2"	3'-6"	1'-11"	11'-0"	0.82	1.50	74	176	TALL	9'-0 1/2"	3.40	8'-6 5/8"	4.89	6.34	1.27
22	2'-5"	3'-8"	2'-1"	11'-7"	0.94	1.59	77	195	TALL	9'-7"	3.53	9'-0 7/8"	5.07	6.55	1.39
23	2'-5 1/2"	3'-10"	2'-1"	12'-1"	0.98	1.68	82	223	TALL	10'-0 1/2"	3.63	9'-6 1/4"	5.21	6.72	1.49
24	2'-6"	4'-0"	2'-3"	12'-7"	1.10	1.77	95	253	TALL	10'-5 3/8"	3.78	9'-10 7/8"	5.43	7.00	1.54
25	2'-6 1/2"	4'-2"	2'-3"	13'-1"	1.14	1.87	100	264	TALL	10'-11"	3.88	10'-4 1/4"	5.57	7.16	1.64
26	2'-7"	4'-4"	2'-3"	13'-7"	1.18	1.96	103	300	TALL	11'-4 5/8"	3.98	10'-9 5/8"	5.71	7.33	1.75
27	2'-7 1/2"	4'-6"	2'-5"	14'-1"	1.31	2.06	122	333	TALL	11'-9 1/2"	4.13	11'-2 1/8"	5.92	7.61	1.80



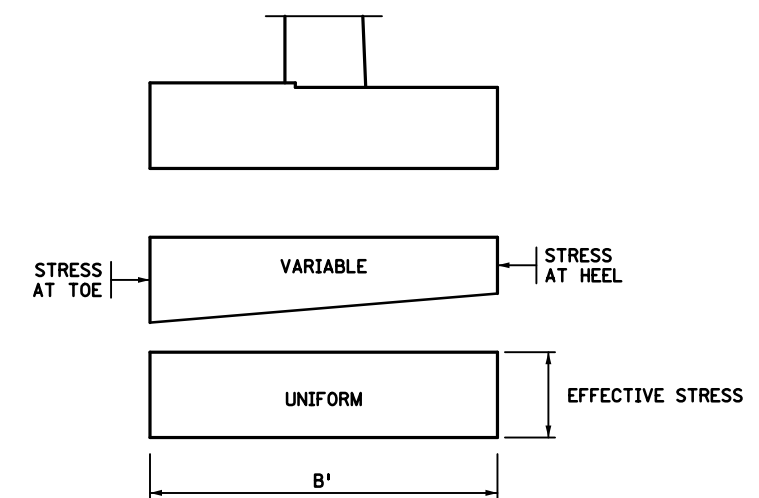
TYPICAL SECTION

STEM HEIGHT h	REINFORCEMENT - SPREAD FOOTING			
	STEM DOWEL SIZE AND SPACING	FOOTING		
		TOE (BOTTOM TRANSVERSE)	HEEL (TOP TRANSVERSE)	LONGITUDINAL (TOP AND BOT.)
		BAR SIZE & SPA.	BAR SIZE & SPA.	BAR SIZE & SPA.
5	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
6	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
7	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
8	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
9	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
10	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
11	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
12	5 @ 12"	5 @ 12"	6 @ 12"	5 @ 12"
13	5 @ 12"	5 @ 12"	6 @ 12"	5 @ 12"
14	5 @ 12"	5 @ 12"	6 @ 12"	5 @ 12"
15	6 @ 12"	5 @ 12"	7 @ 12"	5 @ 12"
16	6 @ 12"	5 @ 12"	7 @ 12"	5 @ 12"
17	6 @ 12"	5 @ 12"	8 @ 12"	5 @ 12"
18	6 @ 12"	5 @ 12"	8 @ 12"	5 @ 12"
19	7 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
20	7 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
21	8 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
22	8 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
23	9 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
24	9 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
25	9 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
26	10 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
27	10 @ 12"	5 @ 12"	11 @ 12"	5 @ 12"

NOTES:

EPOXY REINFORCEMENT QUANTITY ASSUMES A CORK AND DOWEL JOINT IS USED ON BOTH PANEL ENDS. THE QUANTITY MUST BE ADJUSTED WHEN CONSTRUCTION JOINTS ARE USED. QUANTITIES ON THIS SHEET DO NOT INCLUDE BARRIER OR PARAPET. SEE BARRIER OR PARAPET SHEETS FOR REINFORCEMENT (EPOXY) AND BARRIER/PARAPET CONCRETE.

