

Dr. 12 S. A. K. H. & Co.

102

DIETZGEN

ENGINEERS

FIELD BOOK

No. 404

1099

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be $30.6 + (20 - 16) \div 2$ or 2 ft. added to 30.6 = 32.6. For slopes of 1 on 1½ see inside of back cover.

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ALLIED
AUG-3-20
COUN. & AUDITOR

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Construction

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Same Hubs Pairs #1

2M P4.48 2.25 56.14

53.89

Hub 57

5.61 50.53 45.16

5.37

Invert tile

57+50

11.38 44.76

56

~~2.95 52.19~~

4.74 51.40

58

4.61 51.53 45.24 6.29

59

4.73 51.41 45.32 6.09

60

3.55 52.59 45.40 7.19

61

4.19 51.95 45.48 6.47

62

4.87 51.77 45.56 6.21

63

4.56 51.58 45.64 5.94

57

$$\begin{array}{r} 9.65 \\ + 1.25 \\ \hline 11.00 \end{array} \quad 45.14$$

57+50

9.70

57+60

$$\begin{array}{r} 9.73 \\ + 1.35 \\ \hline 11.08 \end{array} \quad 45.06$$

1/6/22

Ramp

Sta	Elev	Gr	Cut
0	37.39		
	41.39		
	46.44	41.50	4.90
1	46.49	41.56	4.90
2	46.74	41.62	5.10
3	47.39	41.68	5.70
4	48.54	41.74	6.80
5	48.64	41.80	6.80
6	48.54	41.86	6.70
7	49.34	41.92	7.40
7+11			
8	48.87	41.98	6.90
9	48.62	42.04	6.60
10	48.52	42.10	6.40
↳ 10+70			
11	48.52	42.16	6.40
12	49.17	42.22	6.90
↳ 13	48.97	42.28	6.70
14	50.41	42.34	8.10
15	50.11	42.40	7.70
16	49.56	42.46	7.10
17	49.16	42.52	6.60
18	50.01	42.58	7.40
19	51.21	42.64	7.60
20	51.21	42.70	7.50

= Bottom of Stream

= Water Level

= Ground "

E & W R N.L. Lincoln Township

N & S R

Sta	Elev	Gr.	Cut	RY cut	Max cut	Mid cut
21	50.32	42.76	7.60			
22	49.32	42.82	6.50			
23	H.G. 49.77	42.88	6.90			
	W.L. 48.62					
24	50.02	42.94	7.10			
24+73						
25	49.22	43.00	6.20			
25+81						
26	50.01	43.06	6.90	7.1	8.1	4.9
26+98						
27	50.61	43.12	7.50			
28	50.36	43.18	7.20			
29	50.11	43.24	6.90			
30	50.71	43.30	7.40			
31	51.76	43.36	8.40			
31+30						
32	50.91	43.42	7.50			
33	50.55	43.48	7.10			
34	50.06	43.54	6.50			
35	50.11	43.60	6.50			
36	50.76	43.66	7.10			
37	52.36	43.72	8.60			
38	51.01	43.78	7.20			
38+48						
39	50.51	43.84	6.90			

N-RR Fence

S-RR Fence

E-W R

Sta	Elev	Gr.	Cut	AV Cut	Max Cut	Min Cut
40	50.56	43.90	6.70 ^r	7.2	8.6	6.5
41	50.46	43.96	6.50			
42	50.11	44.02	6.10			
43	50.66	44.08	6.60			
44	51.11	44.14	7.00			
45	51.16	44.20	7.00			
46	52.16	44.26	7.90			

L 46+15

47	51.97	44.32	7.60			
48	51.17	44.38	6.80			
49	49.97	44.44	5.50			

49+77

50	50.17	44.50	5.70	6.7	7.9	5.5
51	50.62	44.58	6.00			
52	50.72	44.66	6.10			
53	51.07	44.74	6.30			
54	51.07	44.82	6.30			
55	51.24	44.90	6.30	6.1	6.3	5.7
56	51.29	44.98	6.30			
57	51.09	45.06	6.00			
58	51.09	45.14	6.00			
59	51.14	45.22	5.90			
60	51.44	45.30	6.10			
61	51.19	45.38	5.80			
62	51.40	45.46	6.00			

N & S E in Pond

Elev

① 49.54 Small Pond 76' N Sta 58

② 50.00

" " S Sta 63

Sta	Elev	Gr.	Cut	Av Cut	Max Cut	Min Cut
63	50.70	45.54	5.20			
L 63+47						
64	51.55	45.62	5.60			
65	51.50	45.70	5.80			
66	51.75	45.78	6.00			
67	51.80	45.86	5.90			
68	51.55	45.94	5.60			
69	51.13	46.02	5.10			
70	51.28	46.10	5.20	5.8	6.3	5.1
71	51.48	46.18	5.30			
72	51.98	46.26	5.70			
73	51.88	46.34	5.50			
74	52.28	46.42	5.80			
75	52.23	46.50	5.70			
76	52.43	46.58	5.80			
End 76+80	52.07	46.64	5.40	5.6	5.8	5.2

N+S Sec Line E Line Sec 5

End of Main N+S R

Br. A. Main 1

Sta	Elev	Gr	Cut	AVG CUT	MAX CUT	MIN CUT
0	49.93	44.00	5.93			
1	50.98	46.75	4.23			
1+48	51.93	48.07	3.86	4.70	5.90	380

Br. B Main 1

0	50.78	44.50	6.28			
1	55.78	50.80	4.98			
2	58.68	53.30	5.38			
3	60.30	55.80	4.50			
4	60.60	55.90	4.70			
4+98	62.20	57.98	4.22	5.06	3	4.2

Br. C Main 1

0	50.56	44.70	5.86			
1	53.46	49.10	4.36			
2	57.19	52.40	4.79			
2+90						
3	60.44	55.70	4.74			
4	63.55	59.00	4.55			
4+05						
5	64.56	59.80	4.76			
5+30						
5+44	64.41	60.15	6			
5+64	65.91	60.31				
5+86	64.66	60.49				

0 = 46+08 of Main 1

End = 180'S of SRR Fence

0 = Sta 36 of Main 1

End = center of section 5

0 = Sta 40 of Main 1

N HWY Fence

N " Ditch

E of HWY

S HWY Ditch

Sta	Elev	Gr	Cut	AV cut	Max cut	Min cut.
5+95						
6	65.66	60.60	5.06			
7	66.86	61.40	5.46			
7+37	65.91	61.70	4.21	4.9	5.8	4.6

Br. D Main 1

0	51.72	45.00	6.72			
1	53.72	46.70	7.02			
2	55.12	48.40	6.72			
2+5						
2+16	55.22					
2+35	57.12					
2+65						
3	56.82	50.10	6.72			
4	57.27 ⁰⁰	51.80	5.47			
5	57.92 ¹¹	53.50	4.42			
6	59.50	55.20	4.30			
7	60.90	56.90	4.00			
8	62.60	58.60	4.00	5.4	6.7	4.0
9	64.00	60.30	3.70			
10	66.40	62.00	4.40			
11	68.30	63.70	4.60			
12	70.00	65.40	4.60			
13	71.30	67.10	4.20			
14	72.50	68.80	3.70			

S Road Fence

Endon R 135' S of Diagonal H.W.

S = 47+25 of Main #1

N H.W. Fence

N " Ditch

C H.W.

S H.W. Fence

Sta	Elev	Gr.	Cut.	AV Cut	Max Cut	Min Cut
15	74.80	70.50	4.30			
16	75.60	72.20	3.40			
17	77.90	73.90	4.00			
18	79.40	75.60	3.80			
19	81.50	77.30	4.20			
20	83.40	79.00	4.40			
21	84.90	80.70	4.20			
22	86.10	82.40	3.70			
23	88.20	84.10	4.10			
24	90.00	85.80	4.20			
25	91.30	87.50	3.80	4.2	46	34

29

Sta	Lat	D	I	Main	#	AVI	MAX	MID
	Elev	Gr	Cut	Cut	Cut	Cut	Cut	Cut
0	62.50	58.75	3.75					
1	63.80	59.75	4.05					
2	65.00	60.75	4.25					
3	66.20	61.75	4.45					
4	66.80	62.75	4.05	4.1	4.5	3.9		

= Sta. 8 Br. D.

End.

LAT. D 2

0	62.50	58.75	3.75					
1	63.60	59.55	4.05					
2	64.60	60.35	4.25					
3	65.60	61.15	4.45					
4	66.20	61.95	4.25					
5	66.80	62.75	4.05					
5+50	67.20	63.55	3.65	4.1	4.5	3.9		

= Sta. 8 Br. D.

LAT. D-3

Sta	Elev	Gr	Cut	AV cut	Max cut	Min cut
0	77.50	73.20	4.30			
1	80.00	75.60	4.40			
2	82.60	78.00	4.60			
3	84.50	80.40	4.10			
4	87.20	82.80	4.40			
5	89.40	85.20	4.20			
6	92.20	87.60	4.60			
7	94.60	90.00	4.60			
8	96.80	92.40	4.40			
9	99.30	94.80	4.50	4.4	4.6	4.2

= 16+50 D.

