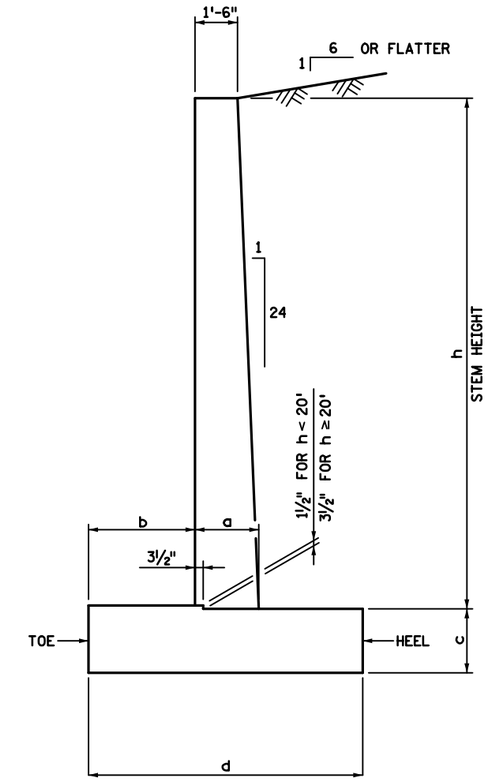
SPREAD FOOTING DIMENSIONS AND SOIL STRESSES
LEVEL FILL

SHORT WALL (5'-11")
MEDIUM WALL (12'-19")
TALL WALL (20'-30")