① WALL THICKNESS AT TOP OF STEM, NOT INCLUDING COPING. REFER TO STANDARD FIGURE 5-297.624 (1 OF 6) FOR MODIFIED TOP OF WALL THICKNESS WHEN USING TYPE S BARRIER.



BEARING STRESS
(SEE TABLE ABOVE)

**PILE FOOTING DIMENSIONS AND PILE SPACING - 100 TON FACTORED RESISTANCE PILE
LIVE LOAD SURCHARGE**

SHORT WALL (5'-9")
MEDIUM WALL (10'-16")
TALL WALL (17'-27")

STEM HEIGHT	FOOTING GEOMETRY				PILE SPACING									QUANTITIES			WALL DETAILING SCHEME ②
	DIM. a	DIM. b	DIM. c	DIM. d	TRANSVERSE				LONGITUDINAL ③					PER FOOT			
					FRONT ROW TO BACK ROW	FRONT ROW TO 2ND ROW	2ND ROW TO 3RD ROW	3RD ROW TO BACK ROW	BACK ROW TO HEEL	FRONT ROW	2ND ROW	3RD ROW	BACK ROW	STEEL PLAIN (POUND)	CONCRETE 1652 CU. YD. ①	NO. OF PILES	
5	1'-8 1/2"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	63.87	0.61	0.167	SHORT
6	1'-9"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	63.87	0.61	0.167	SHORT
7	1'-9 1/2"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	78.33	0.61	0.167	SHORT
8	1'-10"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	78.33	0.61	0.167	SHORT
9	1'-10 1/2"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	78.33	0.61	0.167	SHORT
10	1'-11"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	96.07	0.61	0.167	MEDIUM
11	1'-11 1/2"	2'-9"	2'-0"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	96.07	0.61	0.167	MEDIUM
12	2'-0"	2'-9"	2'-3"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	10'-0"	N.A.	N.A.	10'-0"	63.87	0.68	0.200	MEDIUM
13	2'-0 1/2"	2'-9"	2'-3"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	10'-0"	N.A.	N.A.	10'-0"	63.87	0.68	0.200	MEDIUM
14	2'-1"	2'-9"	2'-3"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	10'-0"	N.A.	N.A.	10'-0"	63.87	0.68	0.200	MEDIUM
15	2'-1 1/2"	2'-9"	2'-3"	8'-0"	5'-0"	N.A.	N.A.	N.A.	1'-6"	10'-0"	N.A.	N.A.	10'-0"	63.87	0.68	0.200	MEDIUM
16	2'-2"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	0.99	0.375	MEDIUM
17	2'-2 1/2"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	0.99	0.375	TALL
18	2'-3"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	0.99	0.375	TALL
19	2'-3 1/2"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	0.99	0.375	TALL
20	2'-4"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	1.02	0.375	TALL
21	2'-4 1/2"	4'-0"	2'-6"	10'-6"	N.A.	3'-6"	3'-6"	N.A.	2'-0"	8'-0"	8'-0"	8'-0"	8'-0"	77.74	1.02	0.375	TALL
22	2'-5"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	112.03	1.44	0.615	TALL
23	2'-5 1/2"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	112.03	1.44	0.615	TALL
24	2'-6"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	112.03	1.44	0.615	TALL
25	2'-6 1/2"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	112.03	1.44	0.615	TALL
26	2'-7"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	125.34	1.44	0.615	TALL
27	2'-7 1/2"	5'-6"	2'-9"	13'-6"	N.A.	3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	138.66	1.44	0.615	TALL