End

Br. E Main #1

Sta	Elev	Gr	Cut	cut	May cut	MAD cut
0	51.20 ⁸⁰	45.00	6.20			
1	52.70 ⁸⁰	47.50	5.20			
2	54.20 ⁸⁰	49.18	5.02			
3	57.00 ⁸⁰	50.86	6.14			
4	57.00 ⁸⁰	52.54	4.46			
5	58.60	54.22	4.38			
6	60.00	55.90	4.10	5.1	6.2	4.10

= 48 Main #1

Br. F MAIN #1

0	51.20	46.50	4.70
1	52.50	48.30	4.20
2	54.35 ⁸⁰	50.10	4.30
3	56.75 ⁸⁰	51.90	4.80
4	58.65	53.70	5.00

L 4+30

0 = Sta 70 of Main

10' N. of J's E+W 1/6 FL

Sta	Elev	Gr	Set	av cut	Max cut	Min cut
5	60.45	55.50	8.500			
6	62.25	57.30	5.00			
7	64.71	59.10	5.60			
8	66.46	60.90	5.60			
L 8+61						
9	71.01	64.90	6.10			
10	73.61	68.90	4.70			
10+28			4.6			
10+53	75.26					
10+72	77.51					
10+90	76.96	72.50	4.50	5.0	6.1	4.2

N Hwy Fence

N Hwy Ditch

CL Hwy

S Hwy Fence End of Br.

Sta	Elev	Gr	Cut	Av cut	Max cut	Min cut
0	47.03					
	48.18					
	53.98	48.20	5.80			
1	54.63	48.30	6.30			
2	54.48	48.40	6.10			
3	53.93	48.50	5.40			
4	54.58	48.60	6.00			
5	54.98	48.70	6.30			
6	54.73	48.80	5.90			
7	54.58	48.90	5.70			
8	55.58	49.00	6.60			
9	54.63	49.10	5.50			
10	54.53	49.20	5.30			
11	54.48	49.30	5.20			
12	54.33	49.40	4.90			
L 13+96						
13	54.43	49.50	4.90			
13+40						
13+68	53.48					
13+91	58.86					
14	57.43	49.60	7.80			
14+20	54.56					
14+48						
15	54.41	49.70	4.70	5.8	6.6	4.7
L 15+30						

Bottom of Stream or Creek Bed
 Water Level
 Ground Level

58.86

49.60

9.26

N RR Fence

N RR Ditch

Top N Rail

S RR Ditch

S RR Fence

Sta	Elev	Gr.	Cut	Av cut	Max cut	Min cut
16	54.61	49.80	4.80			
17	54.96	49.90	5.10			
18	54.71	50.00	4.70			
19	55.11 ⁰⁰	50.10	5.00			
20	55.46 ¹	50.20	5.30			
21	56.01	50.30	5.70			
22	56.21	50.40	5.80			

L: 22+50

23. 56.22 50.50 5.70 ⁴ 5.2 5.8 4.7

24 56.92 50.95 6.00

25 57.02 51.40 5.60

26 57.52 51.85 5.70

26+98

27 57.92 52.30 5.60

27+14 57.02

27+36 59.42

27+50 57.17 ⁰⁰

27+63

L: 28 58.11 52.75 5.40

29 58.31 53.20 5.10

30 58.46 53.65 4.80

31 58.51 54.10 4.40

32 59.11 54.55 4.60

33 59.61 55.00 4.60

34 60.11 55.45 4.70

N. Hwy Fence

N. Hwy Ditch

E Hwy

S Hwy Ditch

S Hwy Fence

Sta	Elev	Gr.	Cut	AV Cut	M+V Cut	M+D Cut
35	60.97	55.90	5.10			
36	61.62	56.35	5.30			
37	62.52	56.80	5.70			
L 38	63.02	57.25	5.80			
39	62.97	57.70	5.30			
40	63.37 ⁷⁰	58.15	5.20			
41	63.72 ^{4.3}	58.60	5.10			
42	64.17	59.05	5.20			
43	64.87	59.50	5.40			
44	65.87	59.95	5.90			
45	66.32	60.40	5.90	5.3	6.0	4.4
45+61	65.12					
46	67.47	61.30	6.20			
L 46+45						
47	68.27	62.20	6.00			
48	68.82	63.10	5.70			
49	68.77 ⁷⁰	64.00	4.80			
50	70.77 ⁹⁰	64.90	5.90			
51	71.35 ⁹⁰	65.80	5.60			
52	71.85	66.70	5.20			
53	72.50	67.60	4.90			
54	73.45	68.50	5.00			
55	74.75	69.40	5.30			
56	76.00	70.30	5.70			
57	77.30	71.20	6.10	5.6	6.2	5.0

069.42 Gr. level IN Ditch
IN Ditch

074.74 Ditch bottom 100' N Sta 56+50

Sta	Elev	Gr.	Cut	AV cut	Max cut	Min cut
58	77.89	72.10	5.70			
59	78.81	73.00	5.80			
59+7	76.81 ⁰⁰					
60	79.70 ⁰⁰	73.90	5.80			
60+36						
60+50	79.29					
60+64	82.29					
60+80	78.59	74.47	4.20	5.5	6.1	4.2

In Ditch

W Hwy Fence

W Hwy Ditch

☐ "

Top of End Johnson's Tile in E Hwy Ditch

Br. A Main #2

Sta	Elev	Gr.	Cut	AV cut	Max cut	MIT cut
0	54.23	49.75	4.50			
1	54.13	49.85	4.30			
2	54.38	49.95	4.40			
3	54.38	50.05	4.30			
4	54.28	50.15	4.10			
4+70	54.33	50.22	4.10	4.3	4.5	4.1

= Sta 12+50 Main #2

= End on J Highs W R 60' N of N RR Fence

Br. B Main #2

0	54.33	50.40	3.90			
1	54.18	50.50	3.70			
2	54.48	50.60	3.90			
3	54.63	50.70	3.90			
4	54.58	50.80	3.80			
5	54.93	50.90	4.10	3.9	4.0	3.7
6	55.13	51.00	4.10			
7	55.18	51.10	4.10			
8	55.28	51.20	4.10			
9	55.53	51.30	4.20			
10	55.73	51.40	4.30			
11	55.83	51.70	4.10			
12	55.98	52.00	4.00			
12+24	56.03	52.07	4.00	4.1	4.3	4.0

= Sta 12+96 Main #2

= Sta 0 Lat. B-1

= End N & S R 50' NW of RR

Lat B-1

Sta	Elev	Gr.	Cut	HY Cut	MAX Cut	MIT Cut
0	54.93	51.00	3.90			
1	54.93	51.10	3.80			
2	54.98	51.20	3.80			
3	55.23	51.30	3.90			
4	55.38	51.40	4.00			
5	55.42	51.50	3.90			
6	55.52	51.60	3.90			
6+45	55.62	51.65	4.00	3.9	4.0	3.8
0	55.17					

= Sta 5 Br. B

= End of Lat B-1 = 58 Rods N of RR on N+S 1/2
 Pond 600' SW by N of End of Lat. B-1

Br. C Main #2

0	54.43	50.00	4.40			
1	54.13	50.05	4.10			
2	53.53	50.10	3.40			
3	52.93	50.15	2.80			
4	52.08	50.20	1.90	3.3	4.4	1.9

= Sta 14+48 Main #2 At S RR Fence

= End of Br. C on J High W 1/2

125' S of S RRF

Br. E Main #2

0	65.51	60.35	5.20			
1	66.91	61.35	5.60			
2	68.66	62.35	6.30			
3	69.26	63.35	5.90			
4	69.79	64.35	4.60			
5	70.29	65.35	4.90			
6	72.74	66.35	6.40	5.3	6.4	1.0

= 43+75 Main #2

Sta	Elev	Gr.	Cut	AV cut	MAX cut	MID cut
26+54						
7	73.59	67.35	6.20			
8	73.79	68.35	5.40			
9	75.04	69.35	5.70			
10	76.44	70.35	5.10			
11	77.49	71.35	6.10			
12	78.44	72.35	6.10			
13	78.29	73.35	4.90			
14	78.80	74.35	4.50			
15	79.80	75.35	4.40			
16	80.70	76.35	4.40			
17	81.60	77.35	4.20			
18	83.00	78.35	4.60			
19	84.30	79.35	5.00			
20	85.60	80.35	4.20	5.2	6.4	4.2
21	87.00	81.85	5.20			
22	89.30	83.35	5.90			
23	90.30	84.85	5.50			
24	91.50	86.35	5.10			
25	92.50	87.85	4.60			
26	96.20	90.65	5.60			
27	99.80	93.45	6.40			
28	101.60	96.25	5.30			
28+50	102.00	97.65	4.40			
29	103.70	99.05	4.60	5.2	6.4	4.2

End.

LAT E-1 Main #2

AV cut	Max cut	MIN cut
-----------	------------	------------

0 85.00 80.00 5.00

= 19+50 B.R.E.

1 87.80 82.90 4.90

2 91.50 85.80 5.70

3 94.60 88.70 ~~5.90~~4 97.00 91.60 ~~5.40~~5 99.80 94.50 ~~5.30~~

6 102.20 97.40 4.80

7 103.50 100.30 3.20

7+50 106.50 101.75 4.80 5.0 69 32

End.

B.R.F Main #2

0 77.40 71.60 5.80

= 57 Main #2

1 79.40 74.10 5.30

2 81.20 76.60 ~~4.60~~3 83.40 79.10 ~~4.30~~

4 85.60 81.60 4.00

5 88.20 84.10 ~~4.10~~

6 89.60 85.60 4.00

7 91.00 87.10 ~~3.90~~8 92.50 88.60 ~~3.90~~

9 95.30 90.10 5.20 4.7 6.1 39 End.

BM.

1.19

58.00

56.81

Center N. Wall Conc Culv.

