THERMASTEEL™ ADVANCED PANEL SYSTEM BELOW GRADE APPLICATION

GENERAL

THERMASTEEL panels may be applied upright as walls, sideways as beams, transverse as floors, roofs or below grade as walls. This section provides a step by step method of calculation for below grade application. This document is a part of the Thermasteel evaluation report ER-0128 of which can be found on the web page https://thermasteelinc.com/wp-content/uploads/thermasteel-specification-sheet.pdf

Foundation Wall Panels with Backfill

Consider that wall panels may be used for foundation walls acting as crawl spaces or basement walls. When applying below grade for basement walls use only 7.5", 1.5 density panels with C600 studs spaced at 16" or 12" o.c. Walls shall be waterproofed as shown in table 16 and stiffened on the exterior side with concrete parchment.

The design accounts for a non-frost susceptible (NFS) backfill, a water proofing and rodent inhibiting barrier (such as parch cement for foundation walls and ¼" galvanized lath) on the outside surface and 5/8" gypsum on the inside face of the panel. Backfill shall not be placed until the wall is secured at the footing and top of wall by the floor framing. Heavy equipment shall not be used to compact backfill next to the wall. Compaction of the backfill using a plate compactor is acceptable in no more than 6-inch lifts. The installer shall be careful not to get heavy equipment next to the wall. At the interior side of the basement wall, the top of the concrete floor slab shall be no less than 6-inches above the bottom of the wall, see Figure 11. The backfill shall be NFS material such as clean sand or a clean sandy gravel. Backfill is not allowed until the top and bottom of the basement wall is secured. Drain tile and all other required provisions, will be used next to the exterior side of the footing to relieve any water pressure around the wall. A state-of-art finite element analysis was conducted on 10-ft tall C600 wall panel subjected to an at rest soil pressure and the wall system meeting the design details provided in Figure 11 will meet lateral displacement of h/240. The basement

wall design is limited to a 10-ft high basement wall with soil no higher than 12-inches below the top of the wall. The design is based on Rankine's soil pressure theory in which the active at rest soil pressure coefficient is k=0.5. Tables are also available should the soil backfill approximate an active soil pressure and in this case the pressure coefficient is k=0.333. Soil density is assumed to be 120 pcf. The basement wall is shown in Figures 11, 12. 13. Figure 14 shows the acting soil pressure that is adjacent to the exterior face of the wall. The Basement wall is to be sized and/ or evaluated using the Allowable Stress Design method (ASD). Table 17 provides the engineer with the allowable axial wall compressive load on a stud line and the allowable moment on that same stud line. Tables 18 through 23 provide for a given soil pressure, the acting flexural moment on a given stud. Panels may be 4-ft tall to 10-ft tall. Any gravity load acting on the basement wall must meet the following load combination, see Equation Eq-7. This equation is providing for ASD load combinations.

$$\left(\frac{P}{Pa}\right) + \left(\frac{M}{Ma}\right) < 1 \qquad \text{(EQ-7)}$$