N.A. = NOT APPLICABLE

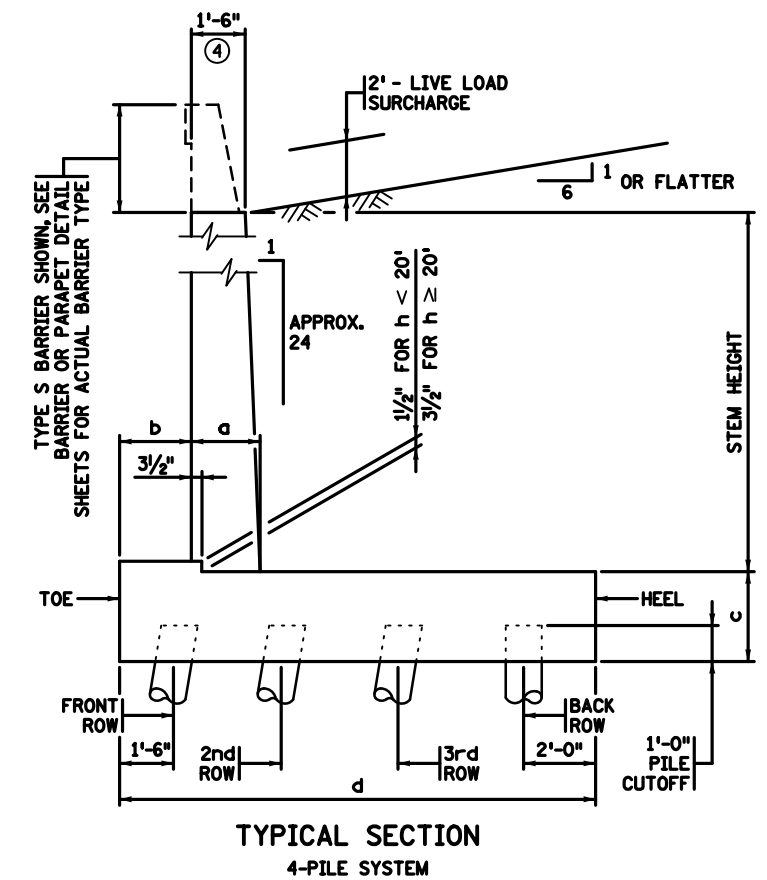
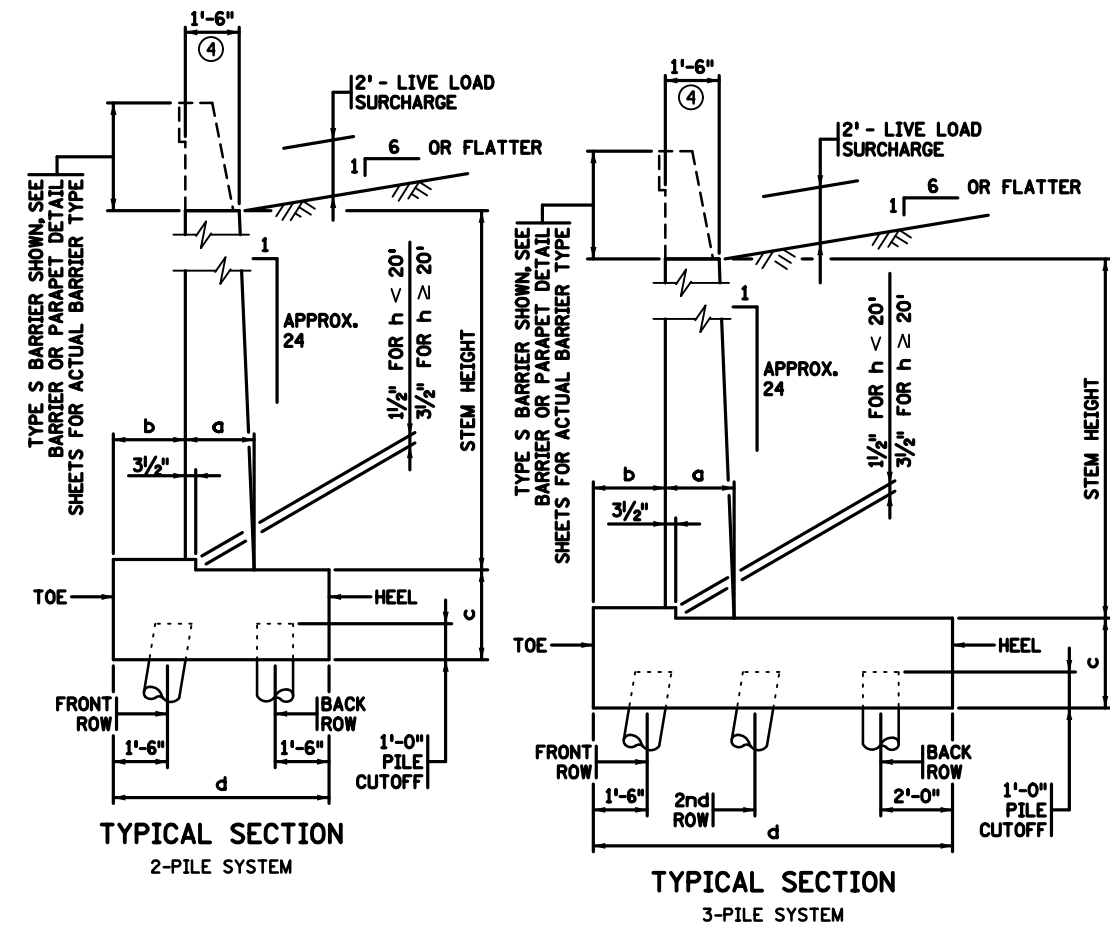
STEM HEIGHT h	REINFORCEMENT - PILE FOUNDATION			
	STEM DOWEL SIZE AND SPACING	FOOTING		
		TOE (BOTTOM TRANSVERSE) BAR SIZE & SPA.	HEEL (TOP TRANSVERSE) BAR SIZE & SPA.	LONGITUDINAL (TOP AND BOT.) BAR SIZE & SPA.
5	5 # 12"	6 # 12"	5 # 12"	7 # 12"
6	5 # 12"	6 # 12"	5 # 12"	7 # 12"
7	5 # 12"	6 # 12"	5 # 12"	8 # 12"
8	5 # 12"	6 # 12"	5 # 12"	8 # 12"
9	5 # 12"	6 # 12"	5 # 12"	8 # 12"
10	5 # 12"	6 # 12"	5 # 12"	9 # 12"
11	5 # 12"	6 # 12"	5 # 12"	9 # 12"
12	5 # 12"	6 # 12"	5 # 12"	7 # 12"
13	5 # 12"	6 # 12"	5 # 12"	7 # 12"
14	5 # 12"	6 # 12"	5 # 12"	7 # 12"
15	6 # 12"	6 # 12"	5 # 12"	7 # 12"
16	6 # 12"	7 # 12"	6 # 12"	6 # 12"
17	6 # 12"	7 # 12"	6 # 12"	6 # 12"
18	6 # 12"	7 # 12"	6 # 12"	6 # 12"
19	7 # 12"	7 # 12"	6 # 12"	6 # 12"
20	7 # 12"	7 # 12"	6 # 12"	6 # 12"
21	8 # 12"	7 # 12"	6 # 12"	6 # 12"
22	8 # 12"	8 # 12"	8 # 12"	5 # 12"
23	9 # 12"	8 # 12"	8 # 12"	5 # 12"
24	9 # 12"	8 # 12"	8 # 12"	5 # 12"
25	9 # 12"	8 # 12"	8 # 12"	5 # 12"
26	10 # 12"	8 # 12"	9 # 12"	5 # 12"
27	10 # 12"	9 # 12"	9 # 12"	5 # 12"

