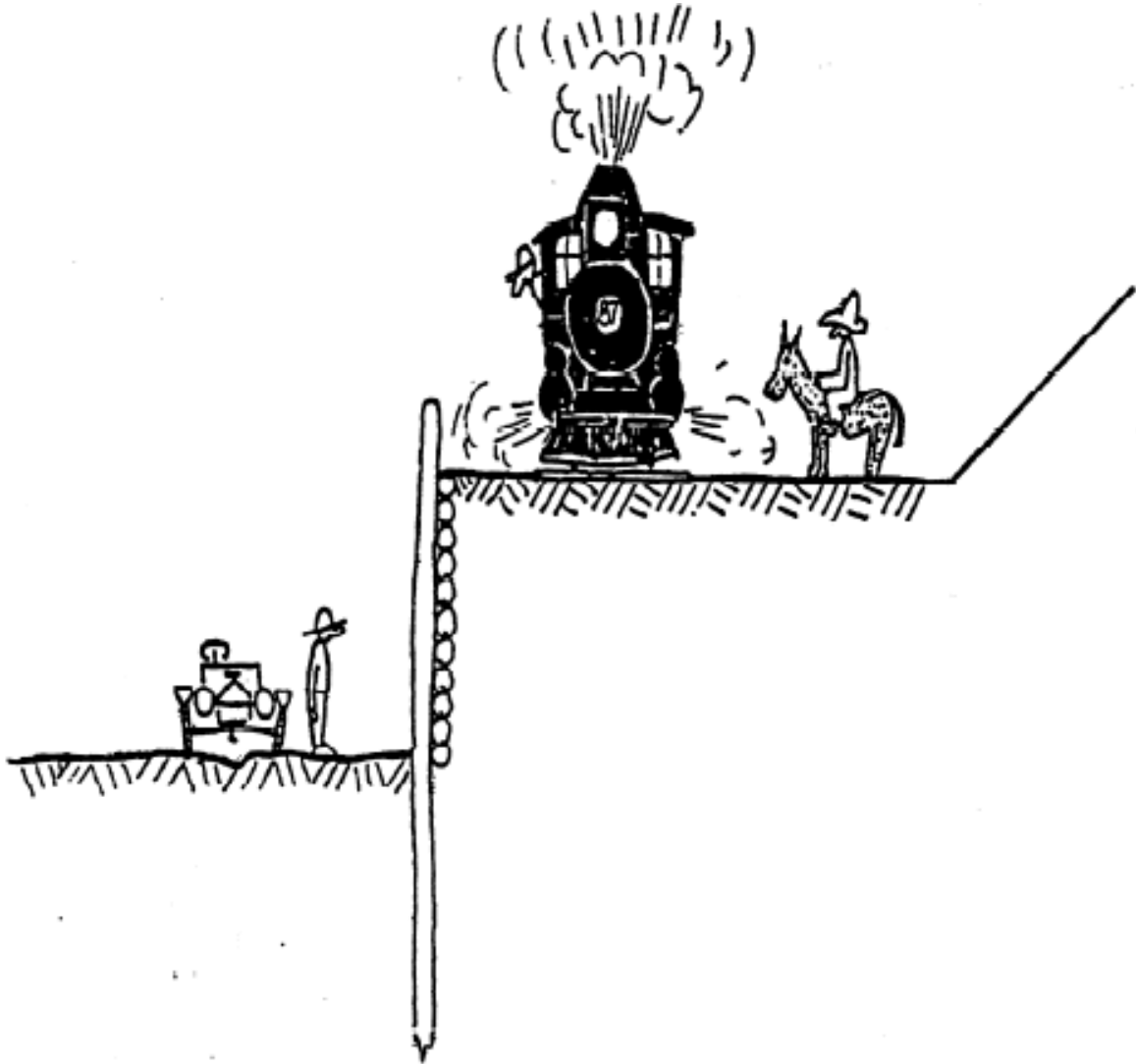


# Appendix C

## Surcharges

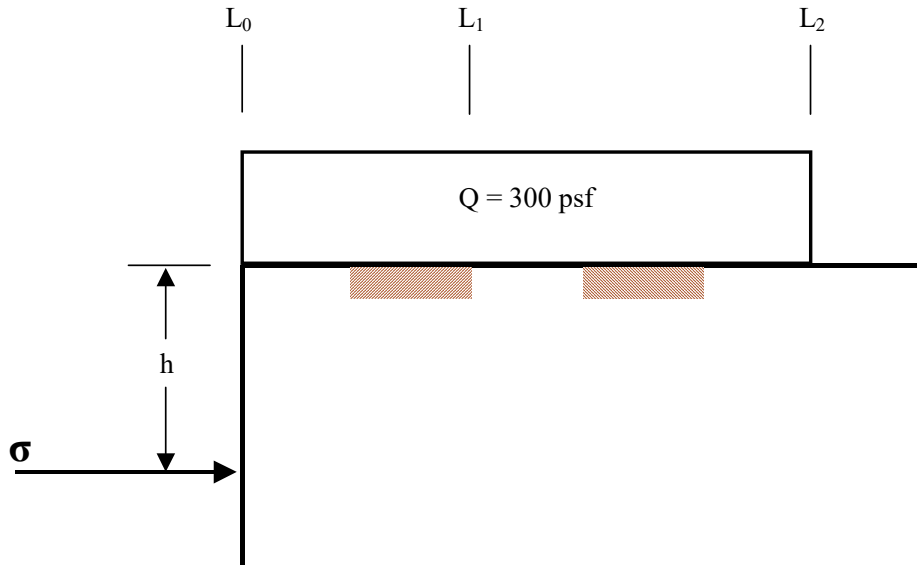


## Surcharges

### TABULAR VALUES FOR STRIP LOADS

The following- tabular values may be used to obtain horizontal pressures due to surcharge loadings.

Tabular values are for a Boussinesq strip surcharge of  $Q = 300$  psf for a length of surcharge beginning at the face of the excavation ( $L_0$ ) to the end of the strip load ( $L_2$ ). Surcharge pressures are listed for one-foot increments of excavation to a depth of 20 feet.



For surcharges not beginning at the face of the excavation ( $L_1$ ) subtract tabular values for distance  $L_1$  from the tabular values for  $L_2$ . Prorate other  $Q$  values by using the ratio  $Q/300$  (difference in  $L$  values).

Note: When  $L_0 = 0$ , the pressure at  $h = 0$  is  $Q$  (300 psf).

