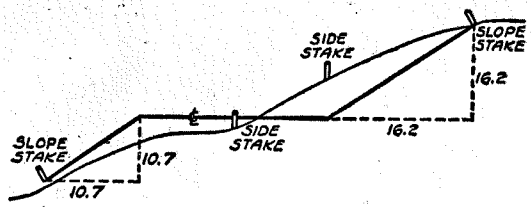


Distances from Side Stakes for Cross-Sectioning

Slope 1 to 1. Roadway of Any Width

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0
1	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	1
2	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	2
3	3.00	3.10	3.20	3.30	3.40	3.50	3.60	3.70	3.80	3.90	3
4	4.00	4.10	4.20	4.30	4.40	4.50	4.60	4.70	4.80	4.90	4
5	5.00	5.10	5.20	5.30	5.40	5.50	5.60	5.70	5.80	5.90	5
6	6.00	6.10	6.20	6.30	6.40	6.50	6.60	6.70	6.80	6.90	6
7	7.00	7.10	7.20	7.30	7.40	7.50	7.60	7.70	7.80	7.90	7
8	8.00	8.10	8.20	8.30	8.40	8.50	8.60	8.70	8.80	8.90	8
9	9.00	9.10	9.20	9.30	9.40	9.50	9.60	9.70	9.80	9.90	9
10	10.00	10.10	10.20	10.30	10.40	10.50	10.60	10.70	10.80	10.90	10
11	11.00	11.10	11.20	11.30	11.40	11.50	11.60	11.70	11.80	11.90	11
12	12.00	12.10	12.20	12.30	12.40	12.50	12.60	12.70	12.80	12.90	12
13	13.00	13.10	13.20	13.30	13.40	13.50	13.60	13.70	13.80	13.90	13
14	14.00	14.10	14.20	14.30	14.40	14.50	14.60	14.70	14.80	14.90	14
15	15.00	15.10	15.20	15.30	15.40	15.50	15.60	15.70	15.80	15.90	15
16	16.00	16.10	16.20	16.30	16.40	16.50	16.60	16.70	16.80	16.90	16
17	17.00	17.10	17.20	17.30	17.40	17.50	17.60	17.70	17.80	17.90	17
18	18.00	18.10	18.20	18.30	18.40	18.50	18.60	18.70	18.80	18.90	18
19	19.00	19.10	19.20	19.30	19.40	19.50	19.60	19.70	19.80	19.90	19
20	20.00	20.10	20.20	20.30	20.40	20.50	20.60	20.70	20.80	20.90	20
21	21.00	21.10	21.20	21.30	21.40	21.50	21.60	21.70	21.80	21.90	21
22	22.00	22.10	22.20	22.30	22.40	22.50	22.60	22.70	22.80	22.90	22
23	23.00	23.10	23.20	23.30	23.40	23.50	23.60	23.70	23.80	23.90	23
24	24.00	24.10	24.20	24.30	24.40	24.50	24.60	24.70	24.80	24.90	24
25	25.00	25.10	25.20	25.30	25.40	25.50	25.60	25.70	25.80	25.90	25
26	26.00	26.10	26.20	26.30	26.40	26.50	26.60	26.70	26.80	26.90	26
27	27.00	27.10	27.20	27.30	27.40	27.50	27.60	27.70	27.80	27.90	27
28	28.00	28.10	28.20	28.30	28.40	28.50	28.60	28.70	28.80	28.90	28
29	29.00	29.10	29.20	29.30	29.40	29.50	29.60	29.70	29.80	29.90	29
30	30.00	30.10	30.20	30.30	30.40	30.50	30.60	30.70	30.80	30.90	30
31	31.00	31.10	31.20	31.30	31.40	31.50	31.60	31.70	31.80	31.90	31
32	32.00	32.10	32.20	32.30	32.40	32.50	32.60	32.70	32.80	32.90	32
33	33.00	33.10	33.20	33.30	33.40	33.50	33.60	33.70	33.80	33.90	33
34	34.00	34.10	34.20	34.30	34.40	34.50	34.60	34.70	34.80	34.90	34
35	35.00	35.10	35.20	35.30	35.40	35.50	35.60	35.70	35.80	35.90	35
36	36.00	36.10	36.20	36.30	36.40	36.50	36.60	36.70	36.80	36.90	36
37	37.00	37.10	37.20	37.30	37.40	37.50	37.60	37.70	37.80	37.90	37
38	38.00	38.10	38.20	38.30	38.40	38.50	38.60	38.70	38.80	38.90	38
39	39.00	39.10	39.20	39.30	39.40	39.50	39.60	39.70	39.80	39.90	39
40	40.00	40.10	40.20	40.30	40.40	40.50	40.60	40.70	40.80	40.90	40
41	41.00	41.10	41.20	41.30	41.40	41.50	41.60	41.70	41.80	41.90	41
42	42.00	42.10	42.20	42.30	42.40	42.50	42.60	42.70	42.80	42.90	42
43	43.00	43.10	43.20	43.30	43.40	43.50	43.60	43.70	43.80	43.90	43
44	44.00	44.10	44.20	44.30	44.40	44.50	44.60	44.70	44.80	44.90	44
45	45.00	45.10	45.20	45.30	45.40	45.50	45.60	45.70	45.80	45.90	45
46	46.00	46.10	46.20	46.30	46.40	46.50	46.60	46.70	46.80	46.90	46
47	47.00	47.10	47.20	47.30	47.40	47.50	47.60	47.70	47.80	47.90	47
48	48.00	48.10	48.20	48.30	48.40	48.50	48.60	48.70	48.80	48.90	48
49	49.00	49.10	49.20	49.30	49.40	49.50	49.60	49.70	49.80	49.90	49
50	50.00	50.10	50.20	50.30	50.40	50.50	50.60	50.70	50.80	50.90	50

Distance of slope stake from side or shoulder stake for any width roadway, slope 1 to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

HARCO
TRADE MARK REG.

Index

T 140 N R. 27 W.

T 140 N R 26 W.

T140 R27

25+40		
25		
24		
23+10		
22		
21		
20		
19		
18		
17		
16+60		
16		
14+40	Left Lowland swamp entered pine forest.	
13		
12		
11		
10		
9+40		
9		
7		
6		
5		
4+00	entered Lowland swamp.	
3+30		
2		
1		
0+00	Started West From sec Cor. 20 Ch. 2 Pts 8	T14 0 R 27

Jan. 17, 1938 - 1.-

Tie Cherry Pond
Chilpkà ch
Wdobs ch π
C.L. Louis pickers
F.L. Louis axe
E. Tappesave
Riley axe

S 83½° W

Pine Forest

129 Bearing S 83½° W
Random Line,

Pine Forest

Lowland swamp, entered.

Left Lowland swamp.

OFFset 185 FT South To 2 inch stake
Ft 2 on 4 Blazed on two sides For
Sec. Cor.

2 inch stake 1 Foot Long.

T14 OR 27

52+59	OFF set 65 FT South.
51	
50	
49+50	
48	
47	
46	
45	
44+29	ENTERED Spruce Swamp.
43	
42+90	
41	
40	
39	
38	
37+17	CROSSED OLD ROAD POSSIBLE BY CAT.
37+00	Government Sign Apx. 60 FT. South OF Line.
36+30	LEFT pine Forest.
36	
34	
33	
32	
31	
30	
29+70	
29	
27	

Jan 17. 1938.

S 83½ W

FOUND 2" iron pipe 1½ FT. above ground 4 inch squared spruce post 5 FT. long. Keyed T14 R5 sec. cor. S&B by iron post.

Spruce Swamp.

Spruce Swamp

Pine Forest

Mag Bearing S 83½ W
Boundary Line.

Pine Forest

T 140 R 27

26+40	
25	
24	
23+40	
22+53	LEFT SPRUCE ENTERED PINE TIMBER
21	
20	
19	
18+65	ENTERED SPRUCE SWAMP.
17	
16+50	
15	
14	
13	
12	
11	
10	
9+18 9+40	LEFT TAM. SWAMP. ENTERED PINE FOREST
8	
7+72	ENTERED TAM. SWAMP.
7+58	CROSSED OLD Logging Road.
6	
5	
4	
3+30	
2	
1	
0+49	LEFT SPRUCE SWAMP.
0+00	STARTED WEST FROM SEC COR 18/19 T 140 R 27

Jan 18, 1938 -2-

S 83½° W

PINE TIMBER

SPRUCE

PINE TIMBER

PINE TIMBER

Magnetic S 83½° W

Random Line

SPRUCE

Tucker Rod.

Chilpka ch

Woods ch. notes

C. Louis pickets

P. Louis axe

Riley axe

Grapes axe

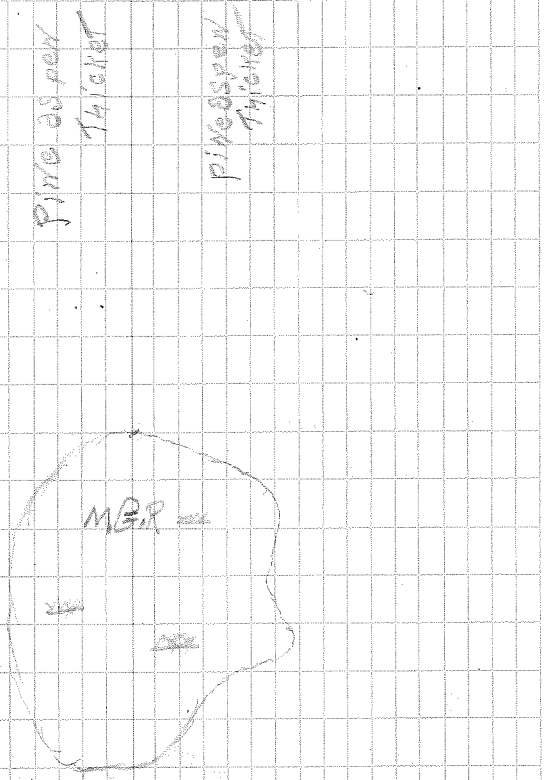
● 2 Inch I.P. 14" stake S. Long.

T 140 R 27.

49+79	Range line. Set 3" aspen Blazed on N side
	Keeled App. Sec. Cor. $\frac{24 \mid 19}{25 \mid 30}$ E.C.W.
48	
47	
46	
45	
44	
43	
42+90	
41	
40	
39	
38	
37	
36+30	
35+00	Left M.B.R. Swamp. Entered pine & aspen Thicket
34	
33	
32	
31	
30	
29+70	
28+00	Entered M.B.R. Swamp.
27	

S 83½° W

Jan 18, 1938



JAN. 19, 1938

	on random From East
22+38	offset 21.6 Ft. South - tied into 29+70
21	
20+50	old sawmill
19	
18	
17	
16	
15	
14	
13	
12	
11	
10	
9+22	Fence South West and North
8+56	Fence North-East
7	
6+60	
5	
4	
3	
2	
1	
0+38	Fence North and south
0+00	Started EAST from Sec. 24/25 / 35

N 82° E

Chief Comstock Axe
Bain Tod
Thurman Axe
Miller Axe
Chupka, ch.
Sawmill Woods, ch.

Line N 82° E.

Open Field

T. 14 S R. 27

T.140 R.27

24+37	Crossed Fence RUNNING SOUTH entered Spruce swamp
25	
24	
23	
22	
21	
20	
19	
18	
17+43	Fence RUNS SOUTH
16+50	
15	
14	
13	
12	
11	
10	
9+10	
8	
7	
6	
5	
4+12	Crossed Fence RUNS SOUTH
3+30	
2	
1	
0+33	Crossed Fence RUNNING SOUTH
0+00	Stone Mound From Sec Cor. ~~2617~~ 3317 T.140 R.27.

Jan 19 1934
Circuits too Brushy also Plains axe Caught on Ridge axe wood ch

-4-

S 83½° W

Found 1" Iron Pip, also 4" Tam. post 2' long Blazed on 2 sides Scribed on one side - ¼ - 26

Open Field

Birch Timber

N 83½° E 83.3 links

Road Bed Line

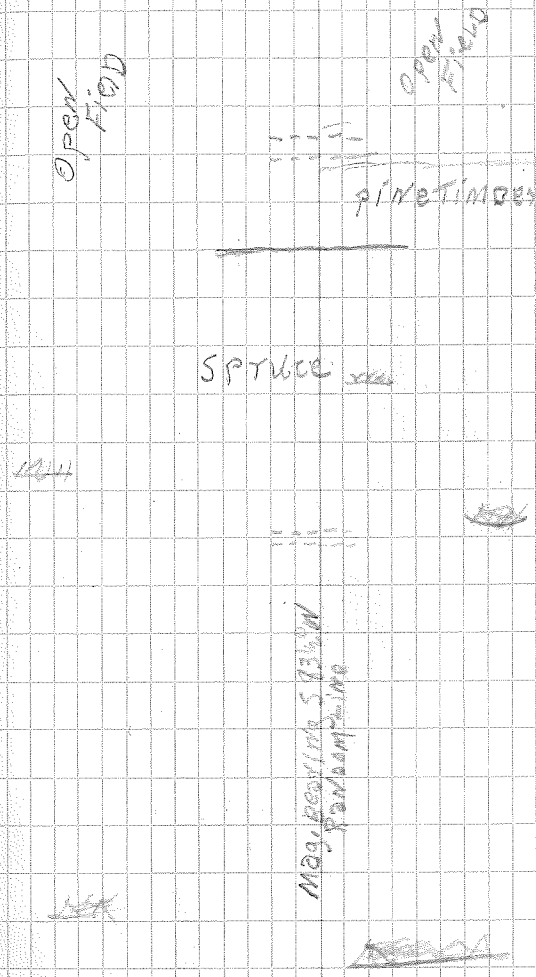
T 140 R 27

52+80	SET 2" aspen STAKE BLAZED ON one SIDE
51	Keeled App. Sec. Cor. $\frac{27}{34}\frac{26}{35}$ E.C.W.
50+50	TOP OF HILL
49+75	FOOT OF HILL.
49+50	
48	
47	
46+44	CROSSED ROAD passable BY car.
45	
44+00	Left Spruce SWamp.
43	
42+80	
41	
40	
39	
38+43	CROSSED OLD Logging ROAD North - South
37	
36+30	
35	
34	
33+28	OFFSET 31' South TO orig. Line.
32	
31	
30	
29+70	
29	
27	

S 43½ W.

Jan 19 1938

FOUND 12" pine STUMP WITH Nail IN IT 20' east of App sec. COR.



