

SPREAD FOOTING DIMENSIONS AND SOIL STRESSES
1(V) : 2(H) SLOPED FILL

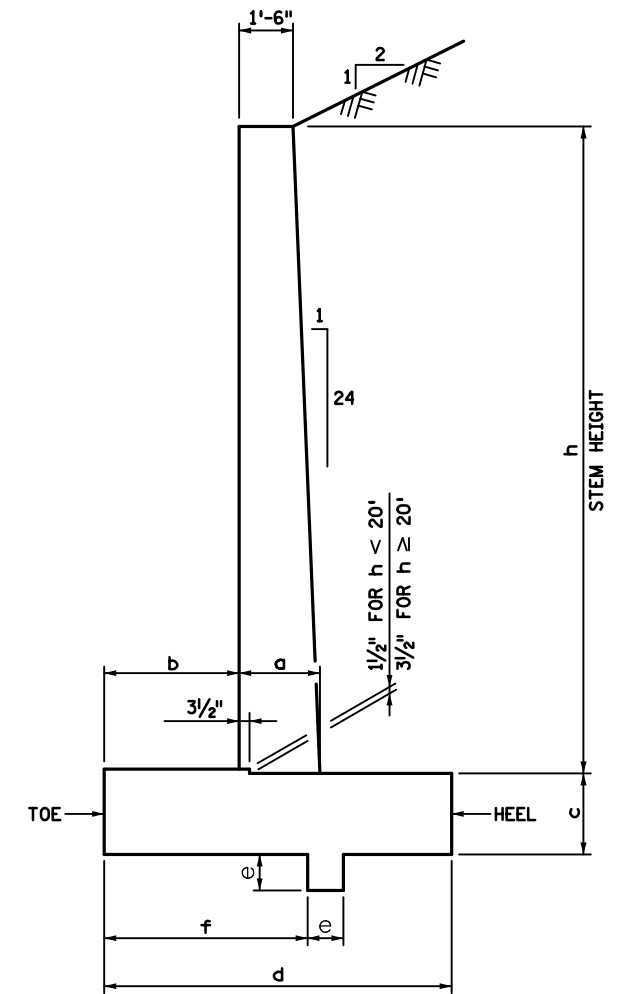
SHORT WALL (5'-10')
MEDIUM WALL (11'-18')
TALL WALL (19'-27')