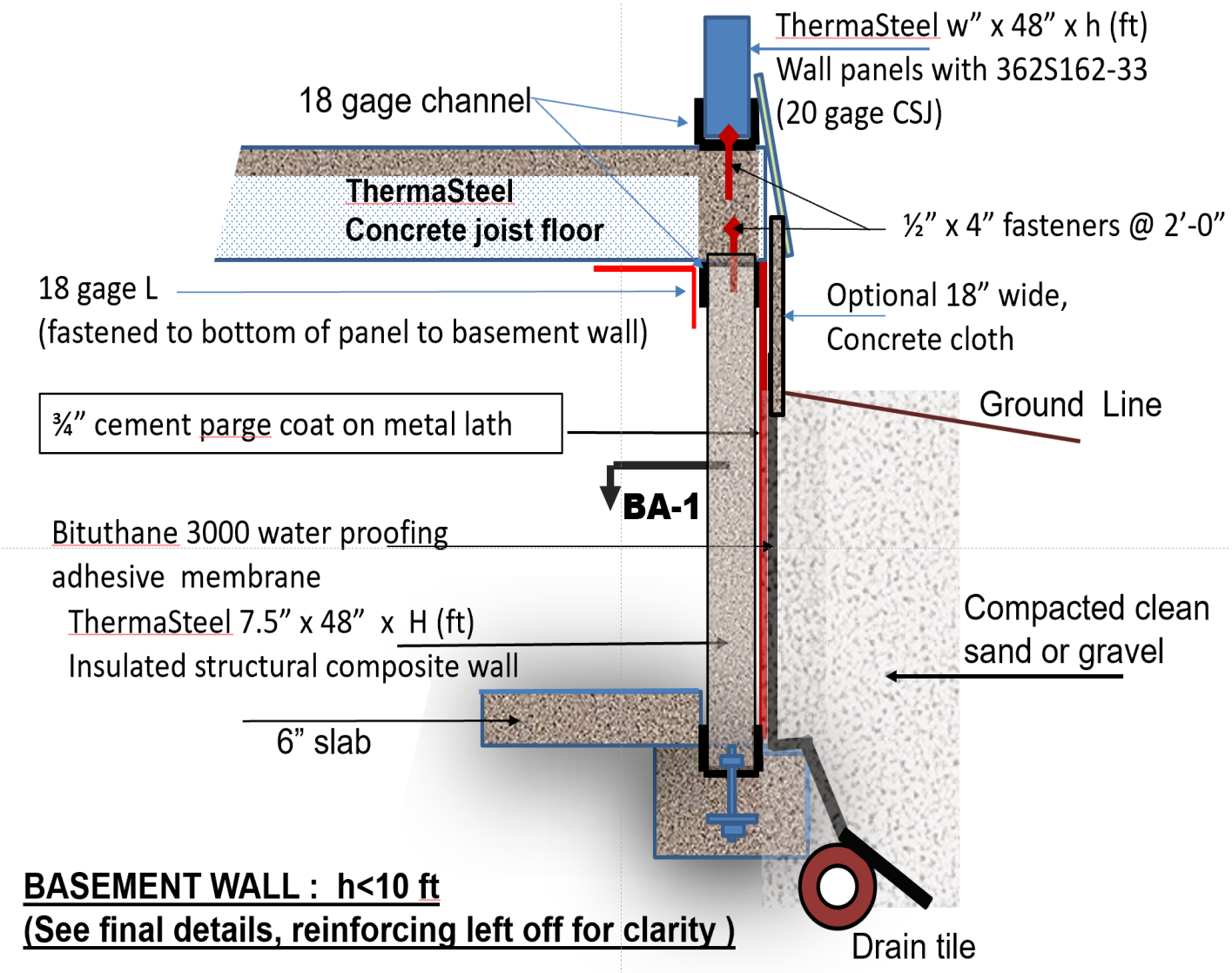