T 14 0 R 27

22+40	
23	
24	
23+10	
22	
21	
20	
19	
18	
17	
16+50	
15	
14+13	Crossed Old Logging Road Not passable by car
13	
12	
11+00	entered Spruce swamp.
10	
9+10	
9	
7	
6	
5	
4	
3+30	
2	
1	
0+01	Started West from APP. SEC. COR. 17/16 T 14 0 R 27. 24 21

S 83½° W

Jan 20 1938. -5-

Mitchell	
Comstock	lake
Finney	axe.
Bain	axe
Woods.	CH.
Chapko	CH.

Spruce Swamp

Spruce Swamp

Meanders Stream

Portage Line

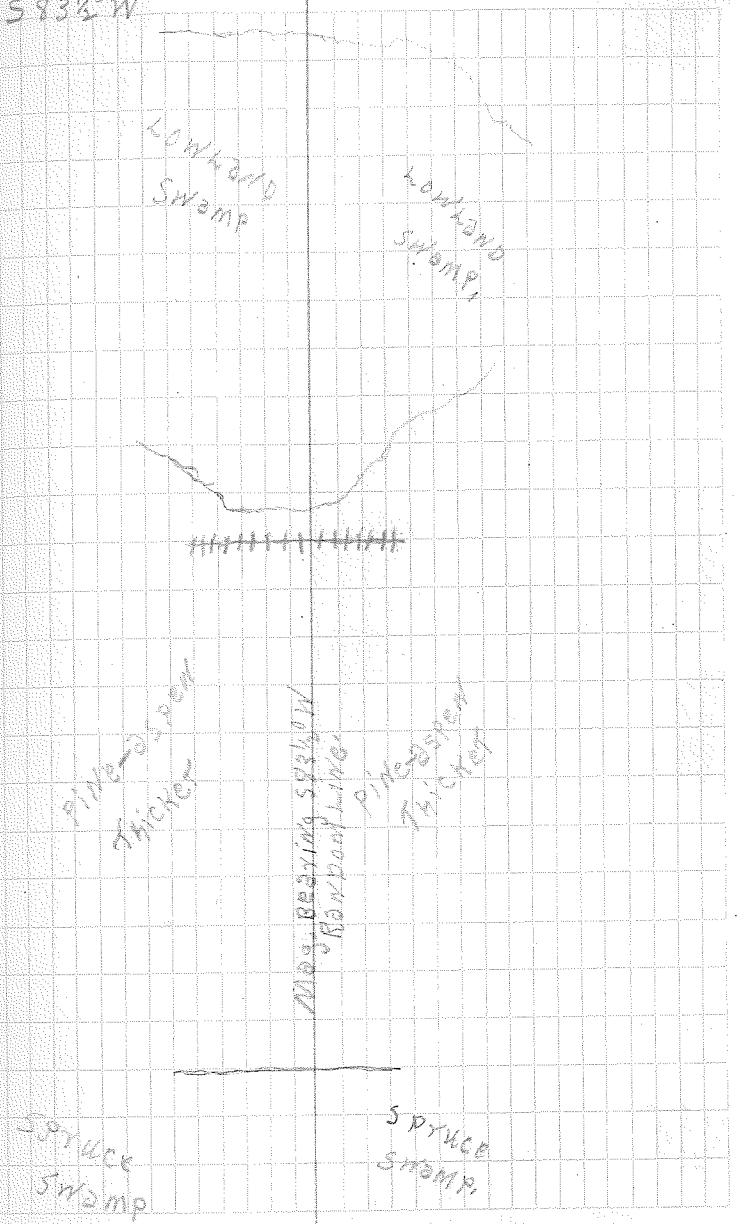
T.12 N. R.27

App. Sec. Cor. 19-17-19-20 - E.C.W

52+80	Set 4" Spruce post H Long Blazed on one side Reeled
52+20	Entered Spruce Swamp.
51	
50	
49+50	
48	
47	
46	
45	
44	
43	
42+90	
42+74	Entered Lowland Swamp.
41+05	Crossed old R.R. Road Grade, passable Byroad.
40	
39	
38	
37	
36+30	
35	
34	
33	
32	
31	
30+00	Left Spruce Swamp
29+70	
28	
27	

Jan 20 1938.

S 83½° W



T.140 R.27

26+40	
25+27	1½ iron pipe 31' North of Line Stamps Basis of Tan Stake 7' Spliced 411
24	
23+47.	Swamp. NW.
23+10	
22	
21	
20	
19+69	Marion Road. NE-SW.
18	
17	
16+50	
15	
14	
13+00	Leave Dam. Swamp. Enter jack pine.
12	
11	
10	
9+80	
9+56	Old grade NE-SW.
8	
7	
6	
5	
4	
3+30	
2	
1	
0+00	Started east from S.C. ~~25/36~~ T.140 R.27

N 83° E

6

Swamp

Nilson Rod
Louis pickets-4
Louis axe-ch.
Graves axe
Riley axe

Jack pine

Jack pine

-S-

-N-

Dam Swamp

Dam Swamp

Mag. Bearing N 83° E
Title Line

Dam. 10" Bears S 33½° E Dist. 25' Stamped.

Dam. 10" Bears N 70° E Dist. 10½' Stamped.

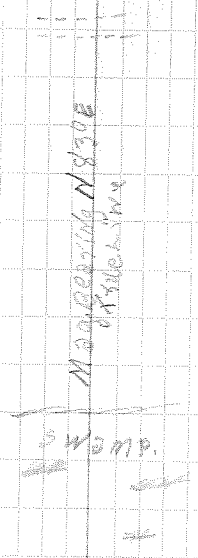
1½" open iron pipe.
3" S.P. stake 2' High.

T.140 R.27

52+87	Center OF OLD grade NW-SE.
52100	Set 3" WHITE OAK post FOR APP. Sec. COR, 30|29 31|32
51	
50	
49+50	
48	
47	
46	
45	
44	
43	
42+90	
41	
40	
39	
39+37	NARROW ROAD N-S.
37	
36+30	
35	
34	
33	
32	
31	
30+00	Leave SWAMP center JACK PINE
29+70	
28	
27	

N 83 E

Jan 20 1939.
Same party



T.140 R.27

26+40	
25	
24	
23+40	
22	
21	
20	
19	
18	
17	
16+50	
15	
14	
13	
12	
11	
10	
9+40	LEFT-SPRUCE SWAMP ENTERED pine & aspen.
9+13	CROSSED OLD Logging Road N-S. Not passable by car.
8	
7	
6	
5	
4	
3+30	
2	
1	
0+00	STARTED WEST FROM APP. S.C. 12/17/1920 T.140 R.27.

140-26 140-27 Survey

Jan 21 1934 -7-

S 83½ W

Miller pickers:
Comstock axe
B Tapes axe
CH Pulis pickers
Algois axe
Bain axe
Riley axe
Chulpka CH
Woods, CH Notes,
Tuckerman

Pine - aspen

Pine - aspen

Spruce swamp

Spruce swamp

May Bearing Spruce Road & Mike

T140 R27

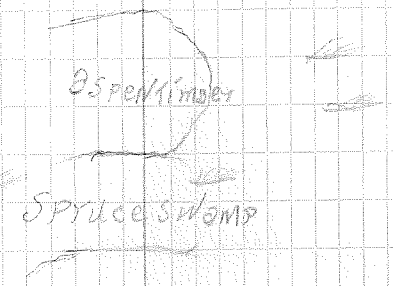
52+80	set 4" Spruce stump 4 high Reed 80 App. S.	13/18 / 24/19 E.C.M.
51		
50		
49+90		
48		
47		
46+00	entered Spruce swamp.	
45		
44		
43+54	Left Spruce swamp.	
42+90		
41+59	entered Spruce Swamp.	
40		
39		
38		
37		
36+30		
35		
34		
33		
32		
31		
30		
29+70		
28		
27		

140-28 [illegible] Survey

Jan 21 1934.

S 83½° W

Spruce Swamp



Spruce Swamp

N 83 E 83½ W
Reindeer

Spruce

T.140 R. 26

26+40
25
24+00 Struck edge of Lake.
23+20
22
21
20
19
18
17
16+50
15+94 Crossed Fence N-S. Left Spruce cedar swamp
14
13
12
11
10+00 entered Spruce-cedar swamp.
9+00
8+62 Telephone Line
8+24 Crossed Highway No. 6.
7+81 Chippewa National Forest Sign on Line
6
5
4
3+30
2
1
0+00 Started East from Section 33 3/4 T.140 R.26

N. 83½° W

Jan 24. 1938 -8-

Tuckey rod
Clouis-pickets
Plouis axe
Riley axe
Chilpha ch.
Woods ch. notes

Rice Lake

Low land Swamp

Sp-cedar

Highway No. 6

Meander bearing N 83½° E
from West Line

#4 Squared Birch Stake with sign

T.140 R.26

52+80	Camein Lake.	34/3 | 35/2			
51					
50					
49+50					
48					
47					
46					
45					
44					
43					
42+90					
41					
40					
39					
38					
37					
34+30					
35					
34					
33					
32					
31					
30					
29+70					
28					
27					

N 83½° E

Jan. 24 1938
Some party.

Rice Lake

Rice Lake

Rice Lake

Rice Lake

Meg. Bearing N 83½° E
Random line.

T.140 R.26

17+29 OFF SET 10' North to line No 2 Stake 35+65 FT.
16 ALSO Line RUNNing From East.
15
14
13
12
11
10
9+90
8
7
6
5
4
3+30
2
1
0+00 STARTED EAST FROM S.C. $\frac{34}{3}\frac{135}{2}$ IN LAKE T 140 R. 26

Survey

Jan. 24. 1938 -9-
Same party.

Rice Lake

Rice Lake

T. 140 R 26

26+40	
25	
24	
23+10	
22	
21	
20	
19	
18	
17	
16+50	
15+79	EDGE OF LAKE
14+48	FENCE WEST-NORTH
14+00	FENCE TURNS NORTH
13+00	BARN NORTH OF LINE
12	
11	
10	
9+20	
8	
7	
6	
5	
4	
3+30	
2	
1	
0+00	STARTED WEST FROM SE 27/26 T.140 R.26

Survey

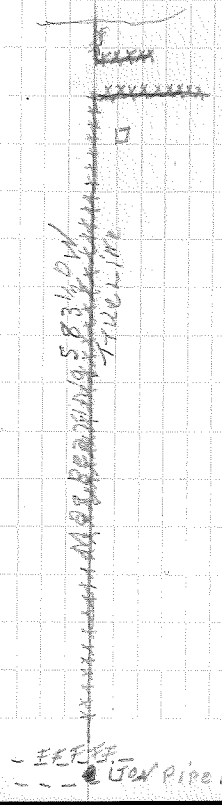
Jan 24. 1938 -10-

S 83½° W

Miller Top
Comstock axe-cut
Bain axe-cut
Thurman axe

Lake

Lake



T140 R.24

53+61.	FOUND OLD LINE North-South.
52	
51+00	ROAD RUNS NW-SE.
50	
49+50	
49	
47+00	LEFT LAKE
46	
45	
44	
43	
42+90	
41	
40	
39	
38	
37	
36+30	
35	
34	
33+00	STRUCK EDGE OF LAKE
32	
31	
30	
29+70	LEFT LAKE
28	
27	

T40-37

Survey

Jan 24. 1938

S 83½° W

Some party

" " Cor. post 12.1 Ft. South 15 W.

" " For sec cor. 28/27 / 33/34

4" Northwestern 41 L.of L

Scribed R.R.-27-33-34

Lake

Lake

N 10° E Bearing S 80½° W 6 Miles 41 Links

Aspen Birch

Aspen Birch

Lake

Lake

T. 140 R.
R. 27

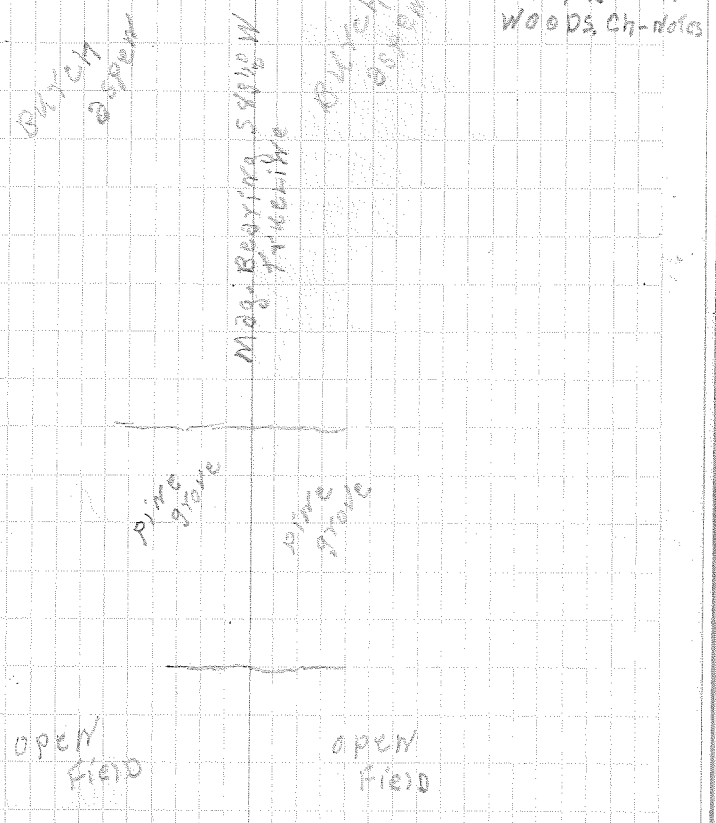
26+40	
26	
24	
23+10	
22	
21	
20	
19	
18	
17	
16+50	
15	
14	
13	
12	
11	
10+00	Left pinegrove.
9+00	
8	
7	
6	
5+20	entered pinegrove.
4	
3+30	
2	
1	
0+00	Started West From App. S.C. 32.26 / 9.35 T.140 R.27

Survey

Jan. 26 1938 -11-

S 83½° W

Tuckey-rod.
C. Lewis-pickets
P. Lewis- axe
Thurman-axe
Comstock-axe
Riley - axe
Bain - axe
Milley - axe
Chickpea - Ch
Woods, Ch-Notes



