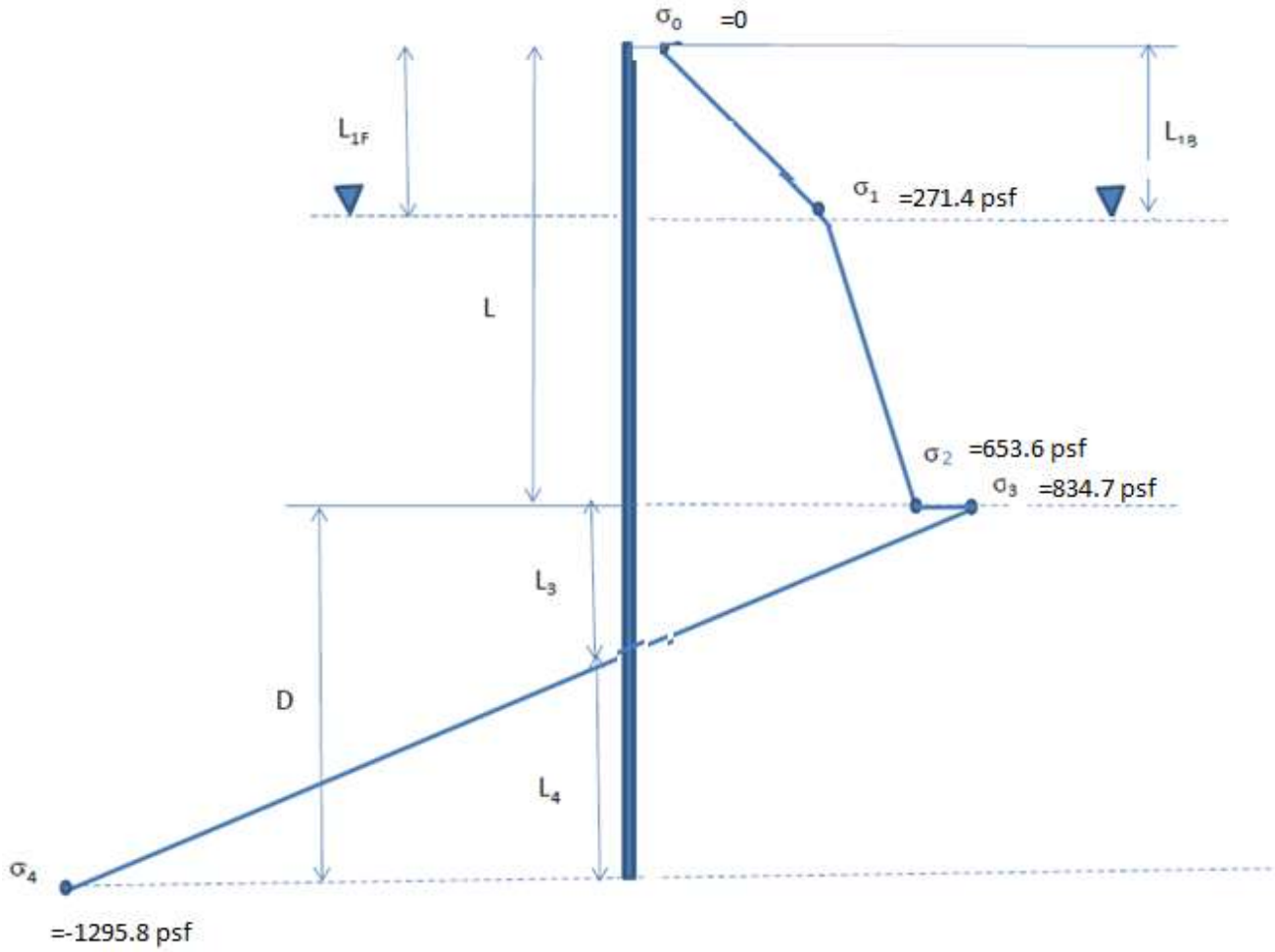
Flexible Anchored Retaining Wall-Rankine Earth Pressures-Granular Soil
Free Earth Support Method

GIVEN:

Retaining Wall Properties				
Retainied Height, L	28	ft		
Yield Strength, Fy	50	ksi		
Allowable Flexural Strength= .55*Fy	27.5	ksi		
Maximum Moment	3351.6	kip-in/ft		
Required Section Modulus	121.88			
Required Embedment Depth, D	14.13	ft		
Actual Embedment Depth	18.37		30% Safety Factor	
Total Sheet Pile Length Required	46.37	ft		
Anchorage Data: Strength Capacity				
Anchor Location, La	5	ft		
Horizontal Anchor Force, Fa	7.1	kips/ft of wall		
Angle of Inclination	0	degrees		
Ultimate Anchor force, Pult	7.08	kips/ft of wall		
Allowable Anchor Stress	37.5	ksi	FS:	2
Trial Anchor Spacing, S	8	ft	Fy:	75 ksi
Ultimate Anchor Force, Pult	56.6	kips		
Anchor area Required, As	1.51	in^2		
Soil & Ground Water Properties				
Wall Backfill-Soil 1				
unit weight, y1	120	pcf	yw=	62.4 pcf
unit weight, y1sat	130	pcf		
effective unit weight, y1'	67.6	pcf		
internal friction angle, f`1	34	degrees		
apparent cohesion, c'1	0			
water level behind wall, L1b	8	ft		
unbalanced water head, Dhw	0	ft		
water level front of wall, L1f	8	ft		
Subgrade- Soil 2				
unit weight, y2		pcf		
unit weight, y2sat	125	pcf		
effective unit weight, y2'	62.6	pcf		
internal friction angle, f`2	28	degrees		
apparent cohesion, c'2	0			
External Load				
Infinite surcharge, qo	0	psf		

Rankine Earth Pressure coefficients	Active	Passive
Wall Backfill- Soil 1	0.282715	3.537132
Subgrade- Soil 2	0.361033	2.769826