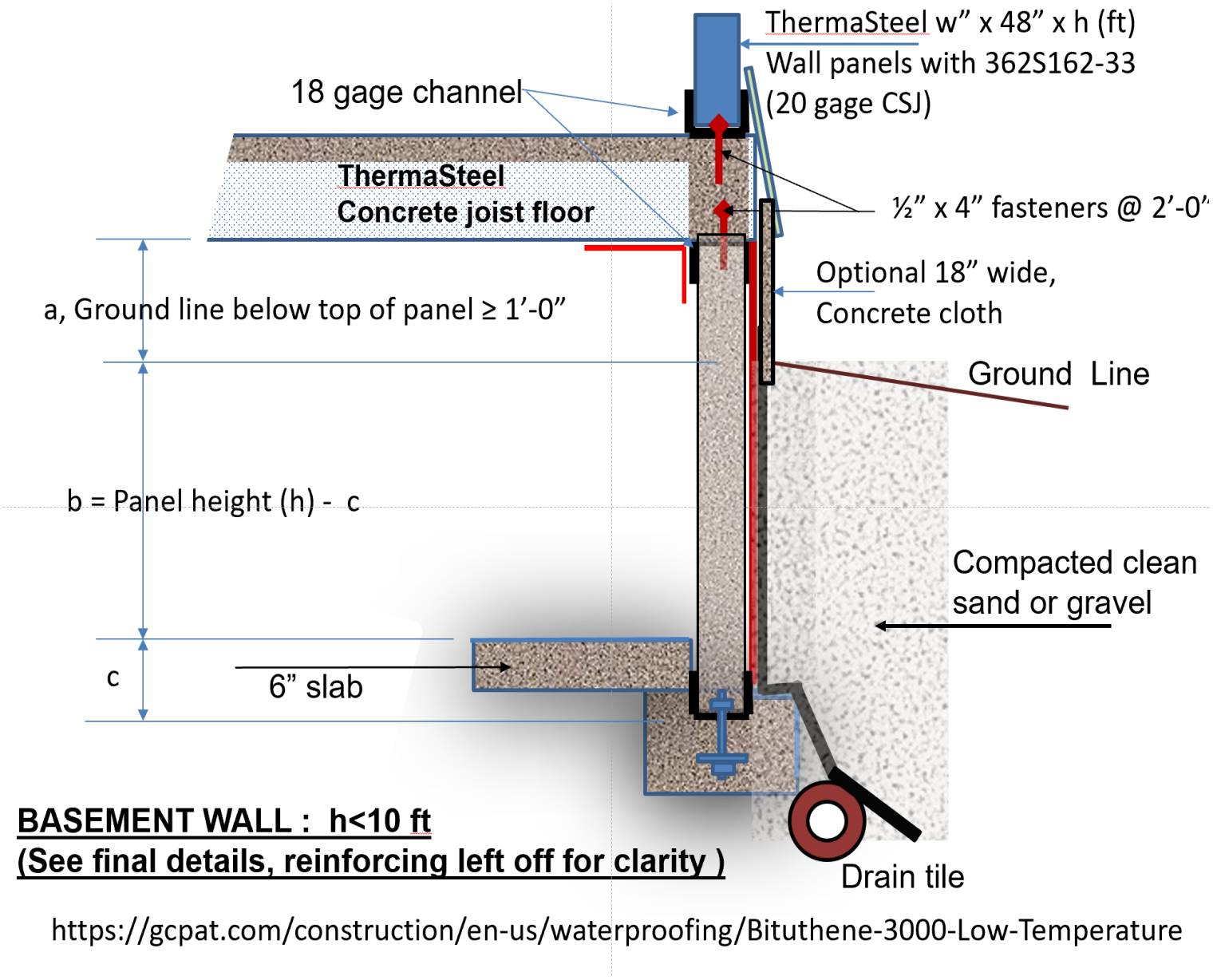