#### EXAMPLE:

Begin Boussinesq strip load 6 feet from excavation,  $L_1 = 6'$

End Boussinesq strip load 20 feet from excavation,  $L_2 = 20'$

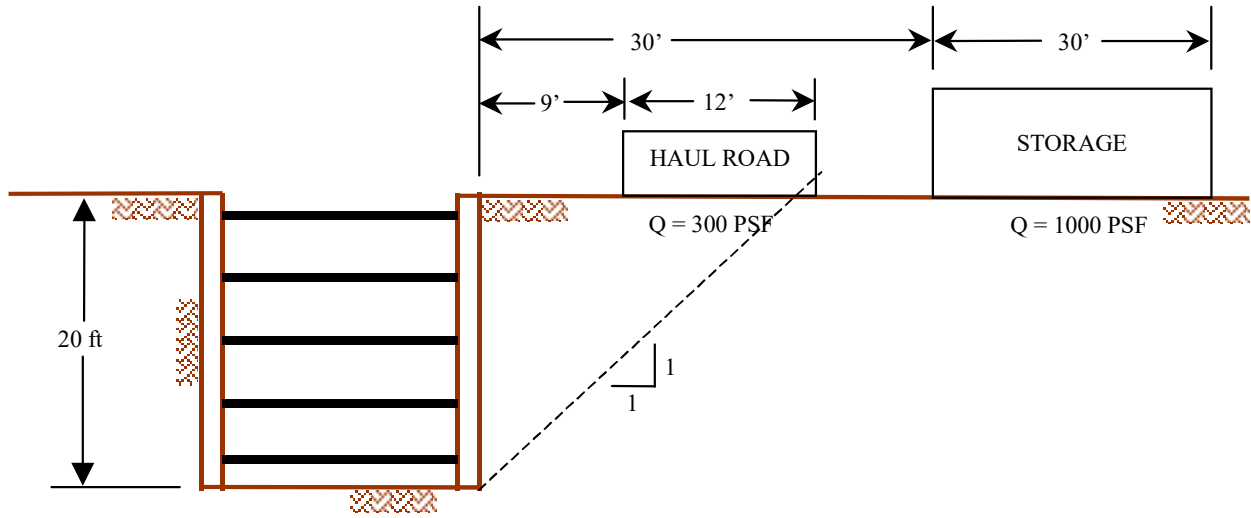
Surcharge load  $Q = 250$  psf

Determine surcharge pressure at  $h = 12'$

$$a_{12} = \frac{250}{300} (112.53 - 12.16) = 83.6 \text{ psf}$$

## CT TRENCHING AND SHORING MANUAL

### EXAMPLE OF ALTERNATIVE SURCHARGE AND TABULAR VALUES:



- 1) Determine surcharge pressures at 5-foot increments of depth starting at the ground surface.
- 2) Compare tabular strip load values to the alternative loading.

Sample calculations for depth = 10 feet:

$$\text{At haul road: } \sigma_{10} = 140.99 - 44.99 = 96.00 \text{ psf}$$

$$\text{For building: } \sigma_{10} = \frac{1000}{300} (237.49 - 181.25) = 187.45 \text{ psf}$$

$$\text{Building } \sigma_{10} + \text{Road } \sigma_{10} = 283.47 \text{ psf}$$

$$\text{Building } \sigma_{10} + \text{Road @ 100 psf} = 287.47 \text{ psf}$$

#### COMBINE SURCHARGES:

<u>Depth</u>	<u>Building <math>\sigma</math></u>	<u>Road <math>\sigma</math></u>	<u>Sum of <math>\sigma</math>'s</u>	<u>Building <math>\sigma</math> + 100 psf</u>
0	0.00	0.00	72.00 min	100.00
5	102.77	90.26	193.03	202.77
10	187.47	96.00	283.47	287.47
15	244.03	72.26	316.29	344.03
20	272.33	49.99	322.32	372.33

## APPENDIX C

**Surcharges**PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$ 

$h$	1	2	3	4	5	6	7	8
1	54.51	135.06	181.25	208.27	225.57	237.49	246.16	252.74
2	12.16	54.51	99.55	135.06	161.47	181.25	196.40	208.27
3	4.15	24.15	54.51	85.43	112.53	135.06	153.52	168.69
4	1.85	12.16	31.23	54.51	77.97	99.55	118.58	135.06
5	0.97	6.81	18.95	35.70	54.51	73.39	91.21	107.48
6	0.57	4.15	12.16	24.15	38.76	54.51	70.29	85.43
7	0.36	2.70	8.18	16.88	28.13	40.97	54.51	68.07
8	0.24	1.85	5.73	12.16	20.85	31.23	42.64	54.51
9	0.17	1.32	4.15	8.99	15.77	24.15	33.70	43.94
10	0.13	0.97	3.10	6.81	12.16	18.95	26.92	35.70
11	0.09	0.74	2.37	5.27	9.53	15.08	21.73	29.24
12	0.07	0.57	1.85	4.15	7.59	12.16	17.73	24.15
13	0.06	0.45	1.47	3.33	6.13	9.92	14.61	20.11
14	0.05	0.36	1.19	2.70	5.02	8.18	12.16	16.88
15	0.04	0.30	0.97	2.22	4.15	6.81	10.20	14.27
16	0.03	0.24	0.81	1.85	3.47	5.73	8.63	12.16
17	0.03	0.20	0.67	1.55	2.93	4.86	7.36	10.42
18	0.02	0.17	0.57	1.32	2.50	4.15	6.32	8.99
19	0.02	0.15	0.49	1.13	2.14	3.58	5.46	7.81
20	0.02	0.13	0.42	0.97	1.85	3.10	4.75	6.81