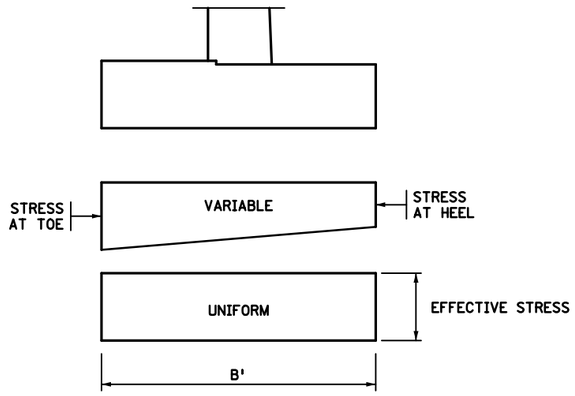
WALL GEOMETRICS AND DATA - SPREAD FOOTING					QUANTITIES PER FOOT - SPREAD FOOTING					EQUIVALENT UNIFORM BEARING STRESS				EQUIVALENT VARIABLE (TRAPEZOIDAL) BEARING STRESS	
					STRUCTURAL CONCRETE		REINFORCEMENT			SERVICE		STRENGTH 1		STRENGTH	
STEM HEIGHT DIM. h	STEM WIDTH DIM. a	TOE WIDTH DIM. b	FOOTING THICKNESS DIM. c	FOOTING WIDTH DIM. d	1G52 FOOTING (CU. YD.)	3G52 STEM (CU. YD.)	PLAIN (POUND)	EPOXY (POUND)	WALL DETAILING SCHEME	EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF	EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF	STRESS AT TOE KSF	STRESS AT HEEL KSF
5	1'-8½"	9"	1'-5"	3'-3"	0.18	0.30	15	31	SHORT	2'-8⅞"	1.10	2'-7⅞"	1.47	1.87	0.54
6	1'-9"	11"	1'-5"	3'-6"	0.19	0.36	15	35	SHORT	2'-10⅝"	1.26	2'-9⅛"	1.71	2.20	0.50
7	1'-9½"	1'-1"	1'-5"	3'-9"	0.20	0.43	18	39	SHORT	3'-0⅛"	1.42	2'-10¼"	1.96	2.56	0.43
8	1'-10"	1'-3"	1'-5"	4'-0"	0.22	0.49	19	42	SHORT	3'-1⅜"	1.60	2'-11¼"	2.22	2.93	0.33
9	1'-10½"	1'-5"	1'-5"	4'-3"	0.23	0.56	19	46	SHORT	3'-2½"	1.78	2'-11⅞"	2.50	3.32	0.20
10	1'-11"	1'-7"	1'-5"	4'-6"	0.25	0.63	20	50	SHORT	3'-3½"	1.96	3'-0½"	2.80	3.73	0.05
11	1'-11½"	1'-9"	1'-5"	4'-10"	0.27	0.70	23	56	SHORT	3'-5⅞"	2.12	3'-2½"	3.04	4.06	0.00
12	2'-0"	1'-11"	1'-5"	5'-3"	0.29	0.78	24	64	MEDIUM	3'-9⅝"	2.24	3'-6"	3.22	4.29	0.00
13	2'-0½"	2'-1"	1'-5"	5'-8"	0.31	0.85	24	68	MEDIUM	4'-1½"	2.36	3'-9⅝"	3.39	4.53	0.00
14	2'-1"	2'-3"	1'-5"	6'-1"	0.33	0.93	28	73	MEDIUM	4'-5⅜"	2.48	4'-1¼"	3.57	4.76	0.00
15	2'-1½"	2'-5"	1'-5"	6'-7"	0.36	1.01	29	77	MEDIUM	4'-10¾"	2.56	4'-6½"	3.66	4.88	0.18
16	2'-2"	2'-7"	1'-7"	7'-1"	0.43	1.09	32	85	MEDIUM	5'-3½"	2.71	4'-11"	3.87	5.15	0.23
17	2'-2½"	2'-9"	1'-7"	7'-7"	0.46	1.17	36	95	MEDIUM	5'-9"	2.79	5'-4⅜"	3.99	5.30	0.34
18	2'-3"	2'-11"	1'-9"	8'-1"	0.54	1.25	40	106	MEDIUM	6'-1⅞"	2.94	5'-8⅞"	4.20	5.57	0.39
19	2'-3½"	3'-1"	1'-9"	8'-7"	0.57	1.33	46	114	MEDIUM	6'-7⅜"	3.03	6'-2¼"	4.32	5.72	0.51
20	2'-4"	3'-3"	1'-9"	9'-1"	0.63	1.42	49	134	TALL	7'-0⅞"	3.13	6'-7⅝"	4.45	5.87	0.62
21	2'-4½"	3'-6"	1'-9"	9'-7"	0.66	1.50	57	143	TALL	7'-6⅝"	3.18	7'-1⅛"	4.53	5.96	0.74
22	2'-5"	3'-9"	2'-1"	10'-3"	0.84	1.59	62	156	TALL	8'-2⅛"	3.31	7'-8½"	4.69	6.15	0.90
23	2'-5½"	4'-0"	2'-1"	10'-10"	0.89	1.68	66	170	TALL	8'-9⅝"	3.35	8'-3¾"	4.74	6.18	1.09
24	2'-6"	4'-3"	2'-1"	11'-4"	0.92	1.77	76	193	TALL	9'-3⅜"	3.41	8'-9¼"	4.83	6.28	1.20
25	2'-6½"	4'-6"	2'-1"	11'-11"	0.97	1.87	81	215	TALL	9'-10⅞"	3.46	9'-4½"	4.90	6.32	1.39
26	2'-7"	4'-9"	2'-1"	12'-5"	1.01	1.96	83	239	TALL	10'-4⅝"	3.53	9'-10⅛"	4.99	6.42	1.50
27	2'-7½"	5'-0"	2'-3"	13'-1"	1.15	2.06	100	264	TALL	11'-1"	3.62	10'-6¼"	5.10	6.51	1.69
28	2'-8"	5'-3"	2'-3"	13'-7"	1.19	2.16	103	295	TALL	11'-6⅞"	3.69	10'-11⅞"	5.20	6.62	1.80
29	2'-8½"	5'-6"	2'-5"	14'-3"	1.34	2.26	108	330	TALL	12'-3¼"	3.77	11'-8⅛"	5.32	6.72	1.99
30	2'-9"	5'-9"	2'-5"	14'-9"	1.39	2.36	113	377	TALL	12'-9⅛"	3.85	12'-1¾"	5.42	6.83	2.09

NOTE:
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.