Hwy 50

5.02

55.74

7.28

50.72

44.60

12/21/21 Briggs

Bucke

Invert tile 50+25

11.05

(44.69)

51

5.05

50.69

44.68

6.01

52

4.90

50.84

44.76

6.08

53

4.82

50.92

44.84

6.08

54

4.71

51.02

44.92

6.11

55

4.27

51.47

45.00

6.47

56

4.34

51.40

45.08

6.32

57

5.82

56.26

5.30

50.44

45.16

5.28

58

4.86

51.40

45.24

6.16

59

4.90

51.36

45.32

6.04

60

3.67

52.59

45.40

7.19

61

4.34

51.92

45.48

6.44

62

4.50

51.76

45.56

6.20

63

4.82

51.44

45.64

5.80

Note:-

added length East BR. 110' 8"

" " West " 125' 6"

A.M. Pottee

Sent M.B. Choat

12/21/21

R.P.B.

BM.

2.37

53.89

Hail East Millin opp sta. 60

BM.

2.26

56.15

53.89

63

4.85

51.30

45.64

5.66

Tile 63+40

10.97

(45.78)

chk.

64

4.96

51.19

45.72

5.47

65

5.01

51.14

45.80

5.34

66

4.60

56.02

4.73

51.42

45.88

5.54

67

4.59

51.43

45.96

5.47

Cont. Pg. 60

Cont on Page 8

Sta	B.S.	H.I.	-5	Elev	Gr	Cut
BN#1	3.50	53.50		50.00		
T.P. Sta 5	3.06	52.00	4.52	48.94		
0-H2O level			9.60	42.40	41.50	
0+0.5			5.50	46.50	41.50	5.00
0+5.0			4.72	47.28	41.53	5.75
1			5.22	46.78	41.56	5.22
2			4.92	47.08	41.62	5.46
3			4.58	47.42	41.68	5.74
4			3.36	48.64	41.74	6.90
5	4.61	53.55	3.06	48.94	41.80	7.14
6			4.89	48.67	41.86	6.81
7			4.30	49.25	41.92	7.33
8			4.70	48.85	41.98	6.87
9			4.93	48.62	42.04	6.58
10			4.95	48.60	42.10	6.50
10+5.0			5.46	48.09	42.13	5.96

4/17/21

Hoff
Hill
Simpsonspike in J.E. Johnsons
NE Cor Rst.

4.0' H2O AT outlet

El. of Ditch Bottom = 38.40

Hugo MANV # / Cont.

B.M. #1

Hug 10+50

10

5.04

55.04

50.00

6.89

48.15

6.41

48.63

42.10

6.53

10+50

6.89

48.15

42.13

6.02

10+75

5.81

49.23

42.14

7.09

11

6.43

48.61

42.16

6.45

11+50

5.93

49.11

42.19

6.92

12

5.75

49.29

42.22

7.07

12+50

5.99

49.05

42.25

6.80

12+75

5.72

49.32

42.27

7.05

13

5.27

49.67

42.28

7.39

13+25

4.95

50.09

42.29

7.80

13+50

4.86

50.18

42.31

7.87

14

4.48

50.56

42.34

8.22

15

4.96

55.25

4.75

50.29

42.40

7.89

16

5.63

49.62

42.46

7.16

17

6.11

49.14

42.52

6.62

18

5.20

50.05

42.58

7.47

19

4.87

50.38

42.64

7.74

20

4.82

50.43

42.70

7.73

21

4.73

50.52

42.76

7.76

22

5.71

49.54

42.82

6.72

7/20/21

Briggs

Hill

Cats given Nichols
7/20/21
Bureau

23 55.25 6.96 48.29 42.88 5.41
24 6.57 48.68 42.94 5.74

Nicholson
Rattray.

8/5/21

Hubs Main #1

Sta B.S. H.I. - S Elev for Cut.

BM #2	1.96	56.22		54.26	
Hub 54.46	5.43	56.86	4.79	51.43	
T.P.	5.30	56.22	5.94	50.92	
Hub 53			4.70	51.52	44.90
T.P.			4.72	51.50	44.98
55			5.00	51.22	45.06
56			4.90	51.32	45.14
57			4.87	51.35	45.22
58			4.87	51.35	45.22
59	5.47	56.99	4.70	51.52	45.30
60			5.63	51.36	45.38
61			5.47	51.52	45.46
62			5.87	51.12	45.54
63			5.33	51.66	45.62
64			5.55	51.44	45.70
65	4.84	56.70	5.13	51.86	45.78
66			4.78	51.92	45.86
67			5.10	51.60	45.94
68			5.54	51.16	46.02
69			5.45	51.25	46.10
Hub: R.P. 70					5.15

Vold

0.0870 for 14"

Cuts given 8/5/21

C.P.H.

Vold - That to lay with force outlet 8/5/21 and failed.

Sta	B.S.	H.I.	-S	Elev	Gr	Cut
22	7.40	56.94		49.54	42.82	6.72
23	8.67	56.96		48.29 ²⁷	42.88	5.39
BM #2	2.54	56.59		54.33		
24			7.03	49.91	42.94	6.97
24+70			7.85	49.09	42.98	6.11
25			7.58	49.36	43.00	6.36
25+50			7.91	49.03	43.03	6.00
26			6.86	50.08	43.06	7.02
26+25			6.70	50.24	43.08	7.16
+50			6.53	50.41	43.09	7.32
27			6.24	50.70	43.12	7.58
28	5.71	56.40	6.25	50.69	43.18	7.51
29			6.06	50.34	43.24	7.16
30			6.14	50.26	43.30	6.96
+50			5.98	50.42	43.33	7.09
31			5.85	50.55	43.36	7.19
32			5.78	50.62	43.42	7.29
33			5.78	50.62	43.48	7.14

spike N Cap RR Bridge

26+25 = 0 Br. A.

8/6/21
Hoff
Hill

Sta B.S. H.I. - S Elev Gr Cut

30 6.67 56.86 50.89

33 6.20 56.82 50.64 43.48 7.16

34 56.84 6.52 50.32 43.57 6.78

35 6.27 50.67 43.60 6.97

+50 6.34 50.50 43.63 6.87

+75 6.05 50.79 43.65 7.14

36 6.84 57.65 6.03 50.81 43.66 7.15

37 6.56 51.09 43.72 7.37

38 6.81 50.84 43.78 7.06

BM#3 3.38 54.27 (old) 54.26

Main #1 - Oct 3.21

BM-3 2.60 56.86 54.26

35750 6.40 50.46 43.63 7.83

36 6.08 50.78 43.66 7.12

37 5.79 51.01 43.72 7.35

38 6.06 50.80 43.78 7.02

39 6.23 50.63 43.84 6.79

40 6.96 57.16 6.66 50.20 43.90 6.30

T.P. 9.88 62.12 4.92 52.24

BMX 5.31 56.81

Center N. Wall Gmc Box Sta 74 25 BRD-Main 1.

10/6/21

Hoff
Hill

BM #3 1.84 56.10

57.26

40

5.89 50.21 43.90

6.31

41

5.24 50.82 43.96

6.86

42

5.52 50.88 43.99

6.59

42

5.56 50.54 44.02

6.52

~~43~~~~5.04 51.06 44.08~~

6.98

44

4.94 51.16 44.14

7.02

45

4.90 51.20 44.20

7.00

46

4.60 51.50 44.26

7.24

~~46.95~~~~3.90 52.20 44.30~~

7.90

From 19.48

68

56.02 4.84 51.18 46.04

5.14

69

5.22 50.80 46.12

4.68

70

5.40 50.62 46.20

4.42

71

4.83 51.19 46.28

4.91

72

4.29 51.73 46.36

5.37

73

4.34 51.68 46.44

5.24

74

3.99 52.03 46.52

5.51

75

3.78 52.24 46.60

5.64

76

4.07 51.95 46.68

5.27

76 + 81

3.56 52.46 46.75

5.71

End

Out from 42nd

ROBR D

2/11/22

NEW Hubs MAIN #

10/13/21

HOFF
131990

DM. X	1.73	58.54	56.81	Pg. 58
45+50		7.40	51.14	44.23 6.91
46		7.00	51.54	44.26 7.28
46+50		6.32	52.22	44.29 7.93
46+75		6.29	52.25	44.30 7.95
47		6.32	52.22	44.32 7.90
47+50		6.25	52.29	44.35 7.94
48		7.12	51.42	44.38 7.04
48+50		7.10	51.44	44.41 7.03
49		7.75	50.79	44.44 6.35
49+50		8.71	49.83	44.47 5.36
49+80		8.70	49.84	44.49 5.35

O BR. D.