CT TRENCHING AND SHORING MANUAL

PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$

$h$	9	10	11	12	13	14	15	16
1	257.90	262.06	265.47	268.32	270.73	272.81	274.61	276.19
2	217.79	225.57	232.04	237.49	242.14	246.16	249.66	252.74
3	181.25	191.77	200.67	208.27	214.84	220.56	225.57	230.01
4	149.24	161.47	172.05	181.25	189.31	196.40	202.68	208.27
5	122.07	135.06	146.57	156.79	165.88	173.99	181.25	187.78
6	99.55	112.53	124.34	135.06	144.75	153.52	161.47	168.69
7	81.20	93.64	105.26	116.02	125.94	135.06	143.42	151.10
8	66.39	77.97	89.06	99.55	109.39	118.58	127.12	135.06
9	54.51	65.08	75.43	85.43	94.97	104.01	112.53	120.53
10	44.99	54.51	64.03	73.39	82.47	91.21	99.55	107.48
11	37.36	45.85	54.51	63.17	71.70	80.03	88.08	95.81
12	31.23	38.76	46.57	54.51	62.45	70.29	77.97	85.43
13	26.27	32.93	39.95	47.18	54.51	61.84	69.10	76.22
14	22.24	28.13	34.41	40.97	47.70	54.51	61.32	68.07
15	18.95	24.15	29.77	35.70	41.86	48.15	54.51	60.86
16	16.25	20.85	25.87	31.23	36.84	42.64	48.55	54.51
17	14.02	18.09	22.58	27.41	32.53	37.85	43.33	48.90
18	12.16	15.77	19.79	24.15	28.81	33.70	38.76	43.94
19	10.60	13.81	17.42	21.36	25.59	30.07	34.75	39.57
20	9.29	12.16	15.39	18.95	22.81	26.92	31.23	35.70

## APPENDIX C

**Surcharges**PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$ 

$h$	17	18	19	20	21	22	23	24
1	277.58	278.82	279.93	280.93	281.84	282.66	283.41	284.10
2	255.47	257.90	260.09	262.06	263.84	265.47	266.95	268.32
3	233.95	237.49	240.67	243.55	246.16	248.55	250.73	252.74
4	213.28	217.79	221.87	225.57	228.95	232.04	234.87	237.49
5	193.67	199.00	203.85	208.27	212.33	216.05	219.47	222.64
6	175.26	181.25	186.74	191.77	196.40	200.67	204.62	208.27
7	158.16	164.65	170.63	176.15	181.25	185.98	190.38	194.46
8	142.42	149.24	155.58	161.47	166.95	172.05	176.81	181.25
9	128.03	135.06	141.62	147.77	153.52	158.91	163.95	168.69
10	114.98	122.07	128.76	135.06	140.99	146.57	151.84	156.79
11	103.21	110.26	116.96	123.32	129.35	135.06	140.46	145.58
12	92.63	99.55	106.19	112.53	118.58	124.34	129.83	135.06
13	83.16	89.89	96.39	102.65	108.66	114.42	119.94	125.21
14	74.70	81.20	87.51	93.64	99.55	105.26	110.75	116.02
15	67.17	73.39	79.48	85.43	91.21	96.82	102.24	107.48
16	60.47	66.39	72.23	77.97	83.59	89.06	94.39	99.55
17	54.51	60.12	65.69	71.21	76.63	81.95	87.15	92.21
18	49.21	54.51	59.81	65.08	70.29	75.43	80.48	85.43
19	44.50	49.49	54.51	59.53	64.52	69.47	74.36	79.16
20	40.30	44.99	49.74	54.51	59.28	64.03	68.74	73.39