REINFORCEMENT - SPREAD FOOTING				
STEM HEIGHT h	STEM	FOOTING		
	DOWEL SIZE AND SPACING	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"	5 @ 12"	5 @ 12"
13	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
14	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
15	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
16	5 @ 12"	5 @ 12"	5 @ 12"	5 @ 12"
17	6 @ 12"	5 @ 12"	6 @ 12"	5 @ 12"
18	6 @ 12"	5 @ 12"	6 @ 12"	5 @ 12"
19	6 @ 12"	5 @ 12"	7 @ 12"	5 @ 12"
20	7 @ 12"	5 @ 12"	7 @ 12"	5 @ 12"
21	7 @ 12"	5 @ 12"	8 @ 12"	5 @ 12"
22	7 @ 12"	5 @ 12"	8 @ 12"	5 @ 12"
23	7 @ 12"	5 @ 12"	8 @ 12"	5 @ 12"
24	8 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
25	8 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
26	9 @ 12"	5 @ 12"	9 @ 12"	5 @ 12"
27	9 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
28	10 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
29	10 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"
30	11 @ 12"	5 @ 12"	10 @ 12"	5 @ 12"



TYPICAL SECTION



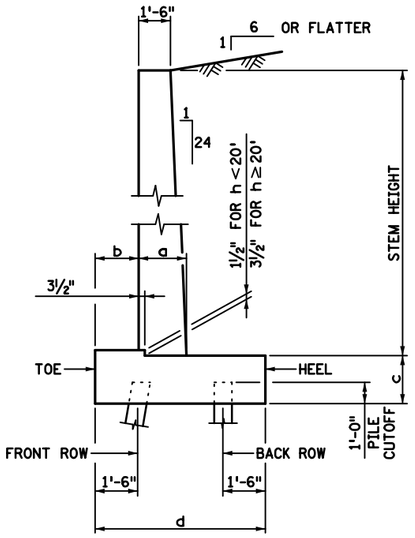
BEARING STRESS
(SEE TABLE ABOVE)

LEAD EXPERT OFFICE: NANCY DAUBENBERGER, STATE BRIDGE ENGINEER		RETAINING WALL (LEVEL FILL) SPREAD FOOTING GEOMETRY AND DATA	APPROVED: 08-27-2014 REVISED: 09-01-2016	CHRISTOPHER ROY STATE DESIGN ENGINEER	STANDARD PLAN 5-297.630	1 OF 2
	DEPARTMENT OF TRANSPORTATION	STANDARD PLAN	STATE PROJ. NO.		SHEET NO.	
			TRUNK HWY.		TOTAL SHEETS	

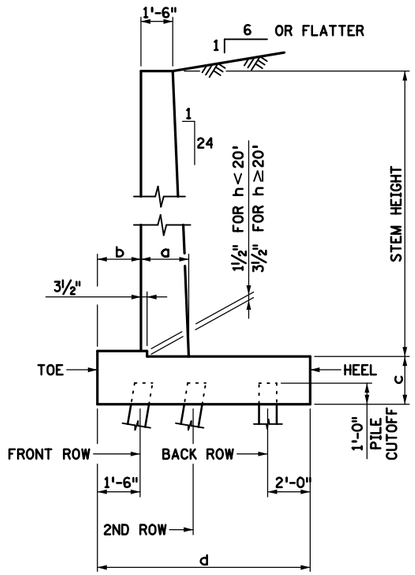
PILE FOOTING DIMENSIONS AND PILE SPACING - 100 TON FACTORED RESISTANCE PILES
LEVEL FILL

SHORT WALL (5'-11')
MEDIUM WALL (12'-19')
TALL WALL (20'-30')