Debr

O MAIN A. Johnson

49	4.57	55.36	50.79	44.44	6.35
+50	5.52	55.35	49.83	44.47	5.36
+80	5.49	55.33	49.84	44.49	5.35
50		5.28	50.10	44.50	5.60
51		4.55	50.80	44.58	5.22
52		4.49	50.86	44.66	6.20
53		4.44	50.91	44.74	6.17
54		4.35	51.00	44.82	6.18
55		3.97	51.38	44.90	6.48

1/90

1/80

BM X	2.09	58.90	56.81	Center N. Wall Conc Box Sta 2+ Br D.	
42+50			8.32	50.58	44.05 6.53
+75			5.94	52.96	44.06 8.90
43			8.22	50.68	44.08 6.60
43+50			8.72	50.18	44.11 6.07
44			8.93	49.97	44.14 5.83
45			9.42	49.48	44.20 5.28
46			9.55	49.35	44.26 5.09
47			9.64	49.26	44.32 4.94
48			9.74	49.16	44.38 4.78
49			9.84	49.06	44.44 4.62
T.P.	1.26	54.72	5.44	53.46	
49			5.65	49.07	44.44
50			4.02	50.90	44.50 6.20
51			4.17	50.55	44.58 5.97
51+12=52			3.92	50.80	44.64 6.16

BM X	0.65	57.46	56.81		
46			8.19	49.27	44.26 5.01
Top 20"			11.14	46.32	1.84 44.48
47			8.20	49.26	44.32 4.94
48			8.33	49.13	44.38 4.75
49			8.40	49.06	44.44 4.62
50			6.70	50.76	44.50 6.26
51			6.77	50.69	44.58 6.11

B17 #2 2.13 56.46

57.38

0

6.13 50.83 44.50 5.83

0+50

5.59 50.89 45.58 5.37

1

5.20 51.26 46.50 4.76

1+60

4.62 51.84 47.70 4.14 End

BR B Main #1

Hub
36 Main 1 12.10 63.91

50.81

35+75 = 12.13 63.92

50.79

0

13.13 50.79 45.00 5.79 = 35+75 Main #1

0+50

11.09 52.83 48.00 4.83

1

8.50 55.42 51.00 4.42 6.50

1+70

5.57 58.35 53.10 5.25

2

5.36 58.56 54.00 4.56 3.00

3

2.72 60.20 56.00 4.20 2.00

4

3.29 60.63 57.00 3.63

5

1.42 62.50 58.00 4.50 1.00

5709

1.20 62.72 58.09 4.63

End

2.00
1.6
1.2009/6/21
Hoff
Hill

SPIKE RRB

= 26+25

1.00

4.17³⁰
1.95

1.75

1.9

1.575

1.75

1.7

1.225

1

Hubs Lat C - Main #1

Sta	B.S.	H.I.	-S	Elev	Gr	Cut.
B.M. #3	4.02	58.28		54.26		
0			8.09	50.19	44.70	5.49
0+50			6.15	52.13	46.95	5.18
1			4.06	54.22	49.20	5.02
+50			2.08	56.20	51.45	4.75
2	6.88	64.71	0.45	57.83	53.70	4.13
+50			5.74	59.97	54.95	4.02
+75			4.94	59.77	55.58	4.19
3			3.97	60.74	56.20	4.54
+25			3.54	61.19	56.83	4.34
+50			2.93	61.78	57.45	4.33
+75	9.70	72.71	1.70	63.01	58.08	4.93
T.P.	4.45	70.61	6.55	66.16		
4			6.65	63.96	58.70	5.26
+25			6.30	64.31	59.01	5.30
+50			6.68	63.93	59.33	4.60
5			5.34	65.27	59.95	5.32
+75			5.34	65.27	60.89	4.38
6			4.46	66.15	61.20	4.95
7			4.12	66.49	61.70	4.79
7+19			4.42	66.19	61.80	4.39

= Sta 40 Main #1

4/27/21 9/27/21
 9.43
 Hoff
 Hill

4.50

0
3
N1
2
N9
5

19
2
19

10/3/21
HOFF
HILL

$= 2 + 46 + 75 \text{ Main \#1}$

175
700

12

1.50 = 0 BR D-1

Excess = 0 D-2

2/11.75
 $\frac{22}{700}$ 28

54	13.5	14.1	-5	Elev	67	C.F
11	9.12	72.26		63.14		
12	7.71	72.20		64.49	60.00	4.49
13		72.22	6.22	66.00	61.75	4.25
125			5.63	66.59	62.19	4.40
150			4.89	67.33	62.63	4.70
175			4.32	67.90	63.03	4.87
14			4.55	67.67	63.50	4.17
15	10.29	79.87	2.64	69.58	65.25	4.33
16			8.31	71.56	67.00	4.56
17			7.36	72.51	68.75	3.76
18			5.38	74.49	70.50	3.99
19	77.96		3.15	76.72	72.25	4.47
150	12.80	90.76	1.91	77.96	73.13	4.83
20			11.77	78.99	74.00	4.99
21			8.56	82.20	76.70	5.50
22			6.39	84.37	79.40	4.97
23			4.08	86.68	82.10	4.58
24	6.06	95.16	1.66	89.10	84.80	4.30
25			3.33	91.83	87.50	4.33
25729			2.47	92.69	88.28	4.41
						End

x

1.75

—

2.70

2.60
 290
 140
 230
 220
 1300

2.60
 5
 1300

Sta	B.S.	H.I.	-S	Elev	Gr	Cut
15D=OD-3	11.18	80.76		69.58	65.30	4.28
1			9.56	71.20	67.30	3.90
2			7.52	73.24	69.30	3.94
3			4.95	75.81	71.30	4.51
4			2.67	78.09	73.30	4.79
+50	12.92	92.28	1.40	79.36	74.80	4.56
5			11.64	80.64	76.30	4.34
6			9.40	82.88	79.30	3.58
7			5.74	86.57	82.30	4.27
8	8.90	98.52	2.66	89.62	85.30	4.32
9			5.39	93.13	88.30	4.83
10			1.32	97.22	92.55	4.67
10+10			-30(2)	98.12	92.98	—

2.50

3.00

+25%

Sta B.S. H.I. -5 Elev Gr. Out.

BM#5 5.35 61.82 56.48

T.P. 4.88 59.68 7.13 54.70

T.P. 3.65 59.18 4.05 55.53

0-H₂O Level 11.10 48.08

0+10 5.13 54.05 48.21 5.84

0+50 4.68 54.50 48.75 6.25

1 4.60 54.58 48.30 6.28

2 4.76 54.42 48.40 6.02

3 5.44 53.74 48.50 5.24

4 4.06 55.12 48.60 6.52

5 4.24 59.33 4.09 55.09 48.70 6.39

6 4.62 54.71 48.80 5.91

7 4.82 54.51 48.90 5.61

8 4.72 54.61 49.00 5.61

9 4.82 54.51 49.10 5.44

10 4.88 54.45 49.20 5.25

Bolt top of S End E Cap Cattle pass.

Hoff
Hill
Simpson

3.0' H₂O At Out let.

El of Ditch Bottom ~ 45.08

Hubs Main #2

9	4.75	59.46	54.51
10	5.00	59.45	54.45

Hubs 11	4.84	54.61	49.20	5.31
12	4.71	54.54	49.40	5.14
12+50	4.83	54.62	49.45	5.17
13	4.74	54.51	49.80	5.01
13+25	5.09	54.36	49.53	4.83
13+50	5.03	54.42	49.55	4.87
14	5.86	53.59	49.60	3.99

B.M. #5 R.R. Xing
4.98 61.46 56.48

13+50 7.06 54.40
Huly 14 7.85 53.61
Top tile 2P 9.53 51.93 49.55

6/46

61.46
49.62
11.84
2 38
9.46

7/20/21

Briggs
Hill

8.95
7.85
8.06
3(2.98)
8.28

Cuts given W. BR.

7/20/21

Briggs

7/26/21

Briggs
Hoff

Hops Main 2

7.5
4.5
12.07.5
4.5
12.0
32.57/26/21
Briggs
Hoff

BM. #5	4.98	61.46	56.48		
14+50			6.50	54.96	49.65
14+75			6.94	54.52	49.67
15			6.90	54.56	49.70
15+25			7.00	54.46	49.73
15+50			6.92	54.54	49.75
15+75			6.93	54.53	49.77
16	6.40	60.71	7.15	54.31	49.80
17			6.15	54.56	49.90
18			5.76	54.95	50.00
19			5.64	55.07	50.10
20			5.21	55.50	50.20
21			4.66	56.05	50.30
22			4.53	56.18	50.40
22+25			4.72	55.99	50.42
22+50			4.68	56.03	50.45
22+75			4.60	56.11	50.48
23			4.35	56.36	50.50
24	6.32	62.93	4.10	56.61	50.95
25			5.77	57.16	51.40
26			5.43	57.50	51.85
27			5.28	57.65	52.30
27+75			3.93	59.00	52.64

Cuto given 7/26/21
Briggs

6.36

Sta	B.S.	H.I.	-S	Elev
81#				
27	9.60	67.25		57.65
+75	8.25	67.25		59.00
28			8.81	58.44 52.75 5.69
28+25			8.87	58.38 52.86 5.52
+50			8.92	58.32 52.98 5.35
+75			8.84	58.41 53.09 5.32
29			8.70	58.55 53.20 5.35
30			8.72	58.53 53.65 4.88
31			8.40	58.85 54.10 4.75
32	7.46	66.71	8.00	59.25 54.55 4.70
33			7.10	59.61 55.00 4.61
34			6.36	60.35 55.45 4.90
35			5.33	61.38 55.90 5.48
36			4.76	61.95 56.35 5.60
+50			4.49	62.22 56.58 5.64
37			4.04	62.67 56.80 5.87
+50			3.80	62.91 57.02 5.89
+75			3.60	63.11 57.14 5.97
38			3.59	63.12 57.25 5.87
+50	5.82	69.00	3.53	63.18 57.48 5.90
39			5.60	63.40 57.70 5.70
+50			5.38	63.62 57.92 5.69
40			5.05	63.95 58.15 5.80
41			4.61	64.39 58.60 5.79
42			4.40	64.60 59.05 5.55

$$\frac{4) 45}{11}$$

8/5/21

$$\frac{0.45}{18} \%$$

 Cuts given 8/5/21
 C.P.H.