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	SHEAR KEY SIZE DIM. e	SHEAR KEY LOCATION DIM. f	STRUCTURAL CONCRETE		REINFORCEMENT			SERVICE		STRENGTH 1		STRESS AT TOE KSF	STRESS AT HEEL KSF
							1G52 FOOTING (CU. YD.)	3G52 STEM (CU. YD.)	PLAIN (POUND)	EPOXY (POUND)		EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF	EFFECTIVE WIDTH B'	EFFECTIVE STRESS KSF		
5	1'-8 1/2"	9"	1'-5"	3'-3"	N.A.	N.A.	0.18	0.30	14.9	31.1	2'-4 5/8"	1.33	1'-10 3/4"	1.85	2.46	0.10	
6	1'-9"	11"	1'-5"	3'-8"	N.A.	N.A.	0.20	0.36	15.7	34.7	2'-7 5/8"	1.53	2'-0 1/2"	2.14	2.86	0.03	
7	1'-9 1/2"	1'-1"	1'-5"	4'-5"	N.A.	N.A.	0.24	0.43	19.6	39.0	3'-3 1/2"	1.63	2'-7 1/2"	2.28	3.03	0.19	
8	1'-10"	1'-3"	1'-5"	5'-2"	N.A.	N.A.	0.28	0.49	23.4	42.5	3'-11 1/2"	1.75	3'-2 5/8"	2.43	3.21	0.34	
9	1'-10 1/2"	1'-5"	1'-5"	5'-11"	N.A.	N.A.	0.32	0.56	27.2	46.1	4'-7 3/4"	1.86	3'-9 7/8"	2.59	3.40	0.49	
10	1'-11"	1'-7"	1'-5"	6'-8"	N.A.	N.A.	0.36	0.63	28.8	52.2	5'-3 3/4"	1.99	4'-5 1/4"	2.76	3.59	0.64	
11	1'-11 1/2"	1'-9"	1'-5"	7'-5"	N.A.	N.A.	0.40	0.70	35.9	61.5	6'-0 1/8"	2.11	5'-0 1/2"	2.93	3.79	0.78	
12	2'-0"	1'-11"	1'-5"	8'-2"	N.A.	N.A.	0.44	0.78	44.3	65.2	6'-8 1/2"	2.24	5'-7 7/8"	3.11	4.00	0.92	
13	2'-0 1/2"	2'-1"	1'-5"	8'-11"	N.A.	N.A.	0.48	0.85	54.3	69.5	7'-4 7/8"	2.36	6'-3 1/4"	3.29	4.20	1.07	
14	2'-1"	2'-3"	1'-5"	8'-11"	1'-4"	3'-7 1/2"	0.55	0.93	54.3	75.7	7'-1 7/8"	2.61	5'-10 1/2"	3.65	4.76	0.86	
15	2'-1 1/2"	2'-6"	1'-5"	8'-11"	1'-4"	3'-11"	0.55	1.01	54.3	85.7	6'-10 5/8"	2.81	5'-5 1/4"	3.98	5.26	0.58	
16	2'-2"	2'-9"	1'-5"	8'-11"	1'-4"	4'-2 1/2"	0.55	1.09	54.3	95.7	6'-7 1/4"	3.05	4'-11 3/4"	4.36	5.81	0.24	
17	2'-2 1/2"	3'-0"	1'-7"	9'-2"	1'-6"	4'-6"	0.64	1.17	61.6	108.0	6'-6 3/4"	3.30	4'-8 7/8"	4.83	6.44	0.00	
18	2'-3"	3'-6"	1'-7"	9'-6"	2'-0"	5'-0 1/2"	0.72	1.25	67.4	118.5	6'-10 3/8"	3.35	4'-10 1/2"	4.98	6.65	0.00	
19	2'-3 1/2"	3'-9"	1'-9"	10'-1"	2'-2"	5'-4"	0.85	1.33	68.0	136.3	7'-3 5/8"	3.51	5'-2 1/4"	5.24	6.99	0.00	
20	2'-4"	4'-0"	1'-9"	10'-7"	2'-6"	5'-7 1/2"	0.96	1.42	75.0	151.7	7'-8 3/4"	3.63	5'-6"	5.42	7.23	0.00	
21	2'-4 1/2"	4'-4"	1'-9"	11'-1"	2'-6"	6'-0"	1.00	1.50	79.7	160.8	8'-1 1/2"	3.71	5'-9"	5.57	7.43	0.00	
22	2'-5"	4'-8"	1'-11"	11'-8"	2'-6"	6'-4 1/2"	1.11	1.59	82.7	180.0	8'-6 3/4"	3.84	6'-0 1/2"	5.78	7.71	0.00	
23	2'-5 1/2"	5'-0"	2'-0"	12'-4"	2'-6"	6'-9"	1.20	1.68	99.1	210.3	9'-2"	3.91	6'-6 1/4"	5.85	7.80	0.00	
24	2'-6"	5'-4"	2'-2"	12'-10"	2'-6"	7'-1 1/2"	1.32	1.77	111.0	233.9	9'-5 5/8"	4.06	6'-8"	6.14	8.19	0.00	
25	2'-6 1/2"	5'-8"	2'-3"	13'-4"	2'-6"	7'-6"	1.41	1.87	114.3	266.3	9'-9 3/4"	4.17	6'-10 3/8"	6.37	8.50	0.00	
26	2'-7"	6'-0"	2'-5"	13'-11"	2'-6"	7'-10 1/2"	1.55	1.96	120.3	302.3	10'-3"	4.30	7'-1 3/4"	6.59	8.79	0.00	
27	2'-7 1/2"	6'-4"	2'-6"	14'-6"	2'-6"	8'-3"	1.65	2.06	109.9	371.1	10'-8 3/4"	4.39	7'-5 7/8"	6.74	8.98	0.00	