STEM HEIGHT	FOOTING GEOMETRY				PILE SPACING									QUANTITIES			WALL DETAILING SCHEME ②
					TRANSVERSE					LONGITUDINAL ③				PER FOOT			
	DIM. a	DIM. b	DIM. c	DIM. d	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 1G52 CU. YD. ①	NO. OF PILES	
5	1'-8½"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	37	0.46	0.167	SHORT
6	1'-9"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	46	0.46	0.167	SHORT
7	1'-9½"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	46	0.46	0.167	SHORT
8	1'-10"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	46	0.46	0.167	SHORT
9	1'-10½"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	57	0.46	0.167	SHORT
10	1'-11"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	57	0.46	0.167	SHORT
11	1'-11½"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	57	0.46	0.167	SHORT
12	2'-0"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	71	0.46	0.167	MEDIUM
13	2'-0½"	1'-9"	2'-0"	6'-0"	3'-0"				1'-6"	12'-0"			12'-0"	71	0.46	0.167	MEDIUM
14	2'-1"	2'-6"	2'-3"	7'-6"	4'-6"				1'-6"	10'-6"			10'-6"	83	0.64	0.190	MEDIUM
15	2'-1½"	2'-6"	2'-3"	7'-6"	4'-6"				1'-6"	10'-6"			10'-6"	83	0.64	0.190	MEDIUM
16	2'-2"	2'-6"	2'-3"	7'-6"	4'-6"				1'-6"	10'-6"			10'-6"	83	0.64	0.190	MEDIUM
17	2'-2½"	2'-6"	2'-3"	7'-6"	4'-6"				1'-6"	10'-6"			10'-6"	83	0.64	0.190	MEDIUM
18	2'-3"	3'-9"	2'-6"	10'-0"		3'-3"	3'-3"		2'-0"	9'-6"	9'-6"		9'-6"	123	0.95	0.316	MEDIUM
19	2'-3½"	3'-9"	2'-6"	10'-0"		3'-3"	3'-3"		2'-0"	9'-6"	9'-6"		9'-6"	123	0.95	0.316	MEDIUM
20	2'-4"	3'-9"	2'-6"	10'-0"		3'-3"	3'-3"		2'-0"	9'-6"	9'-6"		9'-6"	123	0.97	0.316	TALL
21	2'-4½"	3'-9"	2'-6"	10'-0"		3'-3"	3'-3"		2'-0"	9'-6"	9'-6"		9'-6"	123	0.97	0.316	TALL
22	2'-5"	4'-9"	2'-9"	12'-0"		4'-3"	4'-3"		2'-0"	6'-6"	6'-6"		6'-6"	170	1.28	0.462	TALL
23	2'-5½"	4'-9"	2'-9"	12'-0"		4'-3"	4'-3"		2'-0"	6'-6"	6'-6"		6'-6"	170	1.28	0.462	TALL
24	2'-6"	4'-9"	2'-9"	12'-0"		4'-3"	4'-3"		2'-0"	6'-6"	6'-6"		6'-6"	170	1.28	0.462	TALL
25	2'-6½"	4'-9"	2'-9"	12'-0"		4'-3"	4'-3"		2'-0"	6'-6"	6'-6"		6'-6"	170	1.28	0.462	TALL
26	2'-7"	4'-9"	2'-9"	12'-0"		4'-3"	4'-3"		2'-0"	6'-6"	6'-6"		6'-6"	170	1.28	0.462	TALL
27	2'-7½"	5'-6"	2'-9"	13'-6"		3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	195	1.44	0.615	TALL
28	2'-8"	5'-6"	2'-9"	13'-6"		3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	195	1.44	0.615	TALL
29	2'-8½"	5'-6"	2'-9"	13'-6"		3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	195	1.44	0.615	TALL
30	2'-9"	5'-6"	2'-9"	13'-6"		3'-3"	3'-3"	3'-6"	2'-0"	6'-6"	6'-6"	6'-6"	6'-6"	195	1.44	0.615	TALL