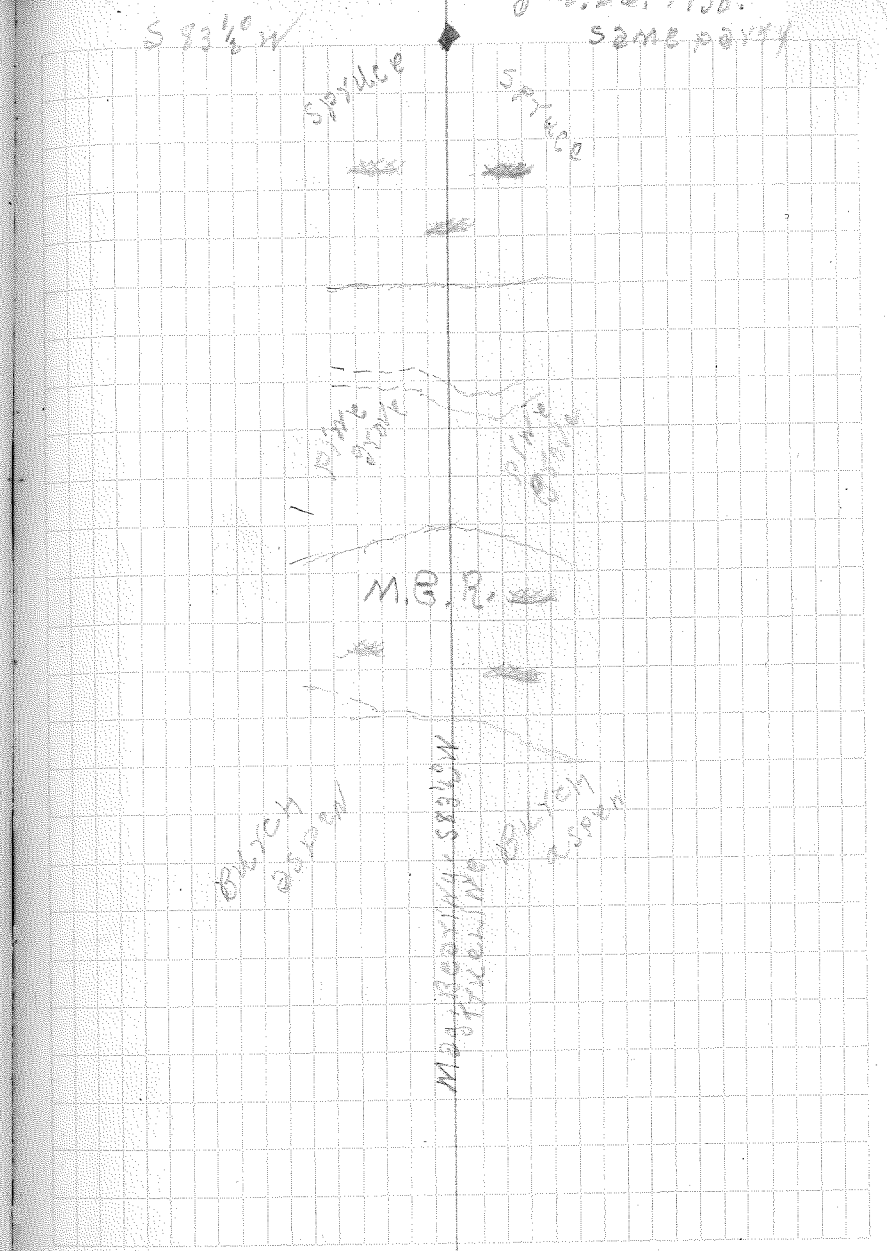
◇ 13" pine stump with nail 20' east of App Sec. Cor.

T.1N.O R.2.7

52+47	OFFSet Mgl North To 2" Sp. Spruce Stake
51	For Sec. Cor 28|27 Recd 27-28.
50	33|34
49	
48	
47+44	entered Spruce Swamp
46	
45	
44+00	Crossed Old Road Not passable by cars.
43	
42+90	Left M.B.R. Swamp, entered pine grove.
41	
40	
39	
38+52	entered M.B.R. Swamp.
37	
36+30	
35	
34	
33	
32	
31	
30	
29+70	
28	
27	

Survey

Jan. 26, 1938.



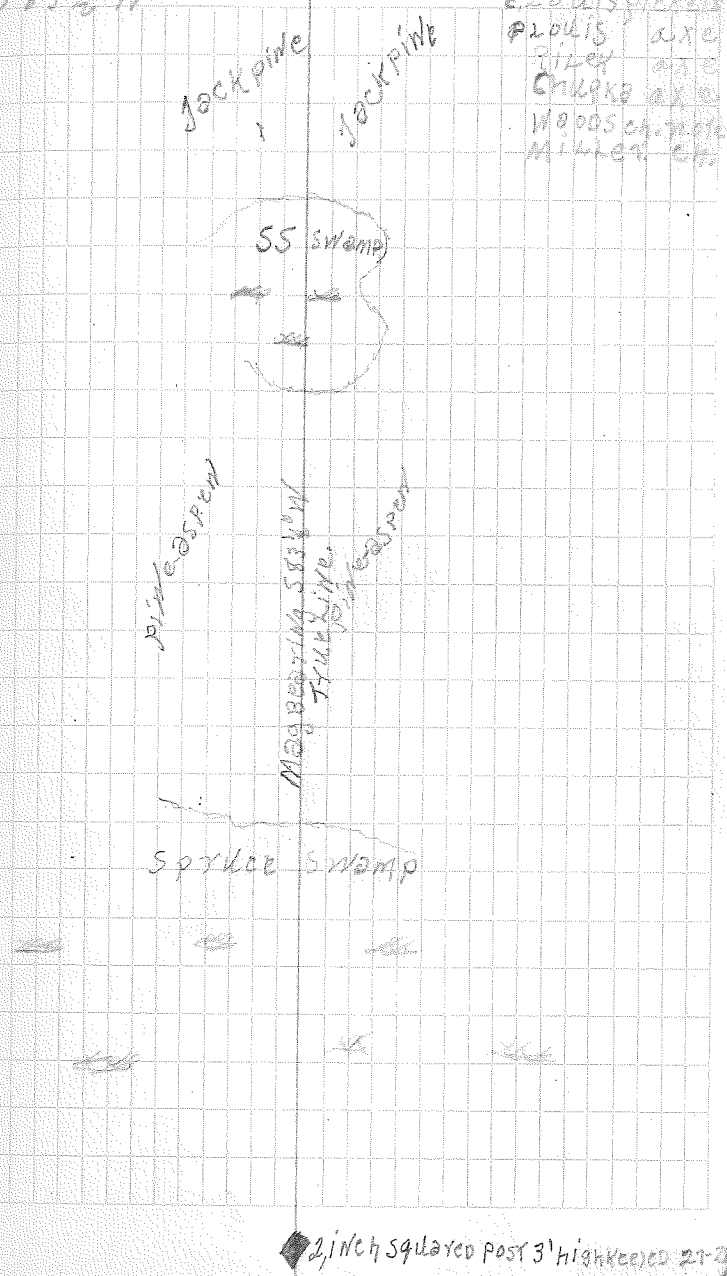
T 140 R 27.

26+40	
25	
24	
23+40	
22+00	Left S.S. swamp. entered jackpine
21	
20	
19	
18+52	entered S.S. swamp.
17	
16+50	
15	
14	
13	
12	
11	
10	
9+56	Left spruce swamp. entered pine & aspen
8	
7	
6	
5	
4	
3+30	
2	
1	
0+00	Started west from S.C. 21/27 / 33/34 T 140 R. 27

June 29, 1932

S 83½ W

E. Louis picked up
P. Louis axe
Oliver axe
Chuske axe
Woodsen Tape
Miller, ext.

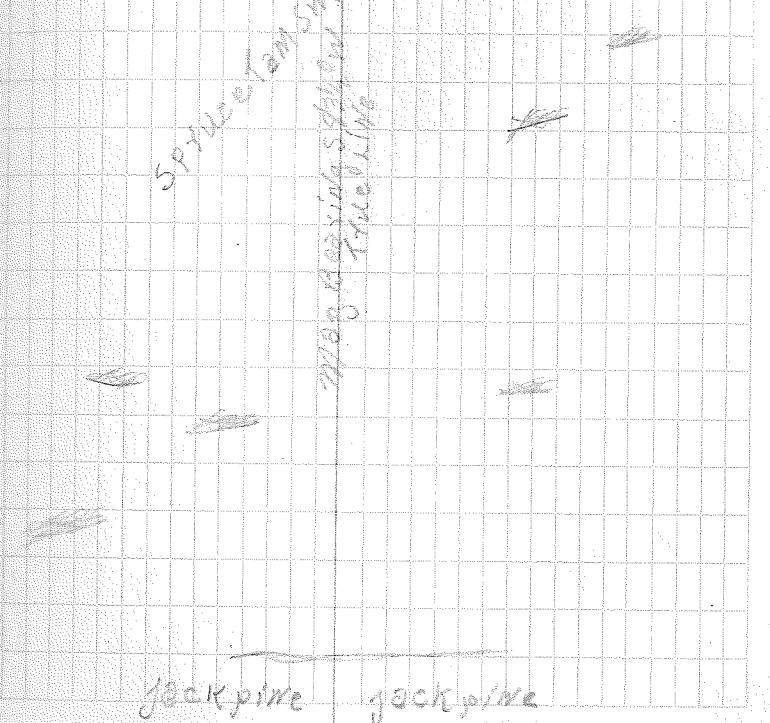


2 inch squared post 3' high keeled 27-28

Survey

Jan 28 1938

S 83½° W



40+00 quit for day Jan. 28 1938

39

38

37

36+30

35

34

33

32

31

30

29+70

28+41 entered spruce-tam. swamp.

27

T. 140 R. 27.

24+40		
25		
24		
23+10		
22		
21		
20		
19		
18		
17		
16+50		
15		
14		
13		
12		
11		
10		
9+90		
8		
7		
6		
5		
4		
3+30		
2		
1		
0+92	crossed	old grade N-S.
0+00	Station	east from S.C. 9 12 4 / 32 33 T. 140 R. 27

Should be N. of 31?
I think that was
his intention.
RAL
12-17-38

Survey

Jan 1, 1938. -13-

N 83½ E

C. L. Ouis pickets
R. Mouis axe
RILEY axe
Chapka axe
Miller Ch
Woods, chainmen.

Mag. Bearing N 83½ E
Timber Line.

Birch & Aspen

Birch & Aspen

2" I.P. 50 ft North of Line.

T.140 R.27

52+80 Set 3" pine stake Squared on one side
Keeled App. S.C. E.C.W
51
50
49+50
48
47
46
45
44
43
42+00
41
40
39
38
37
36+30
35
34+00 Entered Norway pine.
33
32
31+00 Started East From 30+00 Feb 2, 1938
30+00 Quit For Day Feb 1, 1938.
29+70
28
27

Survey

Feb 1, 1938
Feb 2 1938

N 83½° E

Tucker rod

Chas Ellis packer
Mad Ellis Sprig
Riley axe
Bert W axe
Shumate axe
Thayman axe
Compstock axe
Miller Ch
Woods. Ch. Notes

Norway pine

Mag. Bearing N 83½° E
Tucker line

Norway pine

Birch aspen

Birch aspen

T.140 R.27

11+68 OFFSET 20' NORTH TO TIE INTO M.O. 100
10 STAKED ROAD LINE RUNNING FROM WEST.
9+90
8
7+67 ENTERED SP. TAM. SWAMP.
6
5
4
3+30
2
1
0+00 STARTED EAST FROM S.C. ~~S 9 T 28~~ T 14 N R 27

Survey

Feb. 2, 1938 -14-
same party.

N 83½° E

Sp. Tam Swamp

Sp. Tam. Swamp.

Meas. Bearing Magnetic
Tangent

Survey

T. 140 N. R. 27 W. North between Sec. 21 and 22

Date: Feb. 9, 1939

Party: Morse
Michaelson
Bennis
Coolidge

Holster Lake

Ha
Hb
Bm

1H+10 Reach South Shore Holster Lake

Type: Bm
Ha 1' - 2"
Hb 0° - 1"

0400 Started N. from approx. sec. cor. (set 3" aspen squared) 21|22 / 28|27 on random E-W. Line.

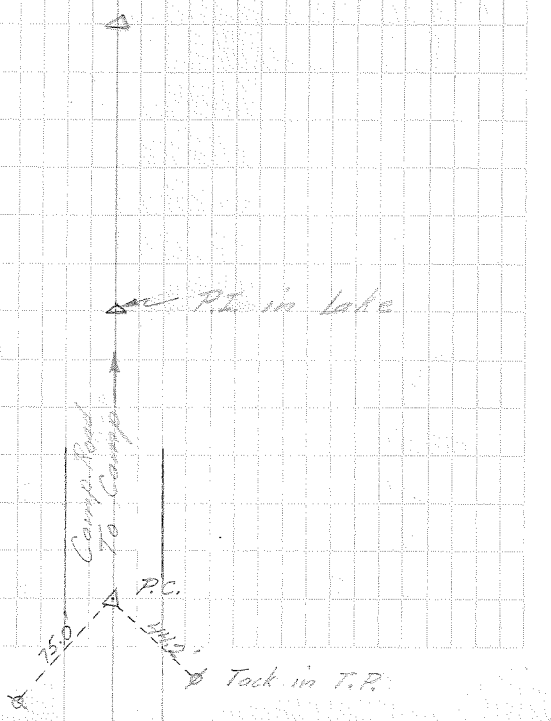
Random line run variation 6½° E.

Survey

Station	Point	Curve Description of Curve	Deflection Angle	
100				
+63.0	P.O.T.			
99				
98				
97				
96				
+56.14	P.T.		2° 49'	
95			2° 38.58'	
94			2° 23.58'	
93			2° 08.58'	
92		Δ = 5° 34'	1° 53.58'	
91		D = 0° 30' L	1° 38.58'	
90	90+00 V	R = 11460.0'	1° 23.58'	
89		T = 557.2	1° 08.58'	
88		L = 1113.34	0° 53.58'	
87			0° 38.58'	
86			0° 23.58'	
85			0° 08.58'	
84+42.8	P.C.		0° 00'	Beginning of Pro. 9 - Job 23

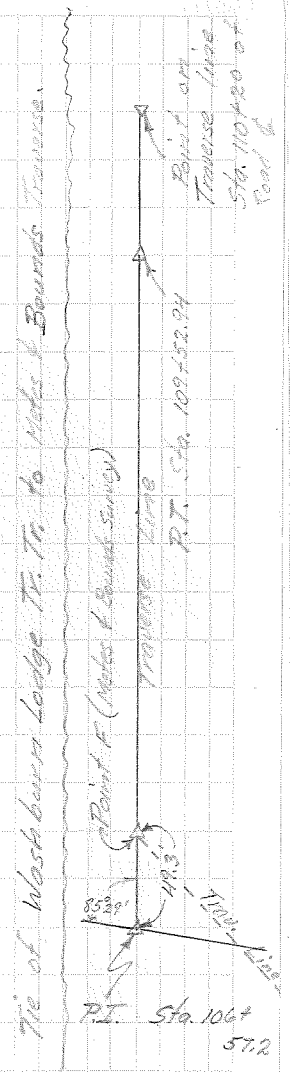
Date: June 6, 1939 Party: Ferguson T.
Dick L. Rod
Snyder R. Ch.
Riggs L. Ch.