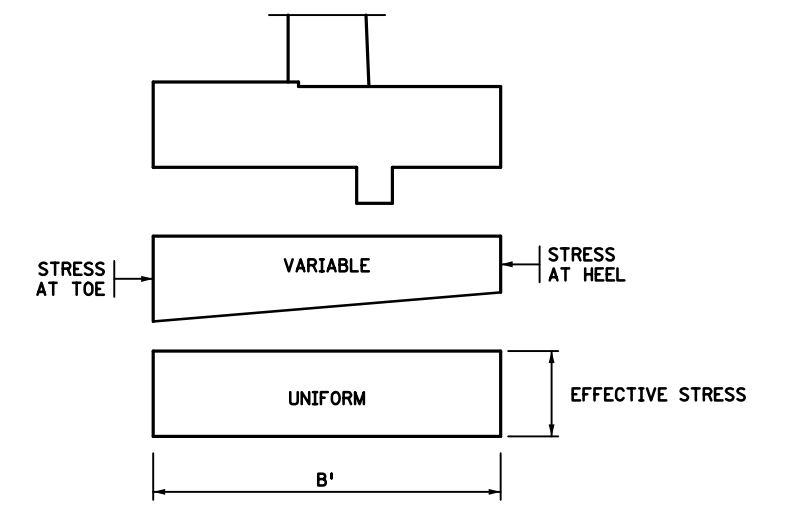
N.A. = NOT APPLICABLE

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.

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



TYPICAL SECTION



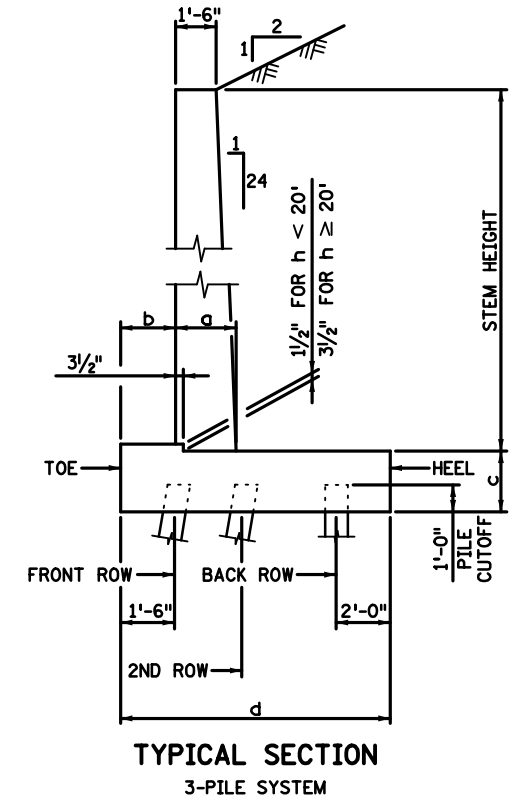
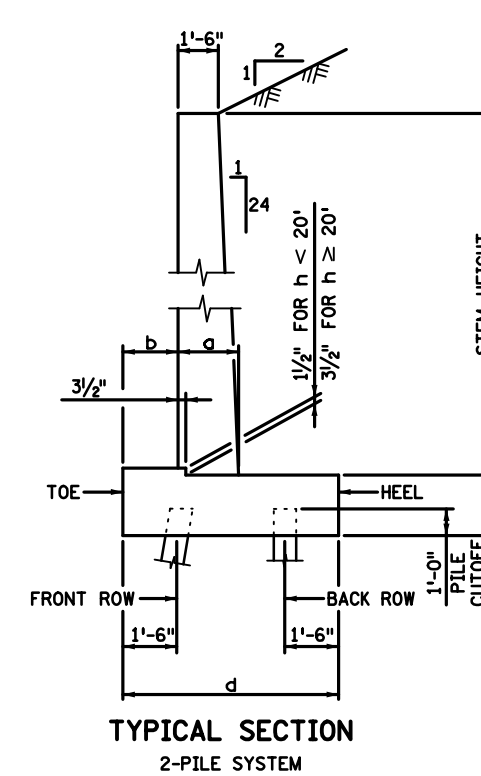
BEARING STRESS
(SEE TABLE ABOVE)