TYPICAL SECTION
2-PILE SYSTEM



TYPICAL SECTION
3-PILE SYSTEM

REINFORCEMENT - PILE FOUNDATION				
STEM HEIGHT h	STEM	FOOTING		
	DOWEL SIZE AND SPACING	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"	6 @ 12"
6	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
7	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
8	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
9	5 @ 12"	5 @ 12"	5 @ 12"	8 @ 12"
10	5 @ 12"	5 @ 12"	5 @ 12"	8 @ 12"
11	5 @ 12"	5 @ 12"	5 @ 12"	8 @ 12"
12	5 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
13	5 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
14	5 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
15	5 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
16	5 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
17	6 @ 12"	5 @ 12"	5 @ 12"	9 @ 12"
18	6 @ 12"	6 @ 12"	6 @ 12"	9 @ 12"
19	6 @ 12"	6 @ 12"	6 @ 12"	9 @ 12"
20	7 @ 12"	6 @ 12"	6 @ 12"	9 @ 12"
21	7 @ 12"	6 @ 12"	6 @ 12"	9 @ 12"
22	7 @ 12"	8 @ 12"	7 @ 12"	9 @ 12"
23	6 @ 12"	8 @ 12"	7 @ 12"	9 @ 12"
24	8 @ 12"	8 @ 12"	7 @ 12"	9 @ 12"
25	8 @ 12"	8 @ 12"	7 @ 12"	9 @ 12"
26	9 @ 12"	8 @ 12"	7 @ 12"	9 @ 12"
27	9 @ 12"	8 @ 12"	8 @ 12"	9 @ 12"
28	10 @ 12"	8 @ 12"	8 @ 12"	9 @ 12"
29	10 @ 12"	8 @ 12"	8 @ 12"	9 @ 12"
30	11 @ 12"	8 @ 12"	8 @ 12"	9 @ 12"

REQUIRED NOMINAL PILE BEARING RESISTANCE
R_n - TONS/PILE

	CIP PILES		H PILES	
FIELD CONTROL METHOD	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:

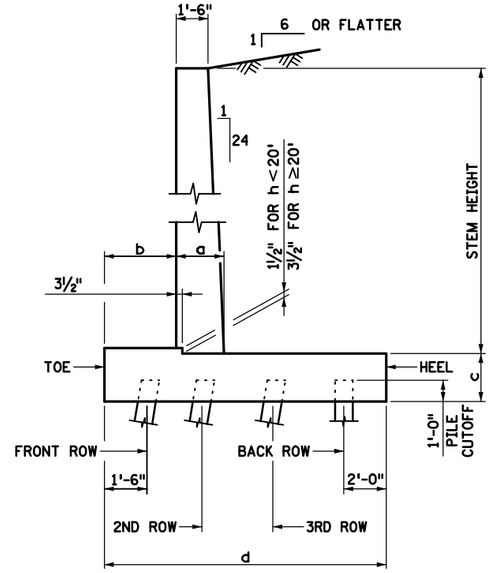
① FOOTING CONCRETE. FOR STEM CONCRETE (3G52) SEE APPROPRIATE WALL PANEL TABULATION.

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 FINAL PILE SPACING.

ALL PILES TO BE BATTERED 4(V) : 1(H) EXCEPT BACK ROW WHICH IS TO BE DRIVEN VERTICAL.

FOOTING BAR SIZE, NO. 5 BAR MINIMUM FOR TRANSVERSE REINFORCEMENT. NO. 6 BAR MINIMUM FOR LONGITUDINAL REINFORCEMENT.



TYPICAL SECTION
4-PILE SYSTEM

LEAD EXPERT OFFICE	NANCY DAUBENBERGER STATE BRIDGE ENGINEER	RETAINING WALL (LEVEL FILL) PILE FOUNDATION GEOMETRY AND DATA	APPROVED: 08-27-2014 REVISED: 09-01-2016	CHRISTOPHER ROY STATE DESIGN ENGINEER	STANDARD PLAN 5-297.630	2 OF 2

DEPARTMENT OF TRANSPORTATION	STANDARD PLAN	STATE PROJ. NO.	SHEET NO.	
		TRUNK HWY.	TOTAL SHEETS	