CT TRENCHING AND SHORING MANUAL

PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$

$h$	25	26	27	28	29	30	31	32
1	284.74	285.32	285.87	286.37	286.84	287.28	287.69	288.07
2	269.57	270.73	271.81	272.81	273.74	274.61	275.43	276.19
3	254.60	256.31	257.90	259.38	260.77	262.06	263.26	264.40
4	239.90	242.14	244.22	246.16	247.97	249.66	251.25	252.74
5	225.57	228.30	230.83	233.20	235.41	237.49	239.44	241.27
6	211.67	214.84	217.79	220.56	223.14	225.57	227.86	230.01
7	198.27	201.83	205.16	208.27	211.20	213.96	216.55	219.00
8	185.41	189.31	192.96	196.40	199.63	202.68	205.56	208.27
9	173.14	177.32	181.25	184.96	188.46	191.77	194.90	197.86
10	161.47	165.88	170.05	173.99	177.72	181.25	184.60	187.78
11	150.43	155.03	159.38	163.51	167.43	171.15	174.69	178.05
12	140.02	144.75	149.24	153.52	157.59	161.47	165.17	168.69
13	130.24	135.06	139.65	144.04	148.23	152.23	156.05	159.71
14	121.08	125.94	130.60	135.06	139.33	143.42	147.34	151.10
15	112.53	117.39	122.07	126.57	130.90	135.06	139.05	142.89
16	104.56	109.39	114.07	118.58	122.93	127.12	131.16	135.06
17	97.14	101.93	106.57	111.06	115.41	119.62	123.68	127.61
18	90.26	94.97	99.55	104.01	108.33	112.53	116.59	120.53
19	83.88	88.49	93.00	97.40	101.68	105.85	109.89	113.83
20	77.97	82.47	86.89	91.21	95.43	99.55	103.57	107.48

## APPENDIX C

**Surcharges**PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$ 

$h$	33	34	35	36	37	38	39	40
1	288.43	288.77	289.09	289.40	289.68	289.95	290.21	290.45
2	276.91	277.58	278.22	278.82	279.39	279.93	280.45	280.93
3	265.47	266.47	267.42	268.32	269.16	269.97	270.73	271.46
4	254.15	255.47	256.72	257.90	259.02	260.09	261.10	262.06
5	242.99	244.62	246.16	247.62	249.00	250.31	251.56	252.74
6	232.04	233.95	235.77	237.49	239.12	240.67	242.14	243.55
7	221.31	223.50	225.57	227.54	229.41	231.18	232.87	234.48
8	210.85	213.28	215.60	217.79	219.88	221.87	223.76	225.57
9	200.67	203.33	205.87	208.27	210.57	212.75	214.84	216.83
10	190.80	193.67	196.40	199.00	201.48	203.85	206.11	208.27
11	181.25	184.31	187.21	189.99	192.64	195.17	197.60	199.92
12	172.05	175.26	178.32	181.25	184.06	186.74	189.31	191.77
13	163.20	166.54	169.74	172.80	175.74	178.55	181.25	183.85
14	154.71	158.16	161.47	164.65	167.70	170.63	173.44	176.15
15	146.57	150.12	153.52	156.79	159.94	162.97	165.88	168.69
16	138.80	142.42	145.89	149.24	152.47	155.58	158.58	161.47
17	131.40	135.06	138.59	142.00	145.29	148.47	151.53	154.50
18	124.34	128.03	131.60	135.06	138.39	141.62	144.75	147.77
19	117.64	121.35	124.94	128.42	131.79	135.06	138.22	141.29
20	111.28	114.98	118.58	122.07	125.46	128.76	131.95	135.06



CT TRENCHING AND SHORING MANUAL

PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$

$h$	41	42	43	44	45	46	47	48
1	290.69	290.91	291.12	291.32	291.51	291.70	291.88	292.04
2	281.40	281.84	282.26	282.66	283.05	283.41	283.77	284.10
3	272.15	272.81	273.44	274.04	274.61	275.16	275.69	276.19
4	262.97	263.84	264.67	265.47	266.22	266.95	267.65	268.32
5	253.87	254.95	255.98	256.96	257.90	258.81	259.67	260.50
6	244.88	246.16	247.38	248.55	249.66	250.73	251.76	252.74
7	236.02	237.49	238.89	240.23	241.52	242.75	243.94	245.07
8	227.30	228.95	230.53	232.04	233.49	234.87	236.21	237.49
9	218.73	220.56	222.30	223.97	225.57	227.11	228.59	230.01
10	210.34	212.33	214.22	216.05	217.79	219.47	221.09	222.64
11	202.14	204.27	206.31	208.27	210.16	211.97	213.71	215.39
12	194.13	196.40	198.58	200.67	202.68	204.62	206.48	208.27
13	186.33	188.73	191.02	193.24	195.36	197.42	199.39	201.30
14	178.75	181.25	183.66	185.98	188.22	190.38	192.46	194.46
15	171.39	173.99	176.50	178.92	181.25	183.51	185.68	187.78
16	164.26	166.95	169.55	172.05	174.47	176.81	179.07	181.25
17	157.36	160.12	162.80	165.38	167.88	170.29	172.63	174.89
18	150.69	153.52	156.26	158.91	161.47	163.95	166.36	168.69
19	144.26	147.14	149.93	152.64	155.26	157.80	160.27	162.66
20	138.07	140.99	143.82	146.57	149.24	151.84	154.35	156.79