REQUIRED NOMINAL PILE BEARING RESISTANCE R _n - TONS/PILE				
FIELD CONTROL METHOD	CIP PILES		H PILES	
	φ dyn	* R _n	φ dyn	* R _n
MnDOT PILE FORMULA 2012 (MPF12) $R_n = 20 \sqrt{\frac{W \times H}{1000}} \times \log\left(\frac{10}{S}\right)$	0.50	200	0.60	167
PDA	0.65	154	0.65	154

* R_n = (FACTORED DESIGN LOAD) / φ dyn

NOTES

- ALL PILES TO BE BATTERED 4(V) : 1(H) EXCEPT BACK ROW WHICH IS TO BE DRIVEN VERTICAL
 - ① FOOTING CONCRETE. FOR STEM CONCRETE (3G52) SEE APPROPRIATE WALLPANEL TABULATION.
 - ② SEE STANDARD PLANS 5-297.621 TO .623 FOR REINFORCING DETAILS.
 - ③ THIS IS THE MAXIMUM PERMITTED LONGITUDINAL PILE SPACING; REFER TO THE PILE LAYOUT SHEETS FOR THE FINAL PILE SPACING.
 - ④ WALL THICKNESS AT TOP OF STEM, NOT INCLUDING COPING. REFER TO STANDARD FIGURE 5-297.624 (1 OF 6) FOR MODIFIED TOP OF WALL THICKNESS WHEN USING TYPE S BARRIER.
- FOOTING BAR SIZE: NO. 5 BAR MINIMUM FOR TRANSVERSE REINFORCEMENT.
NO. 6 BAR MINIMUM FOR LONGITUDINAL REINFORCEMENT.



LEAD EXPERT OFFICE
NANCY DAUBENBERGER
STATE BRIDGE ENGINEER



RETAINING WALL (LIVE LOAD SURCHARGE)
PILE FOUNDATION GEOMETRY AND DATA

APPROVED: 08-27-2014
REVISED: 09-01-2016

CHRISTOPHER ROY
STATE DESIGN ENGINEER

STANDARD PLAN
5-297.632

2 OF 2

STANDARD PLAN

STATE PROJ. NO. SHEET NO.
TRUNK HWY. TOTAL SHEETS