Washburn Lodge Truck Trail
S-1/2 T139N R96W
Location Notes.
Proj. 9 Job-20



Pro. 9 - Job 23

Station	Point	Description of Curve	Deflection Angle
+20	P.O.T.		
110			
+52.94	P.T.		12° 44.5'
109			39° 49.8'
+50			37° 04.8'
108			34° 19.8'
+50			31° 34.8'
107			28° 49.8'
+50	106+57.2 V		26° 04.8'
106		Δ = 85° 29'	23° 19.8'
+50		D = 11° R	20° 34.8'
105		R = 520.9	17° 49.8'
+50		T = 481.38	15° 04.8'
104		L = 777.12	12° 19.8'
+50			9° 34.8'
103			6° 49.8'
+50			4° 04.8'
102			1° 19.8'
(+91.2	P.O.S.T.)		
+75.82	P.C.		0° 00'
101			



Stations	Point	Description of Curve	Deflection Angle		
+26.11	P.T.		15° 38'		
116		Δ=31° 16'	13° 32.7'		
+50		D=16° L	9° 32.7'		
115	115+30.9 V	R=358.1	5° 32.7'		
+50		T=100.21	1° 32.7'		
+30.69	P.C.	L=195.42	0° 00'		
114					
113					
112	P.O.T.				
+75	Beginning of Pro. 9 - Job 20				
111					

Pro. 9 - Job 20

Station	Point	Description Curve	Deflection Angle
+54.33	P.T.		13° 00'
118		Δ= 26°00'	9° 44.4'
+50		D= 12° R	6° 44.4'
117	117+47.9 V	R= 477.5'	3° 44.4'
+50		T= 110.24'	0° 44.4'
116+37.66	P.C.	L= 216.67'	0° 00'

Station	Point	Description of Curve	Deflection Angle
122			
+68.65	P.T.		15° 14.5'
121		Δ = 30°29'	11° 7.4'
+50		D = 12° R	5° 7.4'
120	120+44.73 V	R = 477.5'	5° 7.4'
+50		T = 130.11	2° 7.4'
+14.62	P.C.	L = 254.03'	0° 00'
119			

Station	Point	Description of Curve	Deflection Angle
+10.78	P.T.		29° 53'
126			28° 00.8'
+75		Δ = 59° 46'	23° 38.3'
+50		D = 35° R	19° 15.8'
+25	125+34.1 V	R = 163.7'	14° 53.3'
125		T = 94.08'	10° 30.8'
+75		L = 170.76'	6° 07.3'
+50			1° 44.8'
+40.02	P.C.		0° 00'
124			
123			

End of line. Proj. 9 - Job 20

Station	Point	Description of Curve	Deflection Angle

Date - Aug. 22, 1938 Party :- T. Ferguson Jr.
Wauchusett Lake To. Mass. S. Fitzsimmons
S-1/2 T132 R26 C. Olsen
Notes for connecting
curve between existing
road and new alignment
Proj. 9 Job 23

Station	B.S.	H.I.	F.S.	Elev.
+50	5.0	81.5	5.3	76.5
+25	5.3	81.8	5.6	76.5
	(4.8)		(4.9)	
1+00	4.8	82.1	5.9	77.3
+75	5.0	83.2	6.8	78.2
	(3.8)		(6.9)	
+50	5.2	85.0	5.6	79.8
0+25	4.2	85.4	7.0	81.2
	(2.0)		(7.8)	
0+00	4.8	88.2	7.8	83.4
	(2.7)		(6.8)	
T.P.	3.6	91.2	8.4	87.6
	(3.9)			
2+00 (3-7)	0.3	96.0		95.7

Base line No. 8

July 20, 1939 Party: Ferguson T.

Topography Sta 0 to 5+00 Erickson Bud

Base line No. 8 Latimer Co.

True bearing North Howe Co.

Mag. Declination 7°20' E

First 100 ft. point 4 feet E. of Sta. 2+00 of base line No. 7 Elevation 97.1 Sta 0+00 of base line No. 8 is 100 ft. North of Sta. 2+00 of base line No. 7.

71.6	76.1	77.3	74.5	74.8	68.9	67.5	64.1	60.2	72.9	
254	218	191	191	45	442	78	137	162	185	
				80.8	74.3	72.2				
				240	196	213				
82.1	76.1	72.1	74.9	74.6	72.6	72.6	70.8	74.1	84.6	
239	178	138	143	42	444	79	128	145	129	
				83.1	74.0	72.6				
				239	218	236				
78.6	76.8	74.4	73.3	72.6	67.0	64.9	62.1	70.6	80.8	
308	196	145	74	36	93	51	123	149	185	
					85.2	73.6	71.9			
					240	248	234			
78.2	76.8	75.4	72.7	69.5	69.1	68.1	65.6	72.1	90.3	
177	148	79	42	28	98	46	100	160	179	

Sta	S.S.	H.T.	F.S.	Elev.
	(5.7)		(5.1)	
+50	5.6	93.9	4.9	88.3
+25	5.3	92.3	4.0	87.0
	(7.3)		(4.0)	
4	5.7	91.0	4.3	85.3
+75	5.8	87.6	4.3	83.5
	(6.8)		(4.5)	
+50	5.4	85.1	4.4	82.7
+25	5.6	87.1	3.6	81.5
	(8.4)		(4.2)	
3	6.5	85.1	4.7	78.6
+75	6.2	83.3	5.2	77.1
	(6.3)		(5.0)	
+50	5.8	82.3	5.5	76.5
+25	6.2	82.0	5.4	75.8
	(6.2)		(6.5)	
2	6.0	81.2	6.3	75.2
1+75	5.4	81.5	5.4	76.1

				87.3	75.6	73.1			
				2.50	178	305			
89.3	88.6	88.7	89.3	89.6	88.5	88.0	87.0	86.3	79.7
267	138	102	67	46	317	66	112	137	126
			91.5	82.5	72.7				
			271	231	2.03				
93.8	92.4	92.6	86.0	85.8	86.7	90.8	86.8	78.0	74.6
241	140	125	50	40	40	100	139	167	174
			78.2	74.1					
			8.50	2.45					
82.1	82.8	82.8	77.0	76.5	84.5	73.2	82.3		
200	30	130	47	37	144	100	149		
			74.2	74.0	73.8				
			8.50	8.45	2.40				
77.3	78.0	72.6	74.1	76.0	84.6	82.6	80.0	72.5	73.8
126	30	107	47	37	50	140	44	141	176
			75.3	75.8	75.8	72.1			
			8.50	8.45	8.45	1.90			
75.2	75.8	75.2	75.1	75.4	83.1	80.2	74.3	75.2	74.0
128	30	90	68	31	40	90	118	145	148
				74.3	71.9				
				8.43	153				
74.7	74.9	74.8	74.5	74.0	82.9	78.6	81.9	82.7	73.5
229	140	140	100	78	171	70	124	169	177

Sta.	B.S. (+)	H.I.	F.S. (−)	Elev.
	(3.7)		(7.0)	
+50	3.8	88.9	5.9	85.1
+25	4.2	91.0	5.6	86.8
	(4.5)		(6.5)	
7	4.8	92.4	5.7	87.6
+75	4.7	93.3	6.1	88.6
	(3.7)		(7.0)	
+50	4.3	94.7	6.5	90.4
+25	4.8	96.9	5.2	92.1
	(5.3)		(5.0)	
6	5.3	97.3	5.2	92.0
+75	5.0	97.2	5.8	91.3
	(3.5)		(3.5)	
+50	3.7	97.1	4.0	93.4
+25	5.7	97.4	4.8	91.7
	(6.9)		(3.7)	
5	6.5	96.5	3.9	90.0
+75	5.4	93.9	5.4	88.5

Sta.	+ B.S.	H.I.	− F.S.	Elev.
Lake			8.2	73.4
T.P.	0.9	81.6	3.0	80.7
T.P.	4.6	83.7	7.9	79.1
			(5.8)	
+73	4.1	87.0	5.2	82.9
	(5.4)		(4.7)	
+50	4.9	88.1	4.8	83.2
+25	5.6	88.0	5.4	82.4
	(5.4)		(5.8)	
8	5.1	87.8	5.6	82.7
+75	5.2	88.3	5.8	83.1

		73.8 / 161				
	80.4 / 45	79.4 / 56	80.4 / 100	81.5 / 117	75.6 / 140	77.3 / 152

		76.0 / 144	77.4 / 160	74.2 / 170		
81.6 / 100	82.7 / 40	80.7 / 29	78.9 / 51	78.2 / 110	80.3 / 118	79.8 / 127

Sta.	B.S.	H.I.	F.S.	Elev.
0+25 (B.M.)	5.5	91.2		85.5
T.P.	3.3	90.0	7.6	86.7
T.P.	3.5	87.2	6.3	83.7
T.P.	5.1	85.5	6.8	80.4
T.P.	7.0	87.5	5.0	80.5
T.P.	0.4	82.5	5.4	82.1
T.P.	2.7	76.5	8.7	73.8
0+00 (B.M.)			9.8	66.7

Date - Aug. 3, 1938 Party - Ferguson

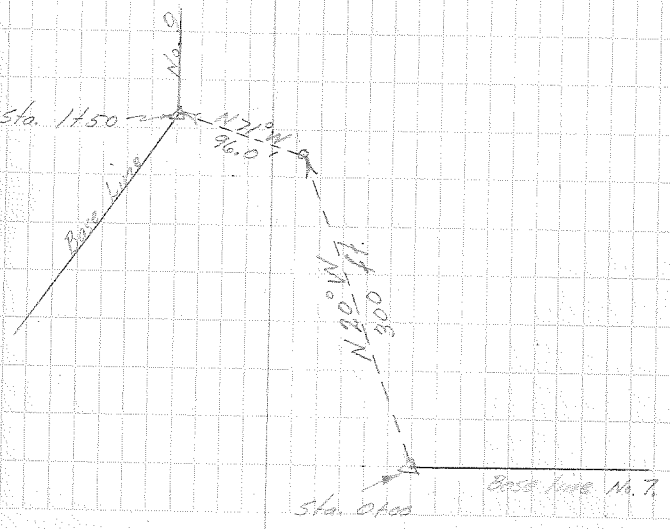
Edelman Rod

Wyanet Ch.

Anderson Ch.

Notes showing projection of
leads from Sta. 0+25 of Base line No. 7
to sta. 0+00 of base line No. 9
Elevation of sta. 0+25 Base line #7 = 85.5'
" " 0+00 " " #9 = 66.7'

Sketch showing tie of Base line No. 9 to
Base line No. 7. Mag. Decl. 7° E



Sta	BS	FS	IS	Elev.	
150			4.6	67.7	
3	4.7	72.3	4.6	67.6	
450	4.7	72.3	4.0	67.5	
0	5.1	72.4	4.9	67.3	
450	4.3	72.2	4.2	67.9	
1	4.7	72.1	4.7	67.4	
450	5.2	72.1	5.3	66.9	
0+00	5.5	72.2		66.7	Water Level Base Line

Date - Aug. 3 1938 Party - Ferguson ⁊

Base line No. 2 Fidelman Rod

Topography notes from Nyerges Cl.

base line No 2 which Anderson Cl.

runs N 24° E from sta.

0+00 150 ft. to sta 1+50, Mag. Decl. 7° E

thence N 3° 30' E 200 ft.

to sta. 3+50

First backsight taken on sta 0+25 of base line No. 7 - Elevation 35.8 - Sta. 0+00 of base line No. 9 is tied to sta. 0+00 of base line No. 7 as shown on preceding page

Lake 9' — 3+50 → 28.0/55 — 27.8/57

Lake 11' — 29.8/48 — 27.6/57 — 27.3/74

Lake 4' — 24.2/40 — 28.4/23

Lake 7' — 21.4/68

Lake 12' — 1+50 → 29.1/78

Lake 14' — 29.4/50 — 25.7/104

Lake 3' — 27.8/40 — 28.2/19 — 27.4/138

Lake 0' — 24.7/57 — 23.2/78 — 21.7/146 — 20.5/174

0+00

Notes for Subdivision
of Sec. 16 T139 R26

March 3, 1938

Party:- Ferguson
Peace
Riley
Huckleberry
Strong

North on a variation
between secs. 15 & 16
T139 R26 starting at
cor. to secs. 15-16-21-22
Cor. in center of road
Mag. Bear. N 7° W.

App. sec. cor.

11 Spruce
11 & Tamarack
11

----o---- Road

Yellow tag on Nor. pine.
4" sq. oak post (App. cor.)

52+85 Cor. to secs. 9-10-15-16

48+29 Leave bog (spruce & tam.)

47+00 Enter spruce & tamarack bog

39+60 Set temp. 1/16 cor. N 1/16 S-15 / S-16

26+40 Set temp 1/16 cor. S-15 / S-16

13+20 Set temp. 1/16 cor. S 1/16 S-15 / S-16

0+00 Cor. to secs. 15-16-21-22. Center of road

March 4, 1938.

Party:- Ferguson
Pease
Riley
Strong
Hackleman
Assisted by E. Wilson
in R.M.

West on a random
between secs. 9 & 16
starting at App. cor.
to secs. 9-10-15-16
T. 139 R. 26
Mag. Bear. S 83° 30' W

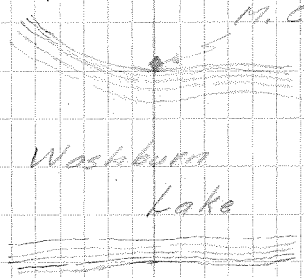
Washburn Lake
on west side of east part of

34+11.2 Offset 13.8 ft. So. to M.C. (I.P.)

east part of Washburn Lake.

15+06 Old shore on east side of

0+00 App. cor. to secs. 9-10-15-16



App. Sec. Cor.

March 16, 1938 Party :- Ferguson
Price
West on a random between Strong
secs. 16-21 starting at Riley
cor to secs. 15-16-21-22
Cor. in center of road
Mag. Bear. S 83°15' W

30+24.2 $\frac{1}{4}$ cor. to secs. $\frac{16}{21}$ (No offset)

13+20 set temp $\frac{1}{16}$ cor $E\frac{1}{16}S\frac{16}{21}$
12+00 Angle in road.