5/a B.S. H.I. -5

8/13/21

BM	3.74	70.80	67.06			
42	6.36	70.96	6.86	64.44	59.05	5.39
43			5.73	65.07	59.50	5.57
44			4.93	65.87	59.95	5.92
45			2.77	68.03	60.40	7.73
46			3.15	67.65	61.30	6.35
41	6.61	70.80	64.39			

8/18/21

x | 46-9/10
9%

Adsgiven 8/13/21

Briggs
Hoff

Hoff-Hill

45	5.51	73.54	68.03	60.40		
46	5.84	73.49	67.65	61.30	6.37	
46+50		73.51	5.34	68.17	61.75	6.42
47			5.14	68.37	62.20	6.17
48			4.57	68.94	63.10	5.84
49			3.62	69.89	64.00	5.89
50			2.56	70.95	64.90	6.05
51			2.10	71.41	65.80	5.61

Sta	B.S.	H.I.	-3	Elev	Gr	Cut.
50	6.83	77.78		70.95		
51	6.31	77.75		71.41	65.80	5.64
52			5.84	71.91	66.70	5.21
53			5.13	72.62	67.60	5.02
54			3.94	73.81	68.60	5.31
55			2.84	74.91	69.40	5.51
56	6.77	82.64	1.88	75.67	70.30	5.57
57			6.06	76.58	71.20	5.38
58			4.99	77.65	72.10	5.55
59			5.48	77.16	73.00	4.16
60			3.38	79.26	73.90	5.36
+25			2.93	79.71	74.12	5.59
+50			2.82	79.82	74.35	5.47
61+04			2.23	80.41	74.84	5.57

1.54
.9

9.36

14"

12"

8/26/21

Hoff
Hill

Oct 3 - 1921
 Counted trees - Total 33
 Including trees cut girdled and blown
 " 4 to be destroyed on Br E
 and 2 on Main #2 at Hwy.

Sta	B.S	H.I	-S	Elev
B.M.	4.45	60.98		56.48
0		6.47	54.46	50.40 4.06
Flow Line - 0		10.53	50.40	3.92
0+50		6.56	54.37	50.45 3.87
1		6.56	54.37	50.50 3.87
2		6.35	54.59	50.60 3.96
3		6.28	54.65	50.90 3.95
4		6.19	54.74	50.80 3.94
5		5.88	65.05	50.90 4.15
B.M #5	6.05	62.53		56.48
Sta 5-Hub	5.17	60.32	7.38	55.15 50.90
6		5.04	55.28	51.00 4.28
7		4.89	55.43	51.10 4.33
8		4.74	55.58	51.20 4.38
9		4.54	55.78	51.30 4.48
10		4.48	<u>55.84</u>	51.40 4.44
11		4.44	55.88	51.70 4.18
12		4.35	55.99	52.00 3.97
12+10		4.13	56.19	52.03 4.16

8/3/21

Briggs
Hoff.

= Sta 13 Main #2

Cuts given 8/3/21

9/1/21 Hoff-Hill

.10%

= 8

.30%

= 15

Sta	B.S.	H.I.	-S	Elev	Gr	Cut.
42-Main	8.30	72.47		64.47		
43- "	7.72	72.79		65.07		
44- "		72.78				
0			7.42	65.36	60.35	5.01
0+50			6.75	66.03	60.95	5.08
1			5.72	67.06	61.55	5.51
2			4.12	68.66	62.75	5.91
3			3.61	69.17	63.95	5.22
4	8.43	78.93	2.28	70.50	65.15	5.35
5			7.05	71.88	66.35	5.53
6			5.68	73.25	67.55	5.70
+25			5.21	73.72	67.85	5.87
+50			4.89	74.04	68.15	5.89
+75			4.65	74.28	68.45	5.83
7			4.53	74.40	68.75	5.65
+50			5.08	73.85	69.35	4.50
8			4.17	74.76	69.95	4.81
+50			4.09	74.84	70.55	4.29
9	7.77	83.24	3.46	75.47	71.15	4.32
+50			7.07	76.17	71.75	4.42
10			6.36	76.88	72.35	4.53
11			4.91	78.33	73.55	4.78
12			4.31	78.93	74.75	4.18
13	9.73	89.74	3.23	80.01	75.95	4.06
14			8.49	81.25	77.15	4.10

= 43+50 Main #2

1.20% 0-18

1.70 18-25

2.10 25-27

4.00 27-28+10

Br E No 17 #2

Sta.	B.S.	H.I.	-5	Elev		
15		89.74	6.80	82.94	78.35	4.59
16			5.37	84.37	79.55	4.82
17			4.00	85.74	80.75	4.99
+50			3.32	86.42	81.35	5.07
18			3.03	86.71	81.95	4.76
+50			2.23	87.57	82.80	4.71
19	9.04	97.31	1.47	88.27	83.65	4.62
+50			8.45	88.86	84.50	4.36
20			7.59	89.72	85.35	4.37
21			5.96	91.35	87.05	4.30
22			4.67	92.64	88.75	3.89
23			2.43	94.88	90.45	4.43
24	9.54	105.78	1.07	96.24	92.15	4.09
+50			7.62	98.16	92.80	5.36
+15			7.18	98.60	93.13	5.47
25			6.69	99.09	93.85	5.24
+25			6.37	99.41	94.37	5.04
+50			6.08	99.70	94.90	4.80
26			5.46	100.22	95.95	4.37
27			3.17	102.61	98.05	4.56
+50	9.04	113.12	1.70	104.08	100.05	4.03
28			5.82	107.30	102.05	5.25
28+10			5.48	107.64	102.45	5.19

$$x \frac{1.20}{1} = 0 \text{ Br E-1}$$

$$x \frac{1.70}{1}$$

$$x \frac{2.10}{1}$$

f.00

3/61

50

Sta B.S. H.I. - S Elev Gr Cut.

0+5 Lat-B	5.17	60.32	55.12	51.00	4.15
0+50		5.16	54.16	51.05	3.11
1		5.10	55.22	51.10	4.12
2		5.01	55.31	51.20	4.11
3		4.86	55.46	51.30	4.16
4		4.92	55.40	51.40	4.00
5		4.83	55.49	51.50	3.99
5772		5.09	55.23	51.57	3.66

Cont on Page 100

Lat A Main #2

BN#5	5.09	61.57	56.48		
0		6.92	57.65	49.75	4.90
0+25		7.04	57.53	49.78	4.75
0+50		7.20	57.37	49.80	4.67
+75		7.26	57.31	49.83	4.48
1		7.17	57.38	49.85	4.52
2		7.29	57.28	49.95	4.23
3		7.22	57.35	50.05	4.30
4		7.23	57.34	50.15	4.19
4+95		7.31	57.26	50.25	4.01

Sta 12 Main #2

Cont on Page 100

End

Lat. C. Main 2

Sta	13.5	H.I.	-5	Elev
B.M. #5	5.09	61.57		56.48
0		7.02	57.55	50.00 4.55
0+50		6.96	57.61	50.03 4.58
1		7.30	57.27	50.05 4.22
2		7.69	53.88	50.10 3.78
3		8.78	52.79	50.15 2.64
3+78		9.44	52.33	50.20 2.13

= 14.75

Main #2

 $\frac{100}{61}$
 $\frac{100}{61}$

End.
 Cent on Page 100

Hubs Lat E-1

18E = 0	11.73	98.44	86.71	82.25	4.46
0+50		10.74	87.70	83.25	4.45
1		9.94	88.50	84.25	4.25
2		8.15	90.29	86.25	4.04
3		6.56	91.88	88.25	3.63
4		4.16	94.28	90.25	4.03
5	12.44	108.94	1.94	96.50	92.25 4.25
6		10.02	98.92	95.25	3.67
7		6.43	102.51	98.25	4.26
8	6.55	114.08	1.41	107.53	103.15 4.38
8+60		3.50	110.58	106.09	4.49

 $\frac{100}{61}$
 $\frac{100}{61}$
 $\frac{100}{61}$
 $\frac{100}{61}$

Hubs Lat F - Main #2

Sta	B.S	H.I.	-S	Elev	Cor	Cut
RP. 57 Main = 0	11.95	88.53		76.58	71.70	4.88
0 + 50			11.43	77.10	72.55	4.55
1			10.93	77.60	73.40	4.20
2			9.48	79.05	75.10	3.95
3			7.37	81.16	76.80	4.36
4			5.61	82.92	78.50	4.42
5			3.87	84.66	80.20	4.46
+50			2.95	85.58	81.50	4.08
+75			2.15	86.38	82.15	4.23
6	10.38	97.20	1.61	86.92	82.80	4.12
+50			8.71	88.49	84.10	4.39
7			7.55	89.65	85.40	4.25
8			4.71	92.49	88.00	4.49
+50			4.46	92.74	89.30	3.44
9			2.01	95.19	90.60	4.59
9 + 03	End					

$$\begin{array}{r} 2) 1.70 \\ \underline{5} \end{array}$$

$$\begin{array}{r} 1.40 \\ 3) 6.0 \\ \underline{3.0} \\ 3.0 \end{array}$$

$$\begin{array}{r} 3) 5.2 \\ \underline{1.4} \\ 3.8 \end{array}$$

$$\begin{array}{r} 3) 8 \\ \underline{2} \end{array}$$

170

 100
 20

 W Hwy D
 V

New Levels - Hubs Lat Bt Main

Sta BS H.I. - S Ekv Gr

BM #5 6.12 62.60 56.48

T.P. 4.78 60.01 7.37 55.23

0 - Grade 9.05 50.96

0 - Hub 3.94 56.09 51.00 6.07

0 + 50 4.86 55.15 51.05 4.10

1 4.82 55.19 51.10 4.09

2 4.77 55.24 51.20 4.04

3 4.61 55.40 51.30 4.10

4 4.60 55.41 51.40 4.01

5 4.46 55.55 51.50 4.05

5 + 72 4.69 55.32 51.57 3.75

Lat A Main #2

BM #5 5.12 61.60 56.48

0 7.17 54.43 49.75 4.68 0 = Sta Main #2

+ 25 7.17 54.43 49.78 4.65

+ 50 7.26 54.34 49.80 4.54

+ 75 7.34 54.26 49.83 4.43

1 7.27 54.33 49.85 4.48

2 7.32 54.28 49.95 4.33

3 7.22 54.38 50.05 4.33

4 7.19 54.41 50.15 4.26

4 + 95 7.21 54.39 50.25 4.14

9/24/21

Halt
Hill.