Figure 11. Typical Basement Wall



BASEMENT WALL : h<10 ft
(See final details, reinforcing left off for clarity)

https://gcpat.com/construction/en-us/waterproofing/Bituthene-3000-Low-Temperature

Figure 12. Location of the soil Pressure on the wall

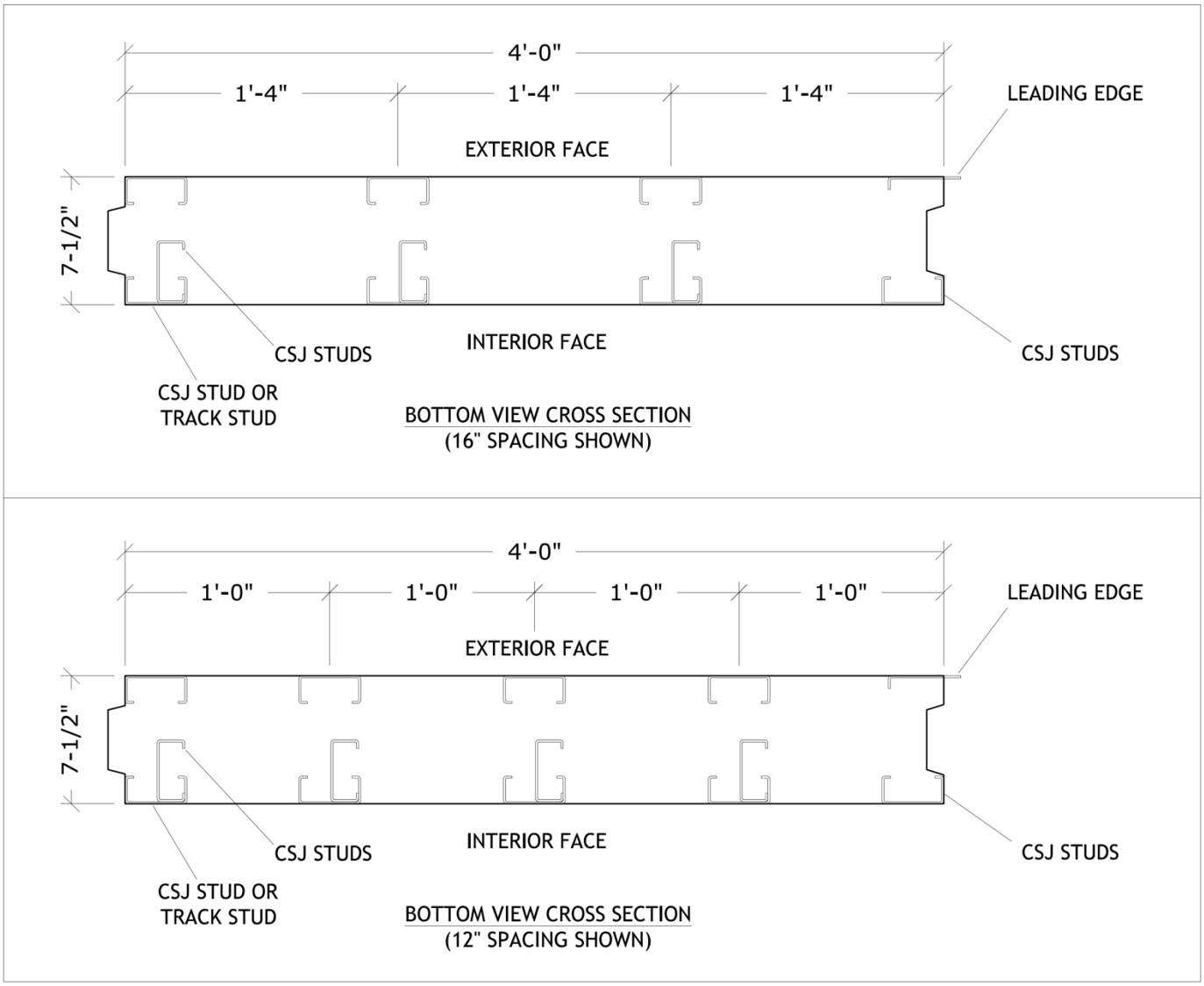
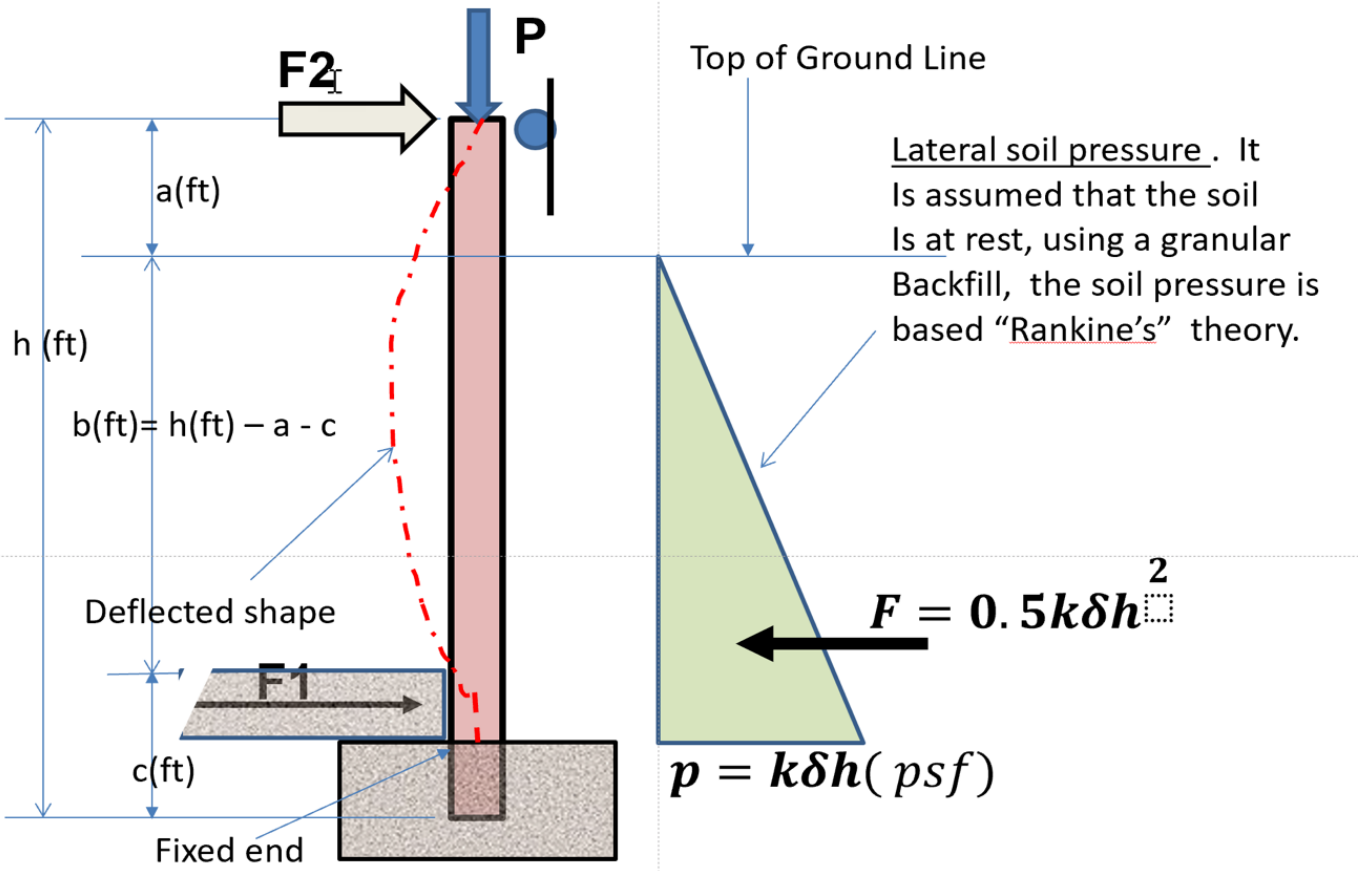