## APPENDIX C

**Surcharges**PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$ 

$h$	49	50	51	52	53	54	55	56
1	292.21	292.36	292.51	292.66	292.79	292.93	293.06	293.18
2	284.43	284.74	285.04	285.32	285.60	285.87	286.12	286.37
3	276.67	277.14	277.58	278.01	278.43	278.82	279.21	279.58
4	268.96	269.57	270.16	270.73	271.28	271.81	272.32	272.81
5	261.29	262.06	262.79	263.50	264.18	264.83	265.47	266.08
6	253.69	254.60	255.47	256.31	257.12	257.90	258.66	259.38
7	246.16	247.21	248.22	249.19	250.13	251.03	251.90	252.74
8	238.72	239.90	241.04	242.14	243.20	244.22	245.21	246.16
9	231.37	232.69	233.95	235.18	236.35	237.49	238.59	239.64
10	224.13	225.57	226.96	228.30	229.59	230.83	232.04	233.20
11	217.01	218.56	220.07	221.52	222.91	224.27	225.57	226.84
12	210.01	211.67	213.28	214.84	216.34	217.79	219.20	220.56
13	203.13	204.91	206.62	208.27	209.87	211.42	212.92	214.37
14	196.40	198.27	200.08	201.83	203.52	205.16	206.74	208.27
15	189.81	191.77	193.67	195.50	197.28	199.00	200.67	202.28
16	183.37	185.41	187.39	189.31	191.17	192.96	194.71	196.40
17	177.08	179.20	181.25	183.25	185.18	187.05	188.86	190.63
18	170.95	173.14	175.26	177.32	179.32	181.25	183.14	184.96
19	164.98	167.23	169.41	171.53	173.59	175.59	177.53	179.42
20	159.17	161.47	163.71	165.88	168.00	170.05	172.05	173.99

CT TRENCHING AND SHORING MANUAL

PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$

$h$	57	58	59	60	61	62	63	64
1	293.30	293.42	293.53	293.64	293.74	293.84	293.94	294.03
2	286.61	286.84	287.06	287.28	287.49	287.69	287.88	288.07
3	279.93	280.28	280.61	280.93	281.24	281.55	281.84	282.12
4	273.28	273.74	274.18	274.61	275.02	275.43	275.81	276.19
5	266.66	267.23	267.78	268.32	268.83	269.33	269.81	270.28
6	260.09	260.77	261.42	262.06	262.67	263.26	263.84	264.40
7	253.56	254.34	255.10	255.84	256.55	257.24	257.90	258.55
8	247.08	247.97	248.83	249.66	250.47	251.25	252.01	252.74
9	240.67	241.66	242.62	243.55	244.45	245.32	246.16	246.98
10	234.33	235.41	236.47	237.49	238.48	239.44	240.37	241.27
11	228.06	229.24	230.39	231.50	232.57	233.61	234.63	235.61
12	221.87	223.14	224.38	225.57	226.73	227.86	228.95	230.01
13	215.77	217.13	218.45	219.72	220.96	222.17	223.34	224.47
14	209.76	211.20	212.60	213.96	215.27	216.55	217.79	219.00
15	203.85	205.37	206.84	208.27	209.66	211.01	212.33	213.60
16	198.04	199.63	201.18	202.68	204.14	205.56	206.93	208.27
17	192.34	194.00	195.61	197.18	198.70	200.18	201.63	203.03
18	186.74	188.46	190.14	191.77	193.36	194.90	196.40	197.86
19	181.25	183.04	184.77	186.46	188.11	189.70	191.26	192.78
20	175.88	177.72	179.51	181.25	182.95	184.60	186.21	187.78