0+00 Cor. to secs. 15-16-21-22

$\frac{1}{4}$ cor. 16-21

sec. cor. 15-16-21-22

March 10, 1938

Party :- Ferguson
Reece
Strang
Riley

West on a random
between secs. 16-31

starting at ¼ cor.
sec. 16/21
Mag. Bear. 5 W

Open ¼ sec. cor. 16/21

I. R. ◆ ¼ Cor. 16/21

Mar. 29, 1935 Party: Ferguson II

No. on a random bet. Woods

secs. 28-29 starting Olson

from cor. to secs 28- Hamby

29-32-33 Var. 6½° E

to secs. 4-5-8-9

21+04.0 Offset 171.5 ft. west to cor

~~[illegible]~~

54+31 Leave sup. NE & SW.

53+17 Enter sup. Mtr. E & W

0+00 Cor to secs 28-29-32-33 I.P.

I.P. Cor. to secs. 28-29-32-33

Sta.	B.S.	H.I.	F.S.	Elev.	
6+75 (B.S.)	4.8	109.8		105.0	
T.P.	5.6	112.6	2.8	107.0	
T.P.	5.0	114.0	3.6	109.0	
112+00	5.2	113.3	5.9	108.1	
+50	1.7	106.9	8.1	105.2	
113	4.4	102.7	8.6	98.3	
+50	5.0	102.3	5.4	97.3	
114	2.7	97.7	7.3	95.0	
+50	5.3	95.3	7.7	90.0	P.O.S.T.
115 = 0+00 B.7	3.1	93.1	5.3	90.0	P.O.S.T.
+25	3.5	89.3	7.3	85.8	1.5
+50	5.1	88.1	6.3	83.0	1.2
+75	6.6	91.4	3.3	84.8	1.3
1+00	7.7	95.1	4.0	87.4	1.5
+25	6.3	99.2	2.2	92.9	1.4
+50	3.8	96.8	6.2	93.0	1.6

Base line No. 7

June 22, 1938 Party: Ferguson A.

Topography from base line No. 7. True Bearing S 88°30' E Mag. Variation 7°00' E

Dick Rod
Riggs Ch.
E. Johnson Sta.

First backsight taken on sta. 6+75 of base line number 5 Elevation 105.0 Sta. 0+00 of base line No. 7 is at sta. 115+00 (P.O.S.T.) on ℄ of Washburn Lodge road. Stations 112 to 115 are on Washburn Lodge road ℄

70.2
68

Bog 76.5 (100) 73.8 (74) 84.0 (26) 84.8 (23) 87.1 (49) 92.9 (87)

Bog 77.1 (69) 81.6 (28) 85.8 (32) 89.5 (61) 95.1 (100)

Bog 75.3 (81) 79.1 (33) 94.5 (49) 99.0 (79) 100.7 (100)

Bog 74.4 (88) 83.4 (35) 96.4 (52) 102.2 (69) 101.7 (97)

Bog 74.4 (101) 89.3 (73) 84.7 (49) 89.0 (26) 98.6 (34) 100.0 (76) 98.9 (100)

Bog 75.1 (100) 79.9 (82) 87.8 (42) 97.6 (58) 95.8 (100)

Sta	B.S.+	H.I.	F.S.-	Elev.	
+75	6.3	98.1	5.0	91.8	1.4
2+00	6.3	102.0	2.4	95.7	1.4
+25	4.0	101.0	5.0	97.0	1.4
+50	3.9	97.9	7.0	94.0	1.4
+75	4.6	96.5	6.0	91.9	1.5
3+00	4.7	95.1	6.1	90.4	1.7
+25	4.4	93.8	5.7	89.4	1.6
+50	4.8	93.7	4.9	88.9	1.8
+75	5.0	94.0	4.7	89.0	2.1
4+00	2.1	90.4	5.7	88.3	2.0
+25	0.5	82.8	8.1	82.3	2.2
+50	4.9	78.0	9.7	73.1	2.3
4+68			6.5	71.5	Lake Level

89.5 / 90 | 87.0 / 54 | 96.7 / 53 | 03.0 / 100

89.8 / 100 | 85.5 / 75 | 88.6 / 30 | 96.2 / 58 | 03.0 / 100

81.2 / 96 | 82.0 / 43 | 04.8 / 47 | 02.6 / 100

84.1 / 94 | 88.0 / 38 | 93.6 / 48 | 00.0 / 95

83.7 / 91 | 00.0 / 31 | 00.2 / 73 | 02.2 / 100

85.3 / 98 | 89.4 / 46 | 88.2 / 40 | 01.1 / 97

88.6 / 100 | 88.7 / 62 | 88.6 / 60 | 89.0 / 100

86.3 / 110 | 89.2 / 46 | 88.0 / 57 | 89.2 / 100 | 85.7 / 152 | Rig

89.8 / 100 | 90.1 / 58 | 88.0 / 40 | 85.0 / 50 | 86.1 / 125 | Rig

83.0 / 110 | 85.1 / 54 | 85.7 / 45 | 86.0 / 100

75.7 / 100 | 72.6 / 53 | 86.4 / 60 | 85.3 / 100

Lake | 71.0 / 41 | 70.4 / 43 | 83.7 / 140

Sta	BS	H.I.	FS.	Elev.
6+75 B.S.	5.2	110.2		105.0
T.P.	7.0	113.7	3.5	106.7
T.P.	5.5	115.7	3.5	110.2
T.P.	4.7	116.0	4.4	111.3
T.P.	6.2	117.5	4.7	111.3
0+00	5.4	117.9	5.0	112.5
+25	4.5	117.5	4.9	113.0
+50	5.4	116.9	6.0	111.5
+75	5.5	116.8	5.6	111.3
1+00	5.3	117.0	5.1	111.7
+25	5.1	117.2	4.9	112.1

Base line No. 6

Date 12/1/25 Party: Ferguson

Topography from base line No. 6. Tree bearing west Mag. Var. 7°E

Dirk Rod
Riggs Ch.
E. Johnson Co.

Sta. 0+00 of base line No. 6 is at sta. 110+44.2 on ℄ of Bear Lake Meadows Tr. Tr. First backsight taken on sta 6+75 of base line No. 5 Elevation 105.0

			102.1 / 60	113.3 / 50	110.0 / 66	110.4 / 116
		95.0 / 78	102.6 / 60	114.3 / 31	107.6 / 62	110.4 / 114
97.5 / 132	98.3 / 114	95.5 / 100	100.2 / 71	105.9 / 40	110.7 / 56	111.4 / 116
		102.4 / 124	101.6 / 80	111.7 / 39	113.1 / 63	112.2 / 114
		106.5 / 111	102.0 / 78	113.8 / 45	112.9 / 58	113.0 / 117

Sta	BS	H.I.	F.S.	Elev.
1+50	5.2	117.7	4.7	112.5
+75	4.8	117.9	4.6	113.1
2+00	5.3	118.0	5.2	112.7
2+25	8.2	121.6	4.6	113.4
2+50			0.6	121.0

114.9 / 79 — 116.3 / 57 — 113.2 / 50 — 113.3 / 82 — 111.8 / 113

118.3 / 75 — 114.3 / 38 — 113.1 / 55 — 112.7 / 84 — 110.4 / 112

126.6 / 81 — 132.4 / 64 — 114.4 / 39 — 118.3 / 37 — 113.2 / 69 — 116.3 / 83 — 108.1 / 111

136.9 / 87 — 121.9 / 67 — 116.1 / 47 — 111.5 / 49 — 107.2 / 110

124.8 / 100 — 119.9 / 70 — 122.1 / 36 — 118.0 / 40 — 106.6 / 101

Date:- June 8, 1938
Profile levels for Bear Lake
Profile Levels Tr Tr

Party:- Ferguson, H.
Dick Reid
Snyder Co.
Riggs Co.

Spike in 8" W. Oak 49.0 ft. N.E. of Sta. 84+42.80 P.C.

Sta	+ B.S.	H.I.	- F.S.	Elev.	
B.M.	1.7	101.7		100.0	
84+42.8	4.7	101.5	4.9	96.8	P.C.
85	4.0	99.5	6.0	95.5	
+50	4.5	97.8	6.2	93.3	
86	5.0	97.3	5.5	92.3	
+50	5.1	97.1	5.3	92.0	
87	5.2	97.0	5.3	91.8	
+50	5.0	96.6	5.4	91.6	
88	5.1	96.3	5.4	91.2	
+50	5.2	96.1	5.4	90.9	
89	5.4	95.9	5.6	90.5	
+50	5.0	95.3	5.6	90.3	
90	5.6	95.5	5.4	89.9	
+50	5.7	95.6	5.6	89.9	
91	5.9	95.9	5.6	90.0	
+50	5.4	96.2	5.1	90.8	
92	5.7	96.6	5.3	90.9	
+50	5.4	96.2	5.8	90.8	
93	5.1	96.2	5.1	91.1	
+50			6.1	90.1	
94			6.1	90.1	
+50	5.5	95.6	6.1	90.1	
95	5.5	96.1	5.0	90.6	
+56.14	4.5	95.4	5.2	90.9	P.T.

Sta	+ B.S.	H.I.	− F.S.	Elev.
96	6.6	97.7	4.3	91.1
+50	3.7	98.4	3.0	94.7
97	5.8	98.4	5.8	92.6
+50	6.1	98.1	6.4	92.0
98	8.2	100.6	5.7	92.4
43.5	11.8	105.6	6.8	93.8
99	8.0	112.7	0.9	104.7
+25	14.4	119.7	4.4	105.3
+63	4.2	123.7	1.3	119.4
100	4.7	121.1	6.3	116.4
+50	5.1	119.8	6.4	114.7
101	4.2	117.6	6.4	113.4
+50	6.0	116.5	7.1	110.5
102	2.5	111.1	7.9	108.6
+50	2.8	101.9	12.6	99.1
103	4.8	99.6	7.1	94.8
+50	7.6	101.5	5.7	93.9
104	9.2	106.8	3.9	97.6
+50	9.0	114.7	1.1	105.7
			1.2	113.5

Sta.	+ B.S.	H.I.	− F.S.	Elev.
0+00 B-5	(8.1)			
=2+50 B-4	8.1	86.2		78.1
+05			(7.8)	78.4
	(8.0)		(1.1)	
+35	8.7	93.2	1.7	84.5
	(7.6)		(1.5)	
+50	5.7	100.1	1.8	91.4
	(7.4)		(1.9)	
+75	7.2	106.2	1.1	99.0
	(4.5)		(3.6)	
1+00	7.2	107.3	3.1	103.1
+25	(5.2) 5.7	105.5	(5.2) 5.5	101.8
	(3.3)		(7.0)	
+50	3.3	101.8	7.0	98.5
	(5.3)		(5.3)	
+75	5.8	102.1	5.5	96.3

Base line No. 5

72.1	25.7	70.4	27.1	18.5
228	109	109	104	57
70.8	29.0	73.5	91.2	54.6
219	150	93	99	53
72.0	23	81.1	83.8	59.1
219	161	132	98	55
				76.3
				234
70.4	81.1	83.1	83.4	74.1
221	175	133	85	46
77.8		85.5	90.4	96.0
195		128.	74	57
				84.8
				208
83.3	83.9	85.8	90.1	75.3
199	161	135	88	47
82.5	85.3	89.4	92.4	76.0
178	160	114	74	38
	85.3	88.3	89.9	95.6
	165	133	95	44

Sta.	R.S.	H.I.	F.S.	Elev.
2+00	(5.0) 4.9	101.7	(5.3) 5.2	96.8
+25	(4.6) 4.5	100.7	(5.6) 5.6	96.2
+50	(2.1) 2.9	97.9	(5.7) 5.7	95.0
+75	(3.6) 3.7	93.0	(7.9) 8.6	89.3
3+00	(6.0) 6.1	93.1	(5.7) 6.0	87.0
+25	(7.1) 6.2	94.7	(4.3) 4.6	88.5
+50	(5.3) 5.7	97.3	(7.0) 3.1	91.6
+75	(5.3) 5.3	97.1	(5.1) 5.15	91.8

97.6 / 160	95.1 / 123	94.9 / 83	93.9 / 59	96.5 / 32
				95.8 / 197
90.7 / 189	89.7 / 127	93.2 / 91	94.3 / 63	97.6 / 34
	90.7 / 184	91.3 / 113	89.8 / 79	91.6 / 35
91.4 / 186	92.0 / 150	89.6 / 114	85.4 / 77	85.7 / 36
91.3 / 151	93.0 / 132	85.3 / 96	84.0 / 72	85.4 / 34
				89.6 / 178
		88.5 / 177	84.7 / 118	84.2 / 59
	86.7 / 172	84.8 / 125	84.8 / 63	87.6 / 36
	84.7 / 169	85.8 / 120	84.7 / 77	87.6 / 40

Sta	T S.S.	H.I.	F.S	Elev.
4+00	(5.4) 5.5	97.5	(5.1) 5.1	92.0
+25	(5.6) 5.6	99.2	(3.7) 3.7	95.6
+50	(6.0) 6.1	99.7	(5.2) 5.2	93.6
+75	(6.4) 6.0	101.2	(4.7) 4.5	95.2
5+00	(6.0) 6.0	101.2	(6.2) 6.0	95.2
+25	(6.7) 6.3	103.1	(4.5) 4.4	96.8
+50	(6.7) 6.7	105.3	(4.5) 4.5	98.6
+75	(6.5) 6.5	107.7	(3.5) 4.1	101.2

	87.7 / 165	84.6 / 91	90.7 / 41
	89.6 / 162	89.5 / 100	91.1 / 49
	92.6 / 162	96.1 / 99	96.2 / 42
	97.5 / 163	98.1 / 123	97.8 / 57
	101.9 / 158	101.6 / 121	98.0 / 54
	108.4 / 160	107.1 / 111	102.5 / 56
		111.4 / 153	107.4 / 80
	111.9 / 158	110.3 / 102	105.7 / 40

Sta	B.S.	H.I.	F.S.	Elev.
6+00	(6.1) 6.7	110.1	(4.3) 4.3	103.4
+25	(5.9) 5.6	110.4	(5.4) 5.3	104.5
+50	(6.1) 6.1	111.7	(5.0) 4.8	105.6
+75	4.5	109.5	(6.8) 6.7	105.0
+92			6.0	103.5

111.6 / 154 | 110.1 / 117 | 108.5 / 60

111.0 / 149 | 109.8 / 125 | 109.2 / 64

110.7 / 146 | 110.4 / 134 | 108.3 / 64

110.9 / 145 | 109.4 / 67

5 | 111.0 / 146 | 109.1 / 57 | 96.8 / 82

Sta	+ B.S.	H.I.	− F.S.	Elev.
B.M.	4.2	104.2		100.0
T.P.	5.0	104.1	5.1	99.1
T.P.	4.8	104.7	4.2	99.9
T.P.	4.9	103.8	5.8	98.9
T.P.	4.1	98.2	9.7	94.1
T.P.	5.9	98.4	5.7	92.5
T.P.	4.3	97.4	5.3	93.1
T.P.	4.8	96.1	6.1	91.3
0+00			5.4	90.7
0+25	5.7	97.0	4.8	91.3
0+50	5.3	97.8	4.5	92.5
0+75	4.9	98.2	4.5	93.3

Base line No. 1
Cross sections for extend Camp Area.