0 = 4 + 95 Lat-B Main #2

9/10
11/69/10
11/6

Sta	BS	H.I.	-S	Elev	Gr	Cut
BM#5	5.12	61.60		56.48		

0			6.96	57.64	50.00	4.64	= 14+75 Main #2
+50			7.04	54.56	50.03	4.53	
1			7.40	54.20	50.05	4.15	
2			7.79	53.81	50.40	3.71	
3			8.84	52.76	50.15	2.61	
5+95			9.25	52.35	50.20	2.15	

BR E Main #1

BM X 5.31 62.12 56.81

0			10.70	51.42	45.20	6.22	= 3+48+50 Main #1
+50			10.38	51.74	46.45	5.29	
1			9.62	52.50	47.70	4.80	
+50			8.69	53.43	48.70	4.73	
2			8.10	54.02	49.70	4.32	
2+50			7.32	54.80	50.70	4.10	
3+25			5.14	56.98	52.20	4.78	
+50			4.36	57.76	52.70	5.06	
+75			4.35	57.77	53.20	4.57	
4	6.76	64.78	4.10	58.02	53.70	4.32	
+50			6.23	58.55	54.45	4.10	
5			5.50	59.28	55.20	4.08	
+50			4.66	60.12	55.95	4.17	
+75			4.21	60.57	56.38	4.24	
6			3.88	60.90	56.70	4.20	
+50			2.97	61.81	57.45	2.36	
7+05			0.92	63.86	58.28	1.58	End

1.50
1.05
51.50

56.70
1.50
58.20

Tile Check - Main #1

Sta	B.S.	H.I.	-S	Elev	Gr Elev
B.M. #1	3.38	53.38		50.00	↓
T.P.	2.34	51.02	4.70	48.68	
0		7.38	3.00	40.58	
0+50		13.64	2.25	41.39	
1			2.08	41.56	41.56
+50			2.00	41.64	
2			1.98	41.66	41.62
+50			1.87		
3			1.98	41.66	41.68
+50			1.93		
4			1.85	41.79	41.74
+50			2.01	41.84	
5	4.56	53.78	1.80	49.22	41.80
+50		7.38	4.65	41.75	
6		46.40	4.62	41.78	41.86
+50					
7			4.52	41.88	41.92
+50			4.45		
8			4.43	41.99	41.98
+50			4.40		
9			4.42	41.98	42.04
+50			4.35		
10			4.32	42.08	42.10
+50			4.30		
11	5.39	54.87	4.30	49.48	42.16

51.02
7.66

2.50
5.05

53.47

3.00

40.52

7.55

8/26/21

Hoff

Hill

On 30" Cor. Pipe

Used Rod length 5.05

On 24" S.P.

Also 21.50 }
24" = 2.33 Outside of 1 1/2" Crack
Rod = 5.05
7.38

Sta	B.S.	H.I.	- S	Elev
11+50		57.87 7.38	5.35	
12		47.49	5.33	42.16 42.22
+50			5.31	
13			5.23	42.26 42.28
+50			5.10	
14			5.13	42.36 42.34
+50			5.12	
15			5.05	42.44 42.40
+50			5.01	
16			5.09	42.40 42.46
+50			5.12	
17			5.12	42.37 42.52
+50			5.00	42.66
18	5.42	55.46 7.38 48.08	4.83	50.04 42.58
+50			5.51	
19			5.53	42.55 42.64
+50			5.50	
20			5.46	42.62 42.70
+50			5.37	
21			5.32	42.76 42.76
+50			5.32	
22			5.36	42.72 42.82
+50			5.21	
23			5.21	42.87 42.88
+50			5.12	
24			5.27	42.81 42.94

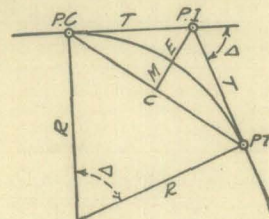
108

549	B.S.	H.I.	-5	Elev	Ground
24+50		55.46	5.21		✓
25		47.38			
		48.08	5.12	42.95	43.00
B.M. 2	1.82	56.16	1.12	54.34	
		7.16			
25+50		49.00	5.85		
26			5.94	43.06	43.06
+50			5.90		
27			5.80	43.20	43.12
+50			5.82		
28			5.75	43.25	43.18
+50			5.80		
28+90			5.82	43.18	43.24
30-Hub			5.97	50.19	

outside Dia of 22' 4/16 = 2.11'

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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CURVE FORMULAS

Radius = $R = \frac{50}{\sin D/2}$ (1) Degree of Curve = D and $\sin \frac{D}{2} = \frac{50}{R}$ (2)Tangent = $T = R \tan \frac{\Delta}{2}$ (3) Length of Curve = $L = 100 \frac{\Delta}{D}$ (4)Middle ordinate = $M = R(1 - \cos \frac{\Delta}{2})$ (5) = $R \text{vers} \frac{\Delta}{2}$ (6)External = $E = T \tan \frac{\Delta}{4}$ (7) = $R \cos \frac{\Delta}{2} (1 - \cos \frac{\Delta}{2})$ (8) = $R \text{exsec} \frac{\Delta}{2}$ (9)Long Chord = $C = 2 R \sin \frac{\Delta}{2}$ (10) Δ = Central Angle

EXPLANATION AND USE OF TABLES

Stations.—Given P. I. = Sta. 161 + 60.35 to find Sta. of P. C. and P. T. $\Delta = 62^\circ 10'$ $D = 8^\circ 20'$. From Table IV for 1° curve $T = 3454.1$ and $\div 8\frac{1}{2} = 414.49$ ft. From Table V correction = .36 or $T = 414.85$ ft. P. C. = Sta. P. I. - $T = 157 + 45.50$. Also from (4) $L = 746.00$ and P. T. = Sta. P. C. + $L = 164 + 91.50$.

Offsets.—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent offset for 100 ft. = 7.27 ft. Distance = 158 - Sta. P. C. = 54.50, hence offset = $7.27 (54.50 \div 100)^2 = 2.16$ ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus $(54.50)^2 \div (2 \times 688.26) = 2.16$ ft.

Deflections.—Deflection angle = $\frac{1}{2} D$ for 100 ft., $\frac{1}{4} D$ for 50 ft., etc. For c ft. = (in minutes) $.3 \times C \times D^\circ$ or = defl. for 1 ft. from Table III $\times C$. For Sta. 158 of above curve = $.3 \times 54.5 \times 8\frac{1}{2} = 136.2'$ or $2^\circ 16.2'$, or $= 2.50 \times 54.5 = 136.2'$ from Table III. For Sta. 159 deflection angle = $2^\circ 16.2' + 8^\circ 20' \div 2 = 6^\circ 26.2'$, etc.

Externals.—May be found in similar manner to tangents. Thus E for curve above is 91.37. For from Table IV for 1° curve $E = 960.6$ for $8^\circ 20' = 960.6 \div 8\frac{1}{2} = 91.27$ and from Table V correction = .10 or $E = 91.37$ ft. Or suppose $\Delta = 32^\circ$ and E is measured and found to be 42 ft. What is D? From Table IV $E = 230.9$ and $\div 42 = 5.5$ or $D = 5^\circ 30'$.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

TABLE II.—INCHES IN DECIMALS OF A FOOT.

1-16	3-32	1/2	3-16	1/4	5-16	3/8	1/2	5/8	3/4	7/8
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

TABLE III.—RADII, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan Offset	Def. for 1 Foot	
0°	10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
	20	17188.8	.073	.291	0.10		781.84	1.600	6.395	2.20
	30	11459.2	.109	.436	0.15	20'	764.49	1.637	6.540	2.25
	40	8594.2	.145	.582	0.20	40	747.89	1.673	6.685	2.30
	50	6875.55	.182	.727	0.25					
1					8	716.78	1.746	6.976	2.40	
	10	5729.65	.218	.873	0.30	20	688.16	1.819	7.266	2.50
	20	4911.15	.255	1.018	0.35	30	674.69	1.855	7.411	2.55
	30	4297.28	.291	1.164	0.40	40	661.74	1.892	7.556	2.60
	40	3819.83	.327	1.309	0.45					
	50	3437.87	.364	1.454	0.50	9	637.28	1.965	7.846	2.70
		3125.36	.400	1.600	0.55	20	614.56	2.037	8.136	2.80
2					30	603.80	2.074	8.281	2.85	
	10	2864.93	.436	1.745	0.60	40	593.42	2.110	8.426	2.90
	20	2644.58	.473	1.891	0.65					
	30	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
	40	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
	50	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
		2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
3					12	478.34	2.620	10.45	3.60	
	10	1910.08	.655	2.618	0.90	30	459.28	2.730	10.89	3.75
	20	1809.57	.691	2.763	0.95	13	441.68	2.839	11.32	3.90
	30	1719.12	.727	2.908	1.00	30	425.40	2.949	11.75	4.05
	40	1637.28	.764	3.054	1.05	14	410.28	3.058	12.18	4.20
	50	1562.88	.800	3.199	1.10	30	396.20	3.168	12.62	4.35
		1494.95	.836	3.345	1.15					
4					15	383.07	3.277	13.05	4.50	
	10	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
	20	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
	30	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
	40	1273.57	.982	3.826	1.35	17	338.27	3.716	14.78	5.10
	50	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
		1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5					20	287.94	4.374	17.37	6.00	
	10	1146.28	1.091	4.362	1.50	21	274.37	4.594	18.22	6.30
	20	1109.33	1.127	4.507	1.55	22	262.04	4.814	19.08	6.60
	30	1074.68	1.164	4.653	1.60	23	250.79	5.035	19.94	6.90
	40	1042.14	1.200	4.798	1.65	24	240.49	5.255	20.79	7.20
	50	1011.51	1.237	4.943	1.70					
		982.64	1.273	5.088	1.75	25	231.01	5.476	21.64	7.50
6					26	222.27	5.697	22.50	7.80	
	10	955.37	1.309	5.234	1.80	27	214.18	5.918	23.35	8.10
	20	929.57	1.346	5.379	1.85	28	206.68	6.139	24.19	8.40
	30	905.13	1.382	5.524	1.90	29	199.70	6.360	25.04	8.70
	40	881.95	1.418	5.669	1.95	30	193.18	6.583	25.88	9.00
		859.92	1.455	5.814	2.00					

Note. Chord Deflection=2 times tangent deflection.