PILE FOOTING DIMENSIONS AND PILE SPACING - 100 TON FACTORED RESISTANCE PILES
1(V) : 2(H) SLOPED FILL

SHORT WALL (5'-10')
 MEDIUM WALL (11'-18')
 TALL WALL (19'-27')

STEM HEIGHT	PILE SPACING													QUANTITIES			WALL DETAILING SCHEME ②
	FOOTING GEOMETRY				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 1652 CU. YD. ①	NO. OF PILES	
5	1'-8 1/2"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	46	0.46	0.167	SHORT
6	1'-9"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	46	0.46	0.167	SHORT
7	1'-9 1/2"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	46	0.46	0.167	SHORT
8	1'-10"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	57	0.46	0.167	SHORT
9	1'-10 1/2"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	57	0.46	0.167	SHORT
10	1'-11"	1'-9"	2'-0"	6'-0"	3'-0"	N.A.	N.A.	N.A.	1'-6"	12'-0"	N.A.	N.A.	12'-0"	57	0.46	0.167	SHORT
11	1'-11 1/2"	3'-0"	2'-3"	8'-6"	5'-6"	N.A.	N.A.	N.A.	1'-6"	8'-0"	N.A.	N.A.	8'-0"	80	0.72	0.250	MEDIUM
12	2'-0"	3'-0"	2'-3"	8'-6"	5'-6"	N.A.	N.A.	N.A.	1'-6"	8'-0"	N.A.	N.A.	8'-0"	80	0.72	0.250	MEDIUM
13	2'-0 1/2"	3'-0"	2'-3"	8'-6"	5'-6"	N.A.	N.A.	N.A.	1'-6"	8'-0"	N.A.	N.A.	8'-0"	80	0.72	0.250	MEDIUM
14	2'-1"	3'-0"	2'-3"	8'-6"	5'-6"	N.A.	N.A.	N.A.	1'-6"	8'-0"	N.A.	N.A.	8'-0"	80	0.72	0.250	MEDIUM
15	2'-1 1/2"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	7'-0"	7'-0"	N.A.	7'-0"	144	1.14	0.429	MEDIUM
16	2'-2"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	7'-0"	7'-0"	N.A.	7'-0"	144	1.14	0.429	MEDIUM
17	2'-2 1/2"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	7'-0"	7'-0"	N.A.	7'-0"	144	1.14	0.429	MEDIUM
18	2'-3"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	7'-0"	7'-0"	N.A.	7'-0"	144	1.14	0.429	MEDIUM
19	2'-3 1/2"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	5'-0"	5'-0"	N.A.	5'-0"	93	1.14	0.600	TALL
20	2'-4"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	5'-0"	5'-0"	N.A.	5'-0"	93	1.17	0.600	TALL
21	2'-4 1/2"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	5'-0"	5'-0"	N.A.	5'-0"	93	1.17	0.600	TALL
22	2'-5"	4'-9"	2'-6"	12'-0"	N.A.	4'-3"	4'-3"	N.A.	2'-0"	5'-0"	5'-0"	N.A.	5'-0"	93	1.17	0.600	TALL
23	2'-5 1/2"	6'-6"	3'-3"	15'-6"	N.A.	4'-0"	4'-0"	4'-0"	2'-0"	4'-6"	4'-6"	4'-6"	4'-6"	157	1.94	0.889	TALL
24	2'-6"	6'-6"	3'-3"	15'-6"	N.A.	4'-0"	4'-0"	4'-0"	2'-0"	4'-6"	4'-6"	4'-6"	4'-6"	157	1.94	0.889	TALL
25	2'-6 1/2"	6'-6"	3'-3"	15'-6"	N.A.	4'-0"	4'-0"	4'-0"	2'-0"	4'-6"	4'-6"	4'-6"	4'-6"	157	1.94	0.889	TALL
26	2'-7"	6'-6"	3'-3"	15'-6"	N.A.	4'-0"	4'-0"	4'-0"	2'-0"	4'-6"	4'-6"	4'-6"	4'-6"	157	1.94	0.889	TALL
27	2'-7 1/2"	6'-6"	3'-3"	15'-6"	N.A.	4'-0"	4'-0"	4'-0"	2'-0"	4'-6"	4'-6"	4'-6"	4'-6"	157	1.94	0.889	TALL