West half of section of concrete step on Repair Step Located this area

Sta.	B.S.	H.I.	F.S.	Elev.	
1+00	5.8	99.2	4.8	93.4	
1+25	4.5	98.4	5.3	93.9	
1+50	6.3	99.1	5.6	92.8	
1+75	6.2	99.2	6.1	93.0	
2+00	4.6	98.0	5.8	93.4	
2+25	5.9	98.2	5.7	92.3	
2+50	5.8	99.2	4.6	93.4	101.7 8 11 10.17 134 11 4.81
2+75	6.3	101.2	4.3	94.9	

Sta.	B.S.	H.I.	F.S.	Elev.	
3+00	6.3	104.1	3.4	97.8	
3+25	5.4	104.8	4.6	99.5	
3+50	5.2	105.1	5.0	99.9	
3+75	5.2	105.1	5.2	99.9	
4+00	5.2	105.3	5.0	100.1	Top of rod - center 104.4
4+25	5.2	105.3	5.2	100.1	
4+50	5.3	105.5	5.1	100.2	
4+75	5.1	105.2	5.4	100.1	

99.8 99.4 96.5 100.3 99.6
99.5 100.0 99.2 100.0 101.2
210 174 135 75 36
99.1
112
246
237

96.8 95.7 97.0 99.2 98.9
54 58 62 97 164
96.6 85.9
178 193

91.5 98.1 98.7 101.9 101.3 98.0 98.1 99.0 91.3 86.3
224 170 134 93 45 59 100 172 188 198
89.3
252

94.8 99.3 104.9 102.7 100.7
168 148 87 49 38
20.9 91.2
259 218

99.7 104.9 106.1 104.2 100.9 99.2 98.2 99.6 98.6 99.1
153 100 76 50 43 49 69 86 109 125
90.8 95.5 98.5 98.3
246 189 140 148

111.4 104.3 103.1 101.5 100.6 99.2 99.5 99.1 100 98.8
57 64 57 43 27 34 52 69 58 110
99.7 100.1 104.2 106.7 99.2 98.9 99.3 89.6
178 191 113 96 128 139 194 210
91.3
242

99.5 103.3 106.6 103.4 100.5 99.2 99.7 99.3 100.1 99.0
140 107 85 56 48 35 51 70 92 111
95.2 96.7 99.4 99.7 99.2 91.5
222 181 127 141 200 217

96.2 95.0 100.0 105.2 100.6
173 107 110 64 49
98.6
227

93.8 98.3 104.1 102.0 99.9
155 104 63 55 47
94.5 92.3 97.1
217 226 206

Sta	BS	H.I.	F.S.	Elev.
5+00	5.0	104.9	5.3	99.9
1+25	5.1	105.0	5.0	99.9
1+50	5.1	104.7	5.4	99.6
1+75	5.2	104.5	5.4	99.3
6+00	0.8	100.1	5.2	99.3
1+25	3.8	92.1	11.8	88.3
1+50			6.4	85.7

Sta	B.S.	H.I.	F.S.	Elev.	
5+50 B-1 = 5+50 B-2	5.1	104.7		99.6	Cor. of base lines.
5+25	5.0	104.4	5.3	99.4	
6+00	5.0	103.9	5.5	98.9	
+25	5.2	103.7	5.4	98.5	
+50	4.9	103.4	5.2	98.5	
+75	5.0	103.1	5.3	98.1	
7+00	4.9	102.5	5.5	97.6	
+25	4.7	101.6	5.4	96.9	

Base line No. 2

84.9 / 119	85.5 / 92	91.0 / 97	93.4 / 97	99.5 / 38	99.6 / 39	99.7 / 61
			1.0	95.3 / 197		
1.0	95.3 / 130	85.3 / 139	88.1 / 78	98.7 / 54	99.2 / 31	
1.0	85.9 / 127	88.4 / 86	92.5 / 62		99.3 / 42	99.0 / 48
	84.4 / 98	90.3 / 97	96.1 / 74		99.7 / 57	
87.3 / 101	84.7 / 97	85.7 / 59	94.8 / 55	96.3 / 47		
	79.8 / 208	89.0 / 195	86.7 / 170	82.3 / 132		
					99.0 / 32	99.2 / 74
98.1 / 143	90.3 / 102	90.5 / 76	91.3 / 69	94.7 / 61	98.8 / 49	99.3 / 88
78.7 / 247	80.7 / 219	81.4 / 178	88.0 / 168	86.3 / 145		
		71.7 / 242	72.3 / 288	71.6 / 283		

Sta	B.S.	H.I.	F.S.	Elev.	
7+50	4.7	100.5	5.5	96.1	
+75	4.3	99.4	5.7	95.1	NE Cur Off 98.5
8+00	5.5	97.1	7.8	91.6	NE Cur Off 94.8
+25	5.0	96.5	5.6	91.5	
+60			10.2	86.3	

21.2 / 121	58.0 / 112	88.7 / 85	92.4 / 72	94.1 / 64	96.5 / 40	97.9 / 60
	71.2 / 300	71.9 / 272	73.2 / 252	79.8 / 22.7		
					94.0 / 9.0	93.8 / 40
73.8 / 234	80.2 / 208	82.3 / 149	88.7 / 79	90.2 / 45 / 22.1 / 282	92.5 / 48	91.1 / 90
72.2 / 268	73.2 / 227	80.4 / 194	82.9 / 121	88.7 / 57	92.0 / 54	89.2 / 49
72.1 / 274	73.5 / 216	80.4 / 156	86.2 / 116	85.3 / 49		

Sta	$\bar{B}$	$\bar{E}$	$\bar{F}$	Elev.
0+00 B-3 0+00 B-1	5.2	95.9		90.7
0+25	5.7	95.9	5.7	90.2
0+50	5.1	96.6	4.4	91.5
0+75	5.6	96.4	5.8	90.8
1+00	5.3	95.9	5.8	90.6
1+25	5.6	96.2	5.3	90.6
1+50	6.0	97.2	5.0	91.2
1+75	6.1	98.5	4.8	92.4

Base line No. 3

104.1 181	103.4 148	109.0 100	98.4 70	96.7 22	89.0 25	85.2 34	87.0 64
105.1 168	111.4 161	107.1 120	97.7 72	92.3 31	82.2 32	80.4 64	
104.6 208	105.5 170	101.9 128	96.6 87	94.9 39 94.7 244	86.8 33	78.4 66	
102.0 224	97.0 147	96.9 109	94.4 81 95.6 244	92.0 43 100.6 229	84.5 38	73.4 59	
97.3 189	94.6 150	94.2 119	90.8 74 90.6 266	87.0 38 92.7 236	85.3 32	77.6 63	75.5 102
100.1 237	90.8 191	90.5 125	92.3 72	93.6 38 94.4 267	84.4 40	77.2 74	75.8 113 76.9 164
99.1 202	99.5 170	98.8 118 99.0 278	94.2 71 99.4 243	94.6 39 92.8 239	85.1 43	77.4 77	75.2 20.9 128.4 16.4

Sta.	+ B.S.	H.I.	− F.S.	Elev.
02+00			5.5	93.0

246	245	23.6	94.0	95.7	86.6	77.0	75.5	70.9
239	230	149	107	54	54	92	120	169
		244	95.0	92.9				
		291	279	247				

Sta.	B.S.	H.I.	F.S.	Elev.
0+00 B-4 = 0+00 B-1	5.6	96.3		90.7
+25	6.9	97.1	6.1	90.2
+50	4.9	96.9	5.1	92.0
+75	5.6	92.2	10.3	86.6
1+00	5.0	89.2	8.0	84.2
+25	3.9	86.1	7.0	82.2
+50	4.7	84.5	6.3	79.8
+75	4.6	83.6	5.5	79.0

Base line No. 4

75.4 / 50 | 75.5 / 58 | 77.1 / 35

74.8 / 96 | 72.3 / 69 | 75.4 / 57 | 77.1 / 24 | 86.0 / 15 | 96.3 / 17

79.8 / 96 | 75.1 / 38 | 77.3 / 11 | 82.5 / 10 | 87.3 / 14

77.1 / 127 | 74.4 / 87 | 74.6 / 39 | 77.3 / 10 | 80 / 5 | 79.8 / 5 | 83.1 / 8

70.4 / 111 | 74.9 / 51 | 75.2 / 26 | 78.4 / 10 | 81.5 / 5

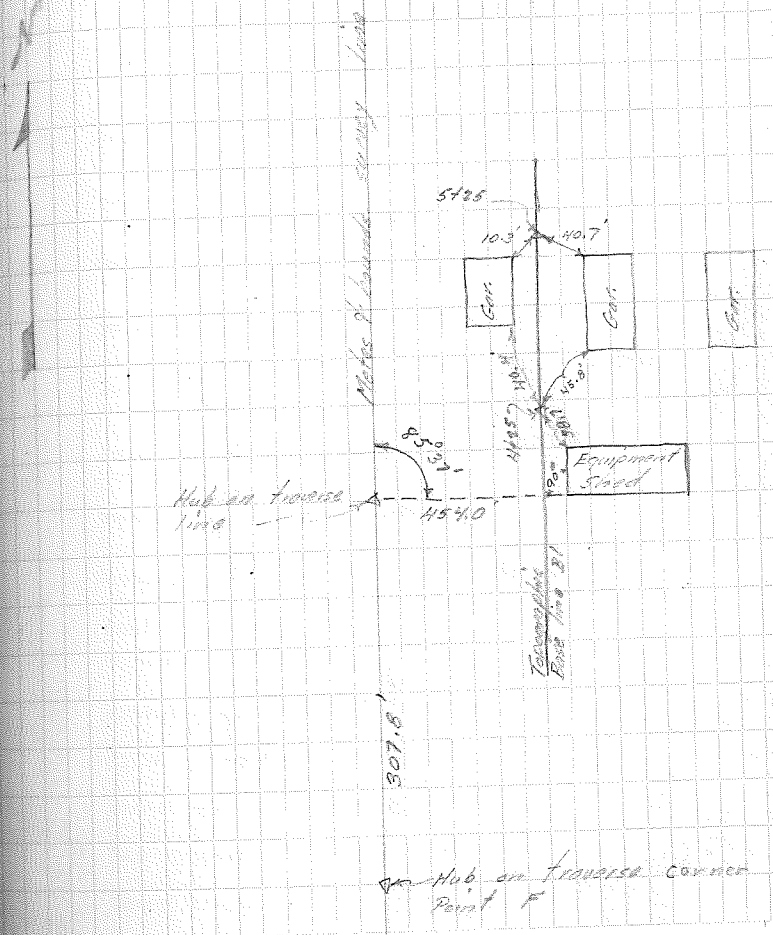
Sta.	P.S.	E.T.	F.S.	Elev.
2+00	5.1	83.8	4.9	78.7
+25	5.0	83.7	5.1	78.7
+50			5.6	78.1

$\frac{70.4}{101}$ $\frac{75.3}{39}$ $\frac{76.6}{12}$ $\frac{78.5}{7}$

$\frac{70.3}{72}$ $\frac{73.8}{65}$ $\frac{74.8}{58}$ $\frac{76.6}{10}$ $\frac{78.2}{5}$ $\frac{79.1}{5}$

$\frac{70.6}{98}$ $\frac{74.7}{57}$ $\frac{75.9}{25}$ $\frac{76.1}{8}$

Date - June 1, 1938 — Party: Ferguson T
Ties for Notes & Bounds survey lines, — Dick Ch.
Topographic base lines, and buildings — Snyder Ch.
Camp. S-27 S-16 T13S R21W — Riggs. Axe



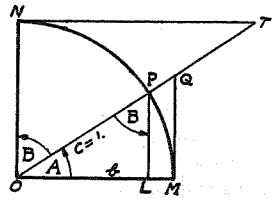


Table II

TRIGONOMETRIC FORMULAE

$\angle A = \angle MOP \qquad \angle B = \angle PON = \angle OPL$

$R = OB = c = 1$

$$\sin A = \frac{a}{c} = \frac{a}{1} = a = \cos B = LP$$

$$\cos A = \frac{b}{c} = \frac{b}{1} = b = \sin B = OL$$

$$\tan A = \frac{a}{b} = \frac{MQ}{OM} = \frac{MQ}{1} = MQ = \cot B = MQ$$

$$\cot A = \frac{NT}{ON} = \frac{NT}{1} = NT = \tan B = NT$$

$$\sec A = \frac{OQ}{OM} = \frac{OQ}{1} = OQ = \csc B = OQ$$

$$\csc A = \frac{OT}{ON} = \frac{OT}{1} = OT = \sec B = OT$$

$$\text{vers } A = \frac{LM}{OP} = LM = \text{covers } B \ \#$$

$$\text{covers } A = \frac{OP - LP}{OP} = OP - LP = \text{vers } B$$

$$\text{exsec } A = PQ = \text{coexsec } B$$

$$\text{coexsec } A = PT = \text{exsec } B$$

$$\sin \tfrac{1}{2}A = \sqrt{\frac{1 - \text{Cos } A}{2}} \qquad \cos \tfrac{1}{2}A = \sqrt{\frac{1 + \text{Cos } A}{2}}$$

$$\sin 2A = 2 \sin A \cos \qquad \cos 2A = \cos^2 A - \sin^2 A$$

Law of Sines $\quad \dfrac{\sin A}{a} = \dfrac{\sin B}{B} = \dfrac{\sin C^1}{C}$

Law of Cosines $\quad c^2 = a^2 + p^2 - 2\,ab \cos C$

Law of Tangents $\quad \dfrac{a+b}{a-b} = \dfrac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$

Table II—Continued

TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Tangents.

Given A, B, c; to find a, b, C.

Use Law of Sines.