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32°	1643.0	230.9	42°	2199.4	407.6	52°	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33°	1697.2	246.1	43°	2257.0	428.5	53°	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34°	1751.7	261.8	44°	2314.9	450.0	54°	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35°	1806.6	278.1	45°	2373.3	472.1	55°	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36°	1861.7	294.9	46°	2432.1	494.8	56°	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37°	1917.1	312.2	47°	2491.3	518.2	57°	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38°	1972.9	330.2	48°	2551.0	542.2	58°	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39°	2029.0	348.6	49°	2611.2	566.9	59°	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40°	2085.4	367.7	50°	2671.8	592.3	60°	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10'	3386.3	925.9	10'	4099.5	1315.6	10'	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62°	3442.7	954.8	72°	4162.8	1352.6	82°	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63°	3511.1	990.2	73°	4239.7	1398.0	83°	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64°	3580.3	1026.6	74°	4317.6	1444.6	84°	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65°	3650.2	1063.9	75°	4396.5	1492.4	85°	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66°	3720.9	1102.2	76°	4476.5	1541.4	86°	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.3
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.2	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67°	3792.4	1141.4	77°	4557.6	1591.6	87°	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68°	3864.7	1181.6	78°	4639.8	1643.0	88°	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69°	3937.9	1222.7	79°	4723.2	1695.8	89°	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70°	4011.9	1265.0	80°	4807.7	1749.9	90°	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92°	5933.2	2518.5	102°	7075.5	3374.9	112°	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93°	6037.8	2594.0	103°	7203.2	3474.4	113°	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94°	6144.3	2671.6	104°	7333.6	3576.8	114°	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95°	6252.8	2751.3	105°	7467.0	3682.3	115°	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96°	6363.4	2833.2	106°	7603.5	3791.0	116°	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97°	6476.2	2917.3	107°	7743.2	3902.9	117°	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98°	6591.2	3003.8	108°	7886.2	4018.2	118°	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99°	6708.6	3092.7	109°	8032.7	4137.1	119°	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	6808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100°	6828.3	3184.1	110°	8182.8	4259.7	120°	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table IV) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.58	.65	.72	.79
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°	.11	.22	.34	.47	.58	.69	.79	.89	.99	1.09	1.20	1.31	1.42	1.54
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.88	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

FOR EXTERNALS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.032	.038	.045	.053	.063	.074	.083
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.077	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.132	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32

TABLE VI.—CORRECTIONS FOR SUB-CHORDS AND LONG CHORDS.

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.96	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.43
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

NOTE.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25'.06 for each chord. Long chords are useful in passing obstacles.

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.037	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

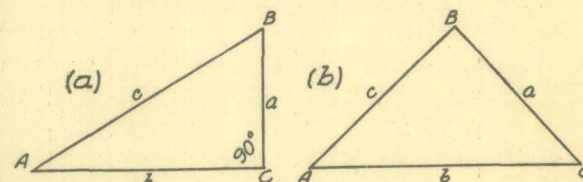
SLOPE REDUCTIONS.

When distances are measured on a slope they may be reduced to the equivalent horizontal distance by the following approximate rule:—subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction=15²÷2×250.3=.45 (by slide rule) or horizontal distance=250.3—.45=249.85. When vertical angle=V. A. is measured horizontal distance=slope distance—slope distance (1—Cos. V. A.). Thus for slope distance of 248.7 ft. and V. A. of 4° 20' from Table VIII Cos=.99714 and correction=1—.99714=.00286 per foot or total of .286×2½ (near enough)=.57 and horizontal distance=248.7—.57=248.13 ft.

See fig. (a).

TRIGONOMETRICAL FORMULAS.

$$\begin{aligned}\sin. & A = \frac{a}{c} \\ \cos. & A = \frac{b}{c} \\ \tan. & A = \frac{a}{b} \\ \cot. & A = \frac{b}{a} \\ \sec. & A = \frac{c}{b} \\ \operatorname{cosec.} & A = \frac{c}{a}\end{aligned}$$



FORMULA FOR SOLVING TRIANGLES.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	$\sin. A = \frac{a}{c}, \cos. B = \frac{a}{c}, b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan. A = \frac{a}{b}, \cot. B = \frac{a}{b}, c = \sqrt{a^2 + b^2}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot. A, c = \frac{a}{\sin. A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan. A, c = \frac{b}{\cos. A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin. A, c = c \cos. A$
Given	Sought.	Oblique triangles. See fig. (b).
A, B, a	b	$b = \frac{a \sin. B}{\sin. A}$
A, a, b	B	$\sin. B = \frac{b \sin. A}{a}$
a, b, C	A — B	$\tan. \frac{1}{2}(A-B) = \frac{(a-b) \tan. \frac{1}{2}(A+B)}{a+b}$
a, b, c	A	$\left\{ \begin{aligned} \text{If } s = \frac{1}{2}(a+b+c), \sin. \frac{1}{2} A &= \sqrt{\frac{(s-b)(s-c)}{bc}} \\ \cos. \frac{1}{2} A &= \sqrt{\frac{s(s-a)}{bc}}, \tan. \frac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} \\ \sin. A &= 2 \sqrt{\frac{s(s-a)(s-b)(s-c)}{bc}} \end{aligned} \right.$
A, B, C, a	area	$\text{area} = \frac{a^2 \sin. B \sin. C}{2 \sin. A}$
A, b, c	area	$\text{area} = \frac{1}{2} bc \sin. A$
a, b, c	area	$s = \frac{1}{2}(a+b+c), \text{area} = \sqrt{s(s-a)(s-b)(s-c)}$

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.	Angle	Sine.	Tan.	Cotg.	Cosin.
0	0	0	00	1	90	1	∞	0	0
10	.0029	.0029	343.8	.99985	80	.9848	.1563	6.435	.1736
20	.0058	.0058	171.9	.99980	70	.9397	.3420	2.903	.3420
30	.0087	.0087	114.6	.99966	60	.8660	.5774	1.732	.5774
40	.0116	.0116	85.94	.99933	50	.7660	.9516	1.047	.7660
50	.0145	.0145	68.75	.99989	40	.6428	1.1918	.6428	.6428
1	.0175	.0175	57.29	.99985	30	.5196	1.5557	.5196	.5196
10	.0204	.0204	49.10	.99979	20	.3907	2.0004	.3907	.3907
20	.0233	.0233	42.96	.99973	10	.2618	2.4152	.2618	.2618
30	.0262	.0262	38.19	.99966	0	.1329	2.8184	.1329	.1329
40	.0291	.0291	34.37	.99958					
50	.0320	.0320	31.24	.99949					
2	.0349	.0349	28.64	.99939					
10	.0378	.0378	26.43	.99929					
20	.0407	.0407	24.54	.99917					
30	.0436	.0437	22.90	.99905					
40	.0465	.0466	21.47	.99892					
50	.0494	.0495	20.21	.99878					
3	.0523	.0524	19.08	.99863					
10	.0552	.0553	18.07	.99847					
20	.0581	.0582	17.17	.99831					
30	.0610	.0612	16.35	.99813					
40	.0640	.0641	15.60	.99795					
50	.0669	.0670	14.92	.99776					
4	.0698	.0699	14.30	.99756					
10	.0727	.0729	13.73	.99736					
20	.0756	.0758	13.20	.99714					
30	.0785	.0787	12.71	.99692					
40	.0814	.0816	12.25	.99668					
50	.0843	.0846	11.83	.99644					
5	.0872	.0875	11.43	.99619					
10	.0901	.0904	11.06	.99594					
20	.0929	.0934	10.71	.99567					
30	.0958	.0963	10.39	.99540					
40	.0987	.0992	10.08	.99511					
50	.1016	.1022	9.788	.99482					
6	.1045	.1051	9.514	.99452					
10	.1074	.1080	9.255	.99421					
20	.1103	.1110	9.010	.99390					
30	.1132	.1139	8.777	.99357					
40	.1161	.1169	8.556	.99324					
50	.1190	.1198	8.345	.99290					
7	.1219	.1228	8.144	.99255					
10	.1248	.1257	7.953	.99219					
20	.1276	.1284	7.770	.99182					
30	.1305	.1317	7.596	.99144					
40	.1334	.1346	7.429	.99106					
50	.1363	.1376	7.269	.99067					