Figure 13. Cross section of wall with C600 CSJ studs configuration every 16” or 12” o.c.

Figure 14. Basement Wall with Rankine's Soil Pressure



$$p = k\delta h; k = 0.5; \delta = 120pcf$$

Elevation View: Model for Calculations

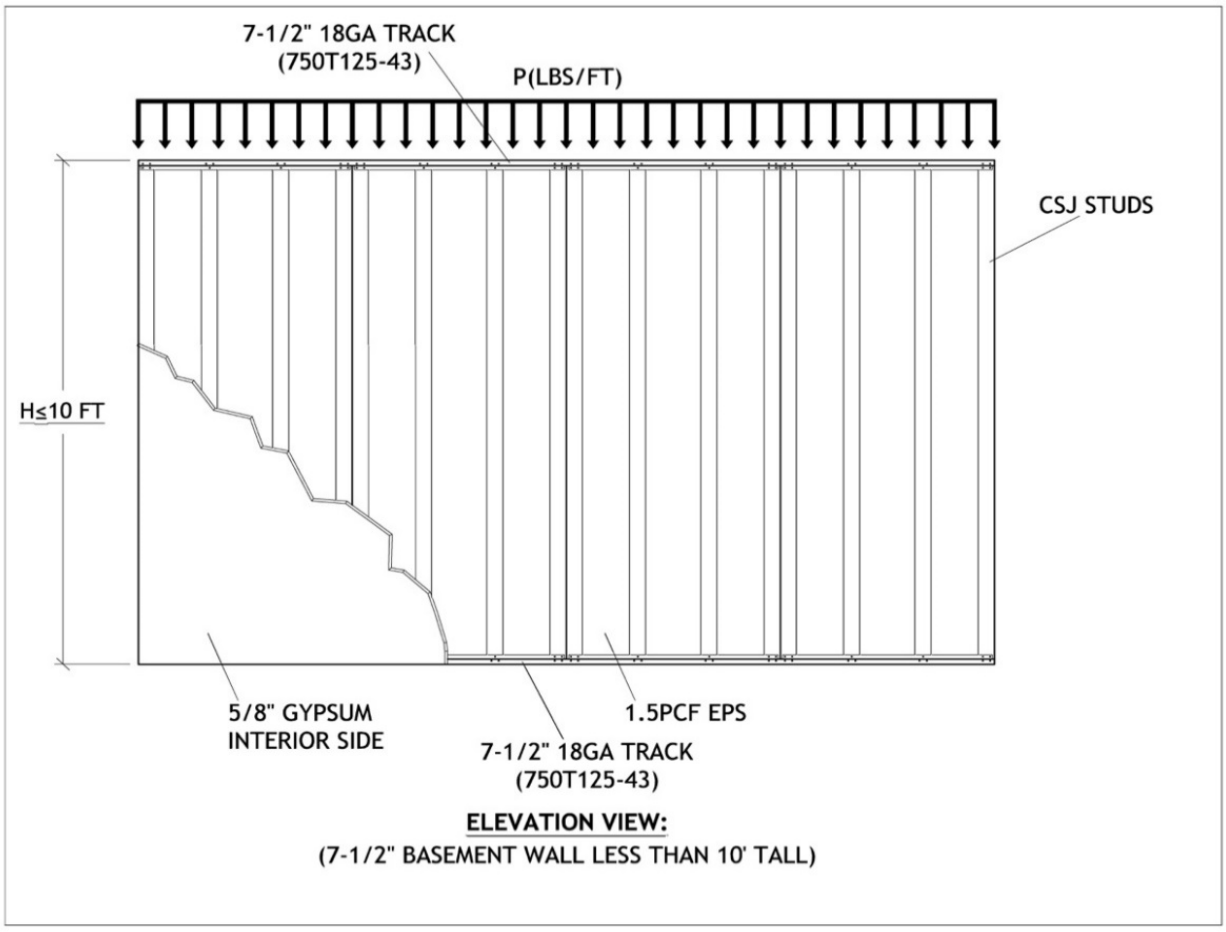


Figure 15. Basement Wall Cross-Section

Table 17. Basement Wall Allowable Loads & Moments

Panel ht		ASD: Allowable Axial & Flexural Forces		
(ft)		Pa (kips)		Ma(ft-kips)
4		10.78		2.45
6		10.78		2.45
8		10.78		2.45
9		10.78		2.45
10		10.78		2.45

Table 18: Basement Wall Bending Moments (ft-kips)							
Case 1. p(psf) = k(b)(120pcf) = 60(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	3	0	180	0.20		0.15
6	1	5	0	300	0.80		0.60
8	1	7	0	420	2.10		1.58
9	1	8	0	480	------		2.32
10	1	9	0	540	------		------
Rankine At Rest Soil Pressure Coefficient: k = 0.5							

Table 19: Basement Wall Bending Moments (ft-kips)							
Case 1A. p(psf) = k(b)(120pcf) = 60(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	2.5	0.5	150	0.11		0.08
6	1	4.5	0.5	270	0.59		0.44
8	1	6.5	0.5	390	1.69		1.27
9	1	7.5	0.5	450	----		1.92
10	1	8.5	0.5	510	----		----
Rankine At Rest Soil Pressure Coefficient: k = 0.5							

Table 20: Basement Wall Bending Moments (ft-kips)							
Case 1B. p(psf) = k(b)(120pcf) = 60(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	2	1	120	0.07		0.05
6	1	4	1	240	0.43		0.32
8	1	6	1	360	1.35		1.01
9	1	7	1	420	2.09		1.57
10	1	8	1	480	----		2.31
Rankine At Rest Soil Pressure Coefficient: k = 0.5							

Table 21: Basement Wall Bending Moments (ft-kips)							
Case 2. p(psf) = k(b)(120pcf) = 40(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	3	0	120	0.12		0.09
6	1	5	0	200	0.53		0.40
8	1	7	0	280	1.40		1.05
9	1	8	0	320	2.05		1.54
10	1	9	0	360	----		2.17
Rankine Active Soil Pressure Coefficient: k = 0.333							

Table 22: Basement Wall Bending Moments (ft-kips)							
Case 2A. p(psf) = k(b)(120pcf) = 40(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	2.5	0.5	100	0.08		0.06
6	1	4.5	0.5	180	0.29		0.22
8	1	6.5	0.5	260	1.13		0.85
9	1	7.5	0.5	300	1.71		1.28
10	1	8.5	0.5	340	2.45		1.84
Rankine Active Soil Pressure Coefficient: k = 0.333							

Table 23: Basement Wall Bending Moments (ft-kips)							
Case 2A. p(psf) = k(b)(120pcf) = 40(b) psf							
					Stud spacing, inches		
					16" oc		12" oc
Panel ht	a	b	c	p	M		M
(ft)	(ft)	(ft)	(ft)	(psf)	(ft-k)		(ft-k)
4	1	2	1	80	0.04		0.03
6	1	4	1	160	0.12		0.09
8	1	6	1	240	1.05		0.79
9	1	7	1	280	1.40		1.05
10	1	8	1	320	2.05		1.54
Rankine Active Soil Pressure Coefficient: k = 0.333							