## APPENDIX C

**Surcharges**PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$ 

$h$	65	66	67	68	69	70	71	72
1	294.12	294.21	294.30	294.38	294.47	294.54	294.62	294.70
2	288.25	288.43	288.60	288.77	288.93	289.09	289.25	289.40
3	282.40	282.66	282.92	283.17	283.41	283.65	283.88	284.10
4	276.55	276.91	277.25	277.58	277.91	278.22	278.53	278.82
5	270.73	271.17	271.60	272.01	272.42	272.81	273.19	273.56
6	264.94	265.47	265.98	266.47	266.95	267.42	267.87	268.32
7	259.18	259.79	260.38	260.95	261.51	262.06	262.58	263.10
8	253.46	254.15	254.82	255.47	256.11	256.72	257.32	257.90
9	247.78	248.55	249.30	250.03	250.73	251.42	252.09	252.74
10	242.14	242.99	243.82	244.62	245.40	246.16	246.90	247.62
11	236.56	237.49	238.39	239.26	240.11	240.94	241.75	242.53
12	231.04	232.04	233.01	233.95	234.87	235.77	236.64	237.49
13	225.57	226.64	227.69	228.70	229.68	230.64	231.58	232.49
14	220.17	221.31	222.42	223.50	224.55	225.57	226.57	227.54
15	214.84	216.05	217.22	218.36	219.47	220.56	221.61	222.64
16	209.58	210.85	212.08	213.28	214.46	215.60	216.71	217.79
17	204.39	205.72	207.01	208.27	209.50	210.70	211.87	213.00
18	199.28	200.67	202.02	203.33	204.62	205.87	207.09	208.27
19	194.25	195.69	197.10	198.46	199.80	201.10	202.37	203.61
20	189.31	190.80	192.25	193.67	195.05	196.40	197.72	199.00

CT TRENCHING AND SHORING MANUAL

PRESSURE AT DEPTH  $h$  FOR UNIFORM LOADINGS FROM  $L_0$  TO  $L_1$  OR  $L_2$

$h$	73	74	75	76	77	78	79	80
1	294.77	294.84	294.91	294.97	295.04	295.10	295.17	295.23
2	289.54	289.68	289.82	289.95	290.08	290.21	290.33	290.45
3	284.32	284.53	284.74	284.94	285.13	285.32	285.51	285.69
4	279.11	279.39	279.67	279.93	280.19	280.45	280.69	280.93
5	273.92	274.27	274.61	274.94	275.27	275.58	275.89	276.19
6	268.75	269.16	269.57	269.97	270.36	270.73	271.10	271.46
7	263.60	264.08	264.55	265.02	265.47	265.90	266.33	266.75
8	258.47	259.02	259.56	260.09	260.60	261.10	261.58	262.06
9	253.38	254.00	254.60	255.18	255.76	256.31	256.86	257.39
10	248.32	249.00	249.66	250.31	250.94	251.56	252.16	252.74
11	243.30	244.04	244.77	245.47	246.16	246.83	247.49	248.13
12	238.31	239.12	239.90	240.67	241.42	242.14	242.85	243.55
13	233.38	234.24	235.08	235.90	236.71	237.49	238.25	239.00
14	228.48	229.41	230.30	231.18	232.04	232.87	233.69	234.48
15	223.64	224.62	225.57	226.50	227.41	228.30	229.16	230.01
16	218.85	219.88	220.89	221.87	222.83	223.76	224.68	225.57
17	214.11	215.20	216.25	217.29	218.29	219.28	220.24	221.18
18	209.44	210.57	211.67	212.75	213.81	214.84	215.85	216.83
19	204.82	206.00	207.15	208.27	209.38	210.45	211.50	212.53
20	200.26	201.48	202.68	203.85	204.99	206.11	207.21	208.27