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.	Angle	Sine.	Tan.	Cotg.	Cosin.
16	.2756	.2867	3.487	.96126	74	.9613	3.487	.2867	.2756
10	.2784	.2899	3.450	.96046	50	.9605	3.450	.2899	.2784
20	.2812	.2931	3.412	.95964	40	.9597	3.412	.2931	.2812
30	.2840	.2962	3.376	.95882	30	.9589	3.376	.2962	.2840
40	.2868	.2994	3.340	.95799	20	.9581	3.340	.2994	.2868
50	.2896	.3026	3.305	.95715	10	.9573	3.305	.3026	.2896
17	.2924	.3057	3.271	.95615	73	.9562	3.271	.3057	.2924
10	.2952	.3089	3.237	.95545	50	.9555	3.237	.3089	.2952
20	.2979	.3121	3.204	.95459	40	.9547	3.204	.3121	.2979
30	.3007	.3153	3.172	.95372	30	.9539	3.172	.3153	.3007
40	.3035	.3185	3.140	.95284	20	.9531	3.140	.3185	.3035
50	.3062	.3217	3.108	.95195	10	.9523	3.108	.3217	.3062
18	.3090	.3249	3.078	.95106	72	.9511	3.078	.3249	.3090
10	.3118	.3281	3.048	.95015	50	.9503	3.048	.3281	.3118
20	.3145	.3314	3.018	.94924	40	.9494	3.018	.3314	.3145
30	.3173	.3346	2.989	.94832	30	.9485	2.989	.3346	.3173
40	.3201	.3378	2.960	.94740	20	.9477	2.960	.3378	.3201
50	.3228	.3411	2.932	.94646	10	.9467	2.932	.3411	.3228
19	.3256	.3443	2.904	.94552	71	.9456	2.904	.3443	.3256
10	.3283	.3476	2.877	.94457	50	.9448	2.877	.3476	.3283
20	.3311	.3508	2.850	.94361	40	.9439	2.850	.3508	.3311
30	.3338	.3541	2.824	.94264	30	.9431	2.824	.3541	.3338
40	.3365	.3574	2.798	.94167	20	.9434	2.798	.3574	.3365
50	.3393	.3607	2.773	.94068	10	.9437	2.773	.3607	.3393
20	.3420	.3640	2.747	.93969	70	.9398	2.747	.3640	.3420
10	.3448	.3673	2.723	.93869	50	.9400	2.723	.3673	.3448
20	.3475	.3706	2.699	.93769	40	.9403	2.699	.3706	.3475
30	.3502	.3739	2.675	.93667	30	.9406	2.675	.3739	.3502
40	.3529	.3772	2.651	.93565	20	.9409	2.651	.3772	.3529
50	.3557	.3805	2.628	.93462	10	.9412	2.628	.3805	.3557
21	.3584	.3839	2.605	.93358	69	.9337	2.605	.3839	.3584
10	.3611	.3872	2.583	.93253	50	.9339	2.583	.3872	.3611
20	.3638	.3906	2.560	.93148	40	.9342	2.560	.3906	.3638
30	.3665	.3939	2.539	.93042	30	.9345	2.539	.3939	.3665
40	.3692	.3973	2.517	.92935	20	.9348	2.517	.3973	.3692
50	.3719	.4006	2.496	.92827	10	.9351	2.496	.4006	.3719
22	.3746	.4040	2.475	.92718	68	.9273	2.475	.4040	.3746
10	.3773	.4074	2.455	.92609	50	.9275	2.455	.4074	.3773
20	.3800	.4108	2.434	.92499	40	.9278	2.434	.4108	.3800
30	.3827	.4142	2.414	.92388	30	.9281	2.414	.4142	.3827
40	.3854	.4176	2.394	.92276	20	.9284	2.394	.4176	.3854
50	.3881	.4210	2.375	.92164	10	.9287	2.375	.4210	.3881
23	.3907	.4245	2.356	.92050	67	.9206	2.356	.4245	.3907
10	.3934	.4279	2.337	.91936	50	.9209	2.337	.4279	.3934
20	.3961	.4314	2.318	.91822	40	.9212	2.318	.4314	.3961
30	.3987	.4348	2.300	.91706	30	.9215	2.300	.4348	.3987
40	.4014	.4383	2.282	.91590	20	.9218	2.282	.4383	.4014
50	.4041	.4417	2.264	.91472	10	.9221	2.264	.4417	.4041

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
°						°					
32	.5299	.6249	1.600	.84805	53	30	.6225	.7954	1.257	.78261	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30	39	.6293	.8098	1.235	.77715	51
40	.5398	.6412	1.560	.84182	20	10	.6316	.8146	1.228	.77531	50
50	.5422	.6453	1.550	.84025	10	20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30	40	.6428	.8391	1.192	.76604	50
40	.5544	.6661	1.501	.83228	20	10	.6450	.8441	1.185	.76417	50
50	.5568	.6703	1.492	.83066	10	20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30	41	.6561	.8693	1.150	.75471	49
40	.5688	.6916	1.446	.82248	20	10	.6583	.8744	1.144	.75280	50
50	.5712	.6959	1.437	.82082	10	20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30	42	.6691	.9004	1.111	.74314	48
40	.5831	.7177	1.393	.81242	20	10	.6713	.9057	1.104	.74120	50
50	.5854	.7221	1.385	.81072	10	20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30	43	.6820	.9325	1.072	.73135	47
40	.5972	.7445	1.343	.80212	20	10	.6841	.9380	1.066	.72937	50
50	.5995	.7490	1.335	.80038	10	20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30	44	.6947	.9657	1.036	.71934	46
40	.6111	.7720	1.295	.79158	20	10	.6967	.9713	1.030	.71732	50
50	.6134	.7766	1.288	.78980	10	20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

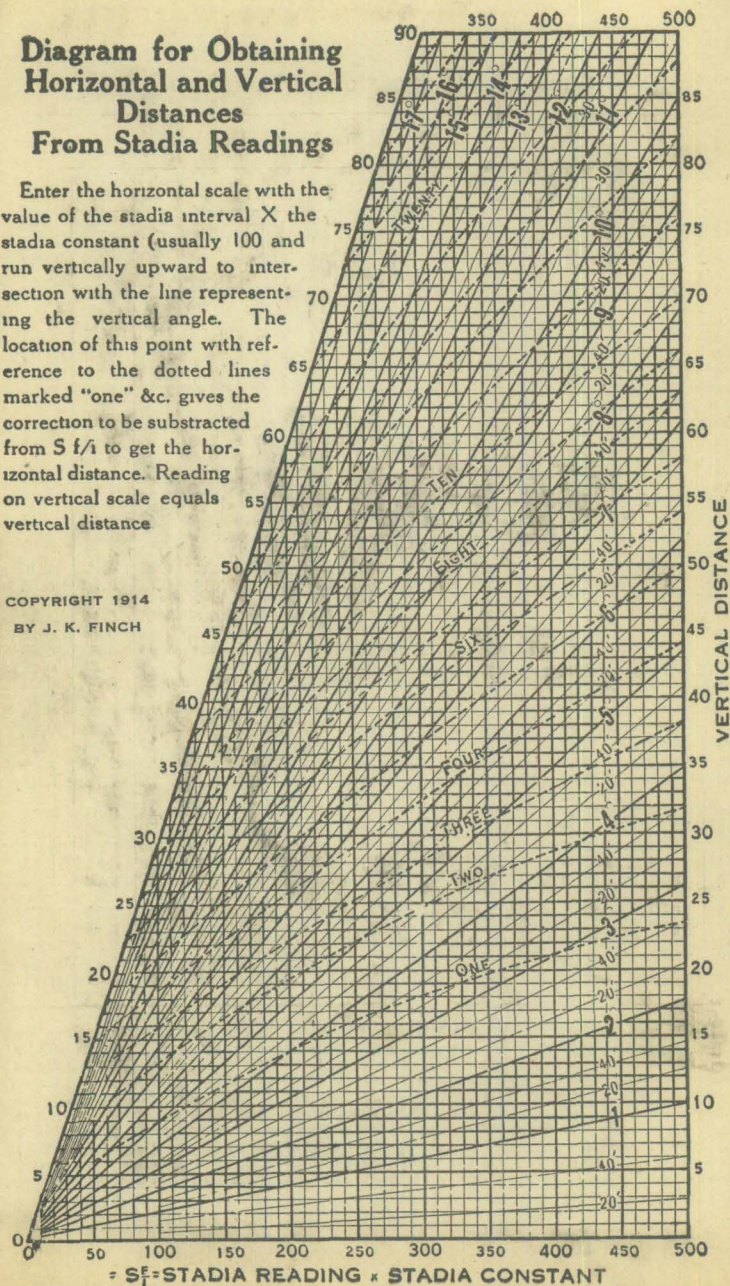
Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if $w = 16.2$ and $h = 5.3$, cu. yds. $= 1.48 + .028 + .089 = 1.597$ cu. yds. or practically 160 cu. yds. per 100 ft. If w exceeds 40 ft., use one half and multiply result by 2, if both w and h are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) $= h$, and $\frac{1}{2}$ the roadbed $= w$, add the triangles formed by taking the distance out to each break in turn ($= w$'s) by the difference between the cuts (or fills) on each side of it ($= h$'s) always subtracting the outer from the inner.

Diagram for Obtaining Horizontal and Vertical Distances From Stadia Readings

Enter the horizontal scale with the value of the stadia interval X the stadia constant (usually 100 and run vertically upward to intersection with the line representing the vertical angle. The location of this point with reference to the dotted lines marked "one" &c. gives the correction to be subtracted from $S f/i$ to get the horizontal distance. Reading on vertical scale equals vertical distance

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DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1½.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	26.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be $41.9 + (20 - 16) \div 2$ or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.

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