N.A. = NOT APPLICABLE



STEM HEIGHT	REINFORCEMENT - PILE FOUNDATION			
	STEM DOWEL SIZE AND SPACING	FOOTING		LONGITUDINAL (TOP AND BOT.)
		TOE (BOTTOM TRANSVERSE)	HEEL (TOP TRANSVERSE)	
h	BAR SIZE & SPA.	BAR SIZE & SPA.	BAR SIZE & SPA.	
5	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
6	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
7	5 @ 12"	5 @ 12"	5 @ 12"	7 @ 12"
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25	9 @ 12"	9 @ 12"	9 @ 12"	5 @ 12"
26	10 @ 12"	9 @ 12"	9 @ 12"	5 @ 12"
27	11 @ 12"	9 @ 12"	9 @ 12"	5 @ 12"

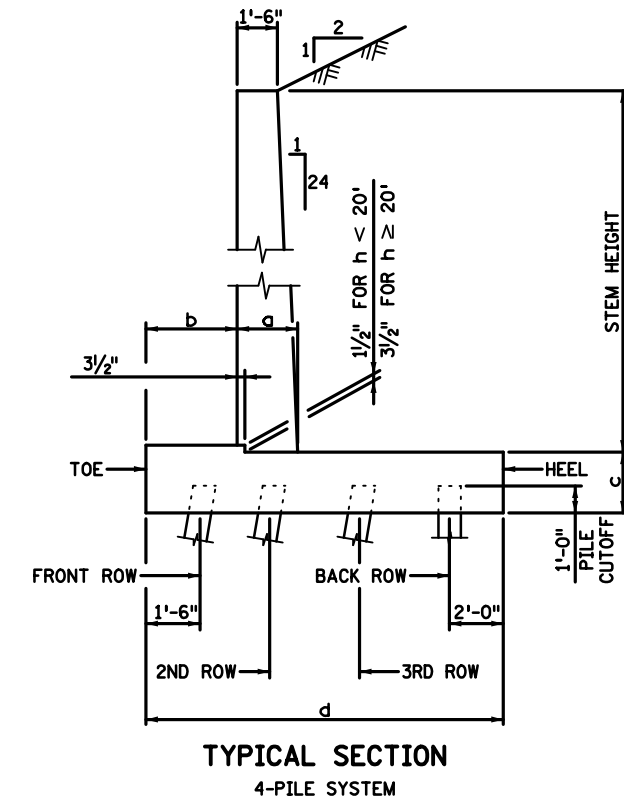
REQUIRED NOMINAL PILE BEARING RESISTANCE R _n - TONS/PILE				
FIELD CONTROL METHOD	CIP PILES		H PILES	
	φ dyn	* R _n	φ dyn	* R _n
MnDOT PILE FORMULA 2012 (MPF12) $R_n = 20 \sqrt{\frac{WxH}{1000}} \times \log\left(\frac{10}{S}\right)$	0.50	200	0.60	167
PDA	0.65	154	0.65	154

* R_n = (FACTORED DESIGN LOAD) / φ dyn

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

- 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.

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 1(V) : 2(H) SLOPED FILL
 PILE FOUNDATION GEOMETRY AND DATA

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

CHRISTOPHER ROY
 STATE DESIGN ENGINEER

STANDARD PLAN
 5-297.631

2 OF 2

STANDARD PLAN

STATE PROJ. NO.
 TRUNK HWY.

SHEET NO.
 TOTAL SHEETS