Given a, b, c; to find A, B, C.

$$\text{Let } \frac{a+b+c}{2} = s, \sqrt{\frac{(s-a)\ (s-b)\ (s-c)}{s}} = r$$

$$\cos \tfrac{1}{2}A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\tan \tfrac{1}{2}A = \frac{r}{s-a}$$

$$\tan \tfrac{1}{2}B = \frac{r}{s-b}$$

$$\tan \tfrac{1}{2}C = \frac{r}{s-c}$$

Area of a triangle:

Area = ½ ab Sin C

$$\text{Area} = \sqrt{s(s-a)\ (s-b)\ (s-c)}$$

PRISMOIDAL FORMULA

$$\text{Vol.} = \frac{h}{6}(B+b+4M)$$

h = altitude; b B = bases; M = midsection

Table III

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 IV

Inches in Decimals of a Foot

1/16 .0052	3/32 .0078	1/8 .0104	3/16 .0156	1/4 .0208	5/16 .0260	3/8 .0313	1/2 .0417	5/8 .0521	3/4 .0625	7/8 .0729

1 .0833	2 .1667	3 .2500	4 .3333	5 .4167	6 .5000	7 .5833	8 .6667	9 .7500	10 .8333	11 .9167

Table V.—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	20′	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25					
					8	716.78	1.746	6.976	2.40
1	5729.65	.218	.873	0.30	20	688.16	1.819	7.266	2.50
10	4911.15	.255	1.018	0.35	30	674.69	1.855	7.411	2.55
20	4297.28	.291	1.164	0.40	40	661.74	1.892	7.556	2.60
30	3819.83	.327	1.309	0.45					
40	3437.87	.364	1.454	0.50	9	637.28	1.965	7.846	2.70
50	3125.36	.400	1.600	0.55	20	614.56	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
2	2864.93	.436	1.745	0.60	40	593.42	2.110	8.426	2.90
10	2644.58	.473	1.891	0.65					
20	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
30	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
40	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
50	2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
					12	478.34	2.620	10.45	3.60
3	1910.08	.655	2.618	0.90	30	459.28	2.730	10.89	3.75
10	1809.57	.691	2.763	0.95	13	441.68	2.839	11.32	3.90
20	1719.12	.727	2.908	1.00	30	425.40	2.949	11.75	4.05
30	1637.28	.764	3.054	1.05	14	410.28	3.058	12.18	4.20
40	1562.88	.800	3.199	1.10	30	396.20	3.168	12.62	4.35
50	1494.95	.836	3.345	1.15					
					15	383.07	3.277	13.05	4.50
4	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
10	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
20	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
30	1273.57	.982	3.926	1.35	17	338.27	3.716	14.78	5.10
40	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
50	1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5	1146.28	1.091	4.362	1.50	20	287.94	4.374	17.37	6.00
10	1109.33	1.127	4.507	1.55	21	274.37	4.594	18.22	6.30
20	1074.68	1.164	4.653	1.60	22	262.04	4.814	19.08	6.60
30	1042.14	1.200	4.798	1.65	23	250.79	5.035	19.94	6.90
40	1011.51	1.237	4.943	1.70	24	240.49	5.255	20.79	7.20
50	982.64	1.273	5.088	1.75					
					25	231.01	5.476	21.64	7.50
6	955.37	1.309	5.234	1.80	26	222.27	5.697	22.50	7.80
10	929.57	1.346	5.379	1.85	27	214.18	5.918	23.35	8.10
20	905.13	1.382	5.524	1.90	28	206.68	6.139	24.19	8.40
30	881.95	1.418	5.669	1.95	29	199.70	6.360	25.04	8.70
40	859.92	1.455	5.814	2.00	30	193.18	6.583	25.88	9.00

Note. Chord Deflection = 2 times tangent deflection.

Table VI.—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 VI.—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	483.3	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 VI.—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 VI.—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	5808.2	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 VII.—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 VI) 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	.53	.58	.63	.68
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	.70	.81	.92	1.04	1.29	1.42	1.54	1.66
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	4.98	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	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.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	.711	.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	.985	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 VIII.—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 IX.—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

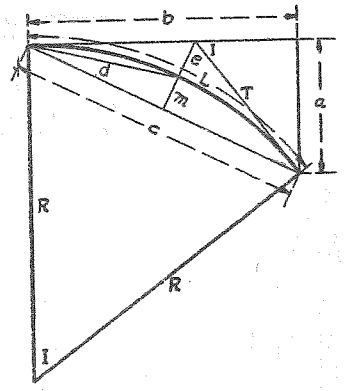


Table X

CURVE FORMULAE FOR SIMPLE CURVES

Compiled by J. Calvin Locke, C.E.

(1) $c = \sqrt{2Ra}$ (2) $c = \sqrt{a^2+b^2}$

(3) $c = \sqrt{2R\,(R-\sqrt{(R+b)\,(R-b)}} = \sqrt{2R(R-\sqrt{R^2-b^2})}$

(4) $c = 2\sqrt{m\,(2R-m)}$

(5) $c = 2R \sin \frac{1}{2} I$ (6) $c = 2T \cos \frac{1}{2} I$

(7) $e = R \operatorname{exsec} \frac{1}{2} I$

(8) $e = R \tan \frac{1}{2} I \tan \frac{1}{4} I$ (9) $e = T \tan \frac{1}{4} I$

(10) $b = \sqrt{a\,(2R-a)}$

(11) $b = \sqrt{\left(c+\frac{c^2}{2R}\right)\left(c-\frac{c^2}{2R}\right)} = \sqrt{c^2-\frac{c^4}{4R^2}}$

(12) $b = R \sin I$ (13) $b = a \cot \frac{1}{2} I$

(14) $R = \frac{a^2+b^2}{2a} = \frac{c^2}{2a}$ (15) $R = \frac{d^2}{2m} = \frac{c^2+4m^2}{8m}$

(16) $d = \sqrt{R\,(2R-\sqrt{(2R+c)\,(2R-c)}} = \sqrt{R(2R-\sqrt{4R^2-c^2})}$

(17) $d = \sqrt{2Rm}$ (18) $d = 2R \sin \frac{1}{4} I$ (19) $m = \frac{d^2}{2R}$

(20) $m = R \mp \sqrt{\left(R+\frac{c}{2}\right)\left(R-\frac{c}{2}\right)} = R \mp \sqrt{R^2-\frac{c^2}{4}}$

(21) $m = R \operatorname{vers} \frac{1}{2} I$ (22) $m = R \sin \frac{1}{2} I \tan \frac{1}{4} I$ (23) $m = \frac{1}{2} c \tan \frac{1}{4} I$

(24) $a = \frac{c^2}{2R}$ (25) $a = R - \sqrt{(R+b)\,(R-b)} = R - \sqrt{R^2-b^2}$

(26) $a = 2R (\sin^2 \frac{1}{2} I)^2$ (27) $a = R \operatorname{vers} I$ (28) $a = R \sin I \tan \frac{1}{2}$

(29) $a = b \tan \frac{1}{2} I$ (30) $a = T \sin I$ (31) $T = R \tan \frac{1}{2} I$

(32) $I = \frac{L}{R} \times 57.295780$ (33) $R = \frac{L}{I} \times 57.295780$

(34) $L = IR \times 0.01745329$ (35) $L = \frac{8d-c}{3}$

(36) Area Seg. $= \frac{LR - R^2 \operatorname{Sin} I}{2} = \frac{LR - Rb}{2}$

Table XI.—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 ½ 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.

Table XII. Stadia Reductions

Vertical Heights

Minutes	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
0	0.00	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10
2	0.06	1.80	3.55	5.28	7.02	8.74	10.45	12.15	13.84	15.51	17.16
4	0.12	1.86	3.60	5.34	7.07	8.80	10.51	12.21	13.89	15.56	17.21
6	0.17	1.92	3.66	5.40	7.13	8.85	10.57	12.26	13.95	15.62	17.26
8	0.23	1.98	3.72	5.46	7.19	8.91	10.62	12.32	14.01	15.67	17.32
10	0.29	2.04	3.78	5.52	7.25	8.97	10.68	12.38	14.06	15.73	17.37
12	0.35	2.09	3.84	5.57	7.30	9.03	10.74	12.43	14.12	15.78	17.43
14	0.41	2.15	3.90	5.63	7.36	9.08	10.79	12.49	14.17	15.84	17.48
16	0.47	2.21	3.95	5.69	7.42	9.14	10.85	12.55	14.23	15.89	17.54
18	0.52	2.27	4.01	5.75	7.48	9.20	10.91	12.60	14.28	15.95	17.59
20	0.58	2.33	4.07	5.80	7.53	9.25	10.96	12.66	14.34	16.00	17.65
22	0.64	2.38	4.13	5.86	7.59	9.31	11.02	12.72	14.40	16.06	17.70
24	0.70	2.44	4.18	5.92	7.65	9.37	11.08	12.77	14.45	16.11	17.76
26	0.76	2.50	4.24	5.98	7.71	9.43	11.13	12.83	14.51	16.17	17.81
28	0.81	2.56	4.30	6.04	7.76	9.48	11.19	12.88	14.56	16.22	17.86
30	0.87	2.62	4.36	6.09	7.82	9.54	11.25	12.94	14.62	16.28	17.92
32	0.93	2.67	4.42	6.15	7.88	9.60	11.30	13.00	14.67	16.33	17.97
34	0.99	2.73	4.48	6.21	7.94	9.65	11.36	13.05	14.73	16.39	18.03
36	1.05	2.79	4.53	6.27	7.99	9.71	11.42	13.11	14.79	16.44	18.08
38	1.11	2.85	4.59	6.33	8.05	9.77	11.47	13.17	14.84	16.50	18.14
40	1.16	2.91	4.65	6.38	8.11	9.83	11.53	13.22	14.90	16.55	18.19
42	1.22	2.97	4.71	6.44	8.17	9.88	11.59	13.28	14.95	16.61	18.24
44	1.28	3.02	4.76	6.50	8.22	9.94	11.64	13.33	15.01	16.66	18.30
46	1.34	3.08	4.82	6.56	8.28	10.00	11.70	13.39	15.06	16.72	18.35
48	1.40	3.14	4.88	6.61	8.34	10.05	11.76	13.45	15.12	16.77	18.41
50	1.45	3.20	4.94	6.67	8.40	10.11	11.81	13.50	15.17	16.83	18.46
52	1.51	3.26	4.99	6.73	8.45	10.17	11.87	13.56	15.23	16.88	18.51
54	1.57	3.31	5.05	6.79	8.51	10.22	11.93	13.61	15.28	16.94	18.57
56	1.63	3.37	5.11	6.84	8.57	10.28	11.98	13.67	15.34	16.99	18.62
58	1.69	3.43	5.17	6.90	8.63	10.34	12.04	13.73	15.40	17.05	18.68
60	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10	18.73

Horizontal Corrections

Dist.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
100	0.0	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.5	3.0
200	0.0	0.1	0.2	0.5	1.0	1.5	2.2	3.0	3.9	4.9	6.0
300	0.0	0.1	0.4	0.8	1.5	2.3	3.3	4.5	5.8	7.4	9.1
400	0.0	0.1	0.5	1.1	2.0	3.0	4.4	6.0	7.8	9.8	12.1
500	0.0	0.2	0.6	1.4	2.5	3.8	5.5	7.5	9.7	12.3	15.1
600	0.0	0.2	0.7	1.6	2.9	4.6	6.5	8.9	11.6	14.7	18.1
700	0.0	0.2	0.8	1.9	3.4	5.3	7.6	10.4	13.6	17.2	21.1
800	0.0	0.2	1.0	2.2	3.9	6.1	8.7	11.9	15.5	19.6	24.2
900	0.0	0.3	1.1	2.4	4.4	6.8	9.8	13.4	17.5	22.1	27.2
1000	0.0	0.3	1.2	2.7	4.9	7.6	10.9	14.9	19.4	24.5	30.2

Table XII. Stadia Reductions

Vertical Heights

Minutes	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
0	18.73	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14
2	18.78	20.39	21.97	23.52	25.05	26.55	28.01	29.44	30.83	32.18
4	18.84	20.44	22.02	23.58	25.10	26.59	28.06	29.48	30.87	32.23
6	18.89	20.50	22.08	23.63	25.15	26.64	28.10	29.53	30.92	32.27
8	18.95	20.55	22.13	23.68	25.20	26.69	28.15	29.58	30.97	32.32
10	19.00	20.60	22.18	23.73	25.25	26.74	28.20	29.62	31.01	32.36
12	19.05	20.66	22.23	23.78	25.30	26.79	28.25	29.67	31.06	32.41
14	19.11	20.71	22.28	23.83	25.35	26.84	28.30	29.72	31.10	32.45
16	19.16	20.76	22.34	23.88	25.40	26.89	28.34	29.76	31.15	32.49
18	19.21	20.81	22.39	23.93	25.45	26.94	28.39	29.81	31.19	32.54
20	19.27	20.87	22.44	23.99	25.50	26.99	28.44	29.86	31.24	32.58
22	19.32	20.92	22.49	24.04	25.55	27.04	28.49	29.90	31.28	32.63
24	19.38	20.97	22.54	24.09	25.60	27.09	28.54	29.95	31.33	32.67
26	19.43	21.03	22.60	24.14	25.65	27.13	28.58	30.00	31.38	32.72
28	19.48	21.08	22.65	24.19	25.70	27.18	28.63	30.04	31.42	32.76
30	19.54	21.13	22.70	24.24	25.75	27.23	28.68	30.09	31.47	32.80
32	19.59	21.18	22.75	24.29	25.80	27.28	28.73	30.14	31.51	32.85
34	19.64	21.24	22.80	24.34	25.85	27.33	28.77	30.19	31.56	32.89
36	19.70	21.29	22.85	24.39	25.90	27.38	28.82	30.23	31.60	32.93
38	19.75	21.34	22.91	24.44	25.95	27.43	28.87	30.28	31.65	32.98
40	19.80	21.39	22.96	24.49	26.00	27.48	28.92	30.32	31.69	33.02
42	19.86	21.45	23.01	24.55	26.05	27.52	28.96	30.37	31.74	33.07
44	19.91	21.50	23.06	24.60	26.10	27.57	29.01	30.41	31.78	33.11
46	19.96	21.55	23.11	24.65	26.15	27.62	29.06	30.46	31.83	33.15
48	20.02	21.60	23.16	24.70	26.20	27.67	29.11	30.51	31.87	33.20
50	20.07	21.66	23.22	24.75	26.25	27.72	29.15	30.55	31.92	33.24
52	20.12	21.71	23.27	24.80	26.30	27.77	29.20	30.60	31.96	33.28
54	20.18	21.76	23.32	24.85	26.35	27.81	29.25	30.65	32.01	33.33
56	20.23	21.81	23.37	24.90	26.40	27.86	29.30	30.69	32.05	33.37
58	20.28	21.87	23.42	24.95	26.45	27.91	29.34	30.74	32.09	33.41
60	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14	33.46