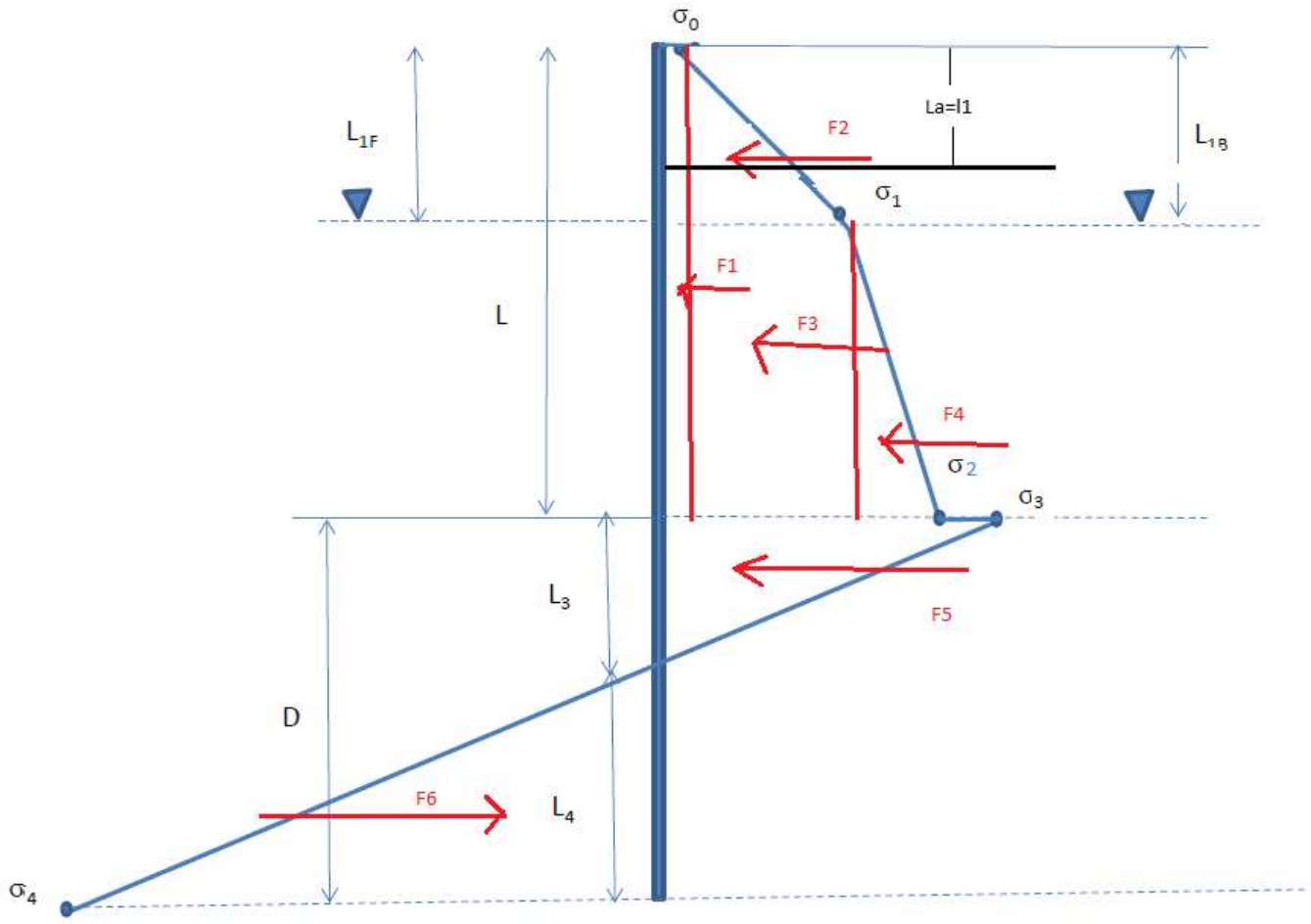
Net Pressure Diagram



Net Lateral Wall Pressure

σ0=Ka*qo	0.0	psf	
σ1=Ka1*(qo+L1b*y1)	271.4	psf	
σ1*=σ1+Ka1*Δhw*y1'+Δhw*yw		psf	
σ2*=σ1+Ka1*(L-L1f)*y1'+Δhw*yw	653.6	psf	
σ3*=Ka2*((L-L1b)*y1'+qo+L1b*y1)+Δhw*yw	834.7	psf	
L3 = σ3/(Kp2-Ka2)*y'2	5.54	ft	EQ 9.6
σ4=σ3-(Kp2-Ka2)*y2')*(D-L3)	-1295.8	psf	EQ 9.65

Net Force Diagram



Net Force	Lbs	Distance to Anchor	Ft	Moment About Anchor Point K-Ft
σo*L= F1	0	L/2-La	9.00	0
(σ1−σ0).5∗L1b=F2	1086	2/3Lb-la	0.33	0.3618751
(σ1−σ0)∗(L-L1b)=F3	5428	(L-L1f)/2+(L1b-La)	13.00	70.565644
(σ2−σ1).5∗(L-L1b)=F4	3822	(2/3)*(L-L1f)+(L1b-La)	16.33	62.430993
(σ3).5∗L3=F5	2310	(1/3)*L3+L - La	24.85	57.399635
(σ4).5∗(D-L3)=F6	-5567	(2/3)*(D-L3)+L3+L-La	34.26	-190.7586
Anchor Force =	7079	Sum Moments about toe =0		0.00 OK

Find Maximum Moment:

Location	Depth	Stress (psf)	Net Force (lbs)	Shear (lbs)	Moment (lbs-ft)	
s_0	0	0				
	1	34	17	17	8	
	2	68	51	68	51	
	3	102	85	153	161	
	4	136	119	271	373	
Anchor	5	170	160	431	724	*Add anchor force
	6	204	187	618	1,249	
	7	237	221	838	1,977	
s_1	8	271	254	1,093	2,942	
	9	291	281	1,374	4,176	
	10	310	300	1,674	5,699	
	11	329	319	1,993	7,533	
	12	348	338	2,331	9,695	
	13	367	357	2,689	12,205	
	14	386	377	3,065	15,082	
	15	405	396	3,461	18,344	
	16	424	415	3,876	22,013	
	17	443	434	4,309	26,105	
	18	463	453	4,762	30,641	
	19	482	472	5,234	35,639	
	20	501	491	5,726	41,119	
	21	520	510	6,236	47,100	
	22	539	529	6,765	53,601	
	23	558	549	7,314	60,640	
	24	577	568	7,881	68,238	
	25	596	587	8,468	76,413	
	26	615	606	9,074	85,184	
	27	635	625	9,699	94,571	
s_2	28	654	644	10,343	104,592	
0	28.01	835	0	10,343	104,695	
1	29	684	759	11,102	115,418	
2	30	533	609	11,711	126,825	
3	31	382	458	12,169	138,764	
4	32	232	307	12,476	151,087	
5	33	81	156	12,632	163,640	
6	34	-70	5	12,637	176,275	
7	35	-221	-145	12,492	188,839	
8	36	-372	-296	12,196	201,183	
9	37	-522	-447	11,749	213,155	
10	38	-673	-598	11,151	224,605	
11	39	-824	-749	10,402	235,381	

12	40	-975	-899	9,503	245,333
13	41	-1,126	-1,050	8,453	254,311
14	42	-1,276	-1,201	7,252	262,163
15	43	-1,427	-1,352	5,900	268,739
16	44	-1,578	-1,503	4,397	273,887
17	45	-1,729	-1,653	2,744	277,458
18	46	-1,880	-1,804	940	279,300
19	47	-2,030	-1,955	-1,015	279,262
20	48	-2,181	-2,106	-3,121	277,194
21	49	-2,332	-2,256	-5,377	272,945
22	50	-2,483	-2,407	-7,785	266,365
23	51	-2,633	-2,558	-10,343	257,301
24	52	-2,784	-2,709	-13,051	245,604
			Min:	-13,051	8
			Max:	12,637	279,300

Max Shear (kips):	**13**
Max Moment (kip in)/ft:	**3351.6**