Horizontal Corrections

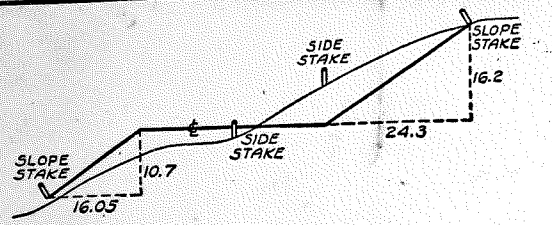
District	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
100	3.6	4.3	5.1	5.9	6.7	7.6	8.5	9.5	10.6	11.7
200	7.3	8.6	10.1	11.7	13.4	15.2	17.1	19.1	21.2	23.4
300	10.9	13.0	15.2	17.6	20.1	22.8	25.6	28.6	31.8	35.1
400	14.6	17.3	20.2	23.4	26.8	30.4	34.2	38.2	42.4	46.8
500	18.2	21.6	25.3	29.3	33.5	38.0	42.7	47.7	53.0	58.5
600	21.8	25.9	30.4	35.1	40.2	45.6	51.3	57.3	63.6	70.2
700	25.5	30.2	35.4	41.0	46.9	53.2	59.8	66.8	74.2	81.9
800	29.1	34.6	40.5	46.8	53.6	60.8	68.4	76.4	84.8	93.6
900	32.8	38.9	45.5	52.7	60.3	68.4	76.9	85.9	95.4	105.3
1000	36.4	43.2	50.6	58.5	67.0	76.0	85.5	95.5	106.0	117.0

Table XIII.—Sines, Cosines, Tangents, Cotangents

Deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	Deg.
0	0000	0000	0029	0029	0058	0058	0087	0087	0116	0116	0145	0145	89
1	175	0175	0204	0204	0233	0233	0262	262	291	291	320	320	88
2	349	349	378	378	407	407	436	437	465	466	494	495	87
3	523	524	552	553	581	582	610	612	640	641	669	706	86
4	698	699	727	729	756	758	785	787	814	816	843	864	85
5	872	875	901	904	929	934	958	963	987	992	1016	1022	84
6	1045	1051	1074	1080	1103	1110	1132	1139	1161	1169	190	198	83
7	219	228	248	257	279	287	305	317	334	346	363	376	82
8	392	405	421	435	449	465	478	495	507	524	536	554	81
9	564	584	593	614	622	644	650	673	679	703	708	733	80
10	736	763	765	793	794	823	822	853	851	883	880	914	79
11	908	944	937	974	965	2004	994	2035	2022	2065	2051	2095	78
12	2079	2126	2108	2156	2136	186	2164	217	193	247	221	278	77
13	250	309	278	339	306	370	334	401	363	432	391	462	76
14	419	493	447	524	476	555	504	586	532	617	560	648	75
15	588	679	616	711	644	742	672	773	700	805	728	836	74
16	756	867	784	899	812	931	840	962	868	994	896	3026	73
17	924	3057	952	3089	939	3121	3007	3153	3035	3185	3062	217	72
18	3090	249	3118	281	3145	314	173	346	201	378	228	411	71
19	256	443	283	476	311	508	338	541	365	574	393	607	70
20	420	640	448	673	475	706	502	739	529	772	557	805	69
21	584	839	611	872	638	906	665	939	692	973	719	4006	68
22	746	4040	773	4074	800	4108	827	4142	854	4176	881	210	67
23	907	245	934	279	961	314	987	348	4014	383	4041	417	66
24	4067	452	4094	487	4120	522	4147	557	173	592	200	628	65
25	226	663	253	699	279	734	305	770	331	806	358	841	64
26	384	877	410	913	436	950	4462	986	488	5022	514	5059	63
27	540	5095	566	5132	592	5169	617	5206	643	243	669	280	62
28	695	317	720	354	746	392	772	430	797	467	823	505	61
29	848	543	874	581	899	619	924	658	950	696	975	735	60
30	5000	774	5025	5812	5050	851	5075	890	5100	930	5125	969	59
31	150	6009	175	6048	200	6088	225	6128	250	6168	275	6208	58
32	299	249	324	289	348	330	5373	371	398	412	422	453	57
33	446	494	471	536	495	577	519	619	544	661	568	703	56
34	592	745	616	787	640	830	664	873	688	916	712	959	55
35	736	7002	760	7046	783	7089	807	7133	831	7177	854	7221	54
36	878	265	901	310	925	355	948	400	972	445	995	490	53
37	6018	536	6041	581	6065	627	6088	673	6111	720	6134	766	52
38	157	813	180	860	202	907	225	954	248	8002	271	8050	51
39	293	8098	316	8146	338	8195	361	8243	383	292	406	342	50
40	428	391	450	441	472	491	494	541	517	591	539	642	49
41	561	693	583	744	604	796	626	847	648	899	670	952	48
42	691	9004	713	9057	734	9110	756	9163	777	9217	799	9271	47
43	820	325	841	380	862	435	884	490	905	545	926	601	46
44	947	657	967	713	988	770	7009	827	7030	884	7050	942	45
45	7071	1.0000	7092	1.0058	7112	1.0117	133	1.0176	153	1.0235	173	1.0295	44
Deg.	60′ cos	60′ cot	50′ cos	50′ cot	40′ cos	40′ cot	30′ cos	30′ cot	20′ cos	20′ cot	10′ cos	10′ cot	Deg.

Table XIII.—Sines, Cosines, Tangents, Cotangents (Continued)

Deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	Deg.
46	7193	1.0355	7214	1.0416	7234	1.0477	7254	1.0533	7274	1.0599	7294	1.0661	43
47	314	.0724	333	.0786	353	.0850	373	.0913	392	.0977	412	.1041	42
48	431	.1106	451	.1171	470	.1237	490	.1303	509	.1369	528	.1436	41
49	547	.1504	566	.1571	585	.1640	604	.1708	623	.1778	642	.1847	40
50	660	1.1918	7679	1.1988	7698	1.2059	7716	1.2131	7735	1.2203	7753	1.2276	39
51	771	.2349	790	.2423	808	.2497	826	.2572	844	.2647	862	.2723	38
52	880	.2799	898	.2876	916	.2954	934	.3032	951	.3111	969	.3190	37
53	986	.3270	8004	.3351	8021	.3452	8039	.3514	8056	.3597	8073	.3680	36
54	8090	.3764	107	.3848	124	.3934	141	.4019	158	.4106	175	.4193	35
55	192	.4281	208	.4370	225	.4460	241	.4550	258	.4641	274	.4733	34
56	290	.4826	307	.4919	323	.5013	339	.5108	355	.5204	371	.5301	33
57	387	.5399	403	.5497	418	.5597	434	.5697	450	.5798	465	.5900	32
58	480	.6003	496	.6107	511	.6212	526	.6319	542	.6426	557	.6534	31
59	572	.6643	587	.6753	601	.6864	616	.6977	631	.7090	646	.7205	30
60	660	1.7321	8675	1.7437	8689	1.7556	8704	1.7675	8718	1.7797	8732	1.7917	29
61	746	.8040	760	.8165	774	.8291	788	.8418	802	.8546	816	.8676	28
62	829	.8807	843	.8940	857	.9074	870	.9210	884	.9347	897	.9486	27
63	910	.9626	923	.9768	936	.9912	949	2.0057	962	2.0204	975	2.0353	26
64	988	2.0503	9001	2.0655	9013	2.0809	9026	.0965	9038	.1123	9051	.1283	25
65	9063	.1445	075	.1609	088	.1775	100	.1943	112	.2113	124	.2286	24
66	135	.2460	147	.2637	159	.2817	171	.2998	182	.3183	194	.3369	23
67	205	.3559	216	.3750	228	.3945	239	.4142	250	.4342	261	.4545	22
68	272	.4751	283	.4960	293	.5172	304	.5386	315	.5605	325	.5826	21
69	336	.6051	346	.6279	356	.6511	367	.6746	377	.6985	387	.7228	20
70	397	2.7475	9407	2.7725	9417	2.7980	9426	2.8239	9436	2.8502	9446	2.8770	19
71	455	.9042	465	.9319	474	.9600	483	.9887	492	3.0178	502	3.0475	18
72	511	3.0777	520	3.1084	528	3.1397	537	3.1716	546	.2041	555	.2371	17
73	563	.2709	572	.3052	580	.3402	588	.3759	596	.4124	605	.4495	16
74	613	.4874	621	.5261	628	.5656	636	.6059	644	.6470	652	.6891	15
75	659	.7321	667	.7760	674	.8208	681	.8657	689	.9136	696	.9617	14
76	703	4.0108	710	4.0611	717	4.1126	724	4.1653	730	4.2193	737	4.2747	13
77	744	.3315	750	.3897	757	.4494	763	.5107	769	.5736	775	.6382	12
78	781	.7046	787	.7729	793	.8430	799	.9152	805	.9894	811	5.0658	11
79	816	.1446	822	5.2257	827	5.3093	833	5.3955	838	5.4845	843	.5764	10
80	9848	5.6713	9853	5.7694	9858	5.8708	9863	5.9758	9868	6.0844	9872	6.1970	9
81	877	6.3138	881	6.4348	886	6.5606	890	6.6912	894	.8269	899	.9682	8
82	903	7.1154	907	7.2687	911	7.4287	914	7.5958	918	7.7704	922	7.9530	7
83	925	8.1443	929	8.3450	932	8.5555	936	8.7769	939	9.0098	942	9.2553	6
84	945	9.5144	948	9.7882	951	10.078	954	10.385	957	10.711	959	11.059	5
85	962	11.430	964	11.826	967	12.250	969	12.706	971	13.197	974	13.727	4
86	976	14.300	978	14.924	980	15.605	981	16.350	983	17.169	985	18.075	3
87	986	19.081	988	20.206	989	21.470	990	22.903	992	24.542	993	26.432	2
88	994	28.636	9995	31.242	9996	34.368	997	38.189	997	42.964	9998	49.104	1
89	9998	57.290	9999	68.750	9999	85.940	9999	114.58	1.000	171.88	1.000	343.77	0
Deg.	60′ cos	60′ cot	50′ cos	50′ cot	40′ cos	40′ cot	30′ cos	30′ cot	20′ cos	30′ cot	10′ cos	10′ cot	Deg.



Distances from Side Stakes for Cross-Sectioning

Slope 1½ to 1. Roadway of Any Width

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.00	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	0
1	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	1
2	3.00	3.15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	2
3	4.50	4.65	4.80	4.95	5.10	5.25	5.40	5.55	5.70	5.85	3
4	6.00	6.15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	4
5	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	5
6	9.00	9.15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	6
7	10.50	10.65	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	7
8	12.00	12.15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	8
9	13.50	13.65	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85	9
10	15.00	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	10
11	16.50	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	11
12	18.00	18.15	18.30	18.45	18.60	18.75	18.90	19.05	19.20	19.35	12
13	19.50	19.65	19.80	19.95	20.10	20.25	20.40	20.55	20.70	20.85	13
14	21.00	21.15	21.30	21.45	21.60	21.75	21.90	22.05	22.20	22.35	14
15	22.50	22.65	22.80	22.95	23.10	23.25	23.40	23.55	23.70	23.85	15
16	24.00	24.15	24.30	24.45	24.60	24.75	24.90	25.05	25.20	25.35	16
17	25.50	25.65	25.80	25.95	26.10	26.25	26.40	26.55	26.70	26.85	17
18	27.00	27.15	27.30	27.45	27.60	27.75	27.90	28.05	28.20	28.35	18
19	28.50	28.65	28.80	28.95	29.10	29.25	29.40	29.55	29.70	29.85	19
20	30.00	30.15	30.30	30.45	30.60	30.75	30.90	31.05	31.20	31.35	20
21	31.50	31.65	31.80	31.95	32.10	32.25	32.40	32.55	32.70	32.85	21
22	33.00	33.15	33.30	33.45	33.60	33.75	33.90	34.05	34.20	34.35	22
23	34.50	34.65	34.80	34.95	35.10	35.25	35.40	35.55	35.70	35.85	23
24	36.00	36.15	36.30	36.45	36.60	36.75	36.90	37.05	37.20	37.35	24
25	37.50	37.65	37.80	37.95	38.10	38.25	38.40	38.55	38.70	38.85	25
26	39.00	39.15	39.30	39.45	39.60	39.75	39.90	40.05	40.20	40.35	26
27	40.50	40.65	40.80	40.95	41.10	41.25	41.40	41.55	41.70	41.85	27
28	42.00	42.15	42.30	42.45	42.60	42.75	42.90	43.05	43.20	43.35	28
29	43.50	43.65	43.80	43.95	44.10	44.25	44.40	44.55	44.70	44.85	29
30	45.00	45.15	45.30	45.45	45.60	45.75	45.90	46.05	46.20	46.35	30
31	46.50	46.65	46.80	46.95	47.10	47.25	47.40	47.55	47.70	47.85	31
32	48.00	48.15	48.30	48.45	48.60	48.75	48.90	49.05	49.20	49.35	32
33	49.50	49.65	49.80	49.95	50.10	50.25	50.40	50.55	50.70	50.85	33
34	51.00	51.15	51.30	51.45	51.60	51.75	51.90	52.05	52.20	52.35	34
35	52.50	52.65	52.80	52.95	53.10	53.25	53.40	53.55	53.70	53.85	35
36	54.00	54.15	54.30	54.45	54.60	54.75	54.90	55.05	55.20	55.35	36
37	55.50	55.65	55.80	55.95	56.10	56.25	56.40	56.55	56.70	56.85	37
38	57.00	57.15	57.30	57.45	57.60	57.75	57.90	58.05	58.20	58.35	38
39	58.50	58.65	58.80	58.95	59.10	59.25	59.40	59.55	59.70	59.85	39
40	60.00	60.15	60.30	60.45	60.60	60.75	60.90	61.05	61.20	61.35	40
41	61.50	61.65	61.80	61.95	62.10	62.25	62.40	62.55	62.70	62.85	41
42	63.00	63.15	63.30	63.45	63.60	63.75	63.90	64.05	64.20	64.35	42
43	64.50	64.65	64.80	64.95	65.10	65.25	65.40	65.55	65.70	65.85	43
44	66.00	66.15	66.30	66.45	66.60	66.75	66.90	67.05	67.20	67.35	44
45	67.50	67.65	67.80	67.95	68.10	68.25	68.40	68.55	68.70	68.85	45
46	69.00	69.15	69.30	69.45	69.60	69.75	69.90	70.05	70.20	70.35	46
47	70.50	70.65	70.80	70.95	71.10	71.25	71.40	71.55	71.70	71.85	47
48	72.00	72.15	72.30	72.45	72.60	72.75	72.90	73.05	73.20	73.35	48
49	73.50	73.65	73.80	73.95	74.10	74.25	74.40	74.55	74.70	74.85	49
50	75.00	75.15	75.30	75.45	75.60	75.75	75.90	76.05	76.20	76.35	50

Distance of slope stake from side or shoulder stake for any width roadway, slope 1½ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.