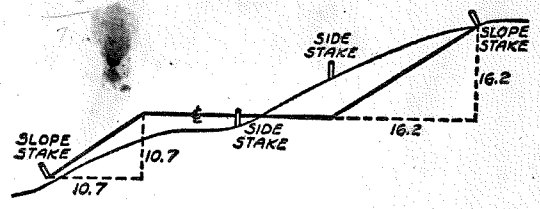
10

10



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.

138-27

138-27

Book - 5.

HARCO
TRADE MARK REG.

138-27

Set Tally Stakes at following

3+30 = 1 Tally
9+90 = 3 "
13+20 = 1/16 cor.
16+50 = 5 Tally
23+10 = 7 "
26+40 = 1/4 cor
29+70 = 9 Tally
36+30 = 11 "
39+60 = 1/16 cor.
42+90 = 13 Tally
49+50 = 15 "
52+80 = Mile — sec cor.

138-27

138-27

T 138 R 27

22 21 20 19 18 17 16 15 14 13

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

9 10 11 12 23 24 25 26 7 8

(1) (2) (3) (4) (5) (6) 29 30

138-27

138-27

East [illegible] $\frac{16}{21}$ T 138 R-27

2 [illegible] set Aspen [illegible]

2" Aspen [illegible]

13+20 set Temp. W. 1/16 cor. 2" Aspen [illegible]

Trail running N. 45.

0+00 started East from $\frac{17 | 16}{20 | 21}$ T 138 R-27.
app cor

1

June 20 1939

Look For

W. Birch 7" S 20° W 05 lks

Aspen 6" N 50 E 17 lks

Woods - chf.

Estvold ch. notes

Dieman - ch - axe

Holland - axe

Cronquest - pickets

Found!

No Evidence.

Mag. Bearing N [illegible] E
[illegible] line

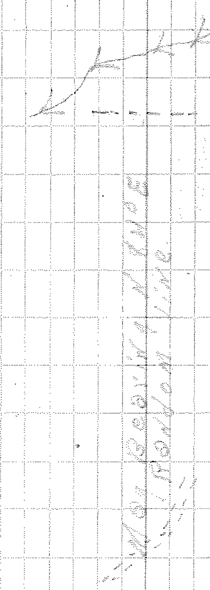
V 2.6°

138-27 138--27

52+80	set App. sec. cor. 3" Aspen stake.	16/15 21/22
43+59	East edge of crick.	
43+34	West edge of crick.	
42+30	crossed trail N-S	
33+10	Hit Trail (Toto rd.)	
26+40	continued ~~west~~ East from ¼ cor.	16/21

June 20, 1939

Look For
Aspen 7" N 22° 30 lks
Birch 7" N 37½ W 33 lks Found
Y. pine 9" S 41½ E 32 lks No Evidence
Y. pine 8" S 22½ W 24 lks.



Va. 6°

138-27 | 138--27

	East	between	$\frac{15}{22}$		138-27
26+40	Set Temp. ¼ cor. - (3" Birch stake)				
	Squared and keeled				
13+20	Set temp. cor. W. 1/16 cor.				
	(1½" aspen stake)				
0+00	Started East from (approx. cor.)			16 | 15 / 21 | 22	138-27

June 22, 1939

Look for:

Blk. oak 6" N45E 60 lks.

Butternut 6" S78W 44 lks.

Party: Dahl - Brush

Estrem - Notes

Holland - Brush

Dieman - Chain

Cronquist - Picnets

Found:

Mag. Bearing N. 89° E
Random line

Var. 6°

138--27

52+80 Set Temp. Sec. Cor. 15|14 22|23
3" Birch Stake

39+60 Set Temp. E. 1/16 cor. (2" Aspen stake)

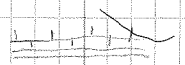
36+30 To center of Kego Lake Trail

26+40 continued E. from 1/4 cor. 15/22

June 23, 1939

Loaded for: Y. Pine 10" S.38E. 40 lks. Party:
Y. Pine 10" S.4E. 35 lks.

Found: No
Evidence



138-27 | 138--27

East between $\frac{14}{23}$ 138-27

26+40 Set approx $\frac{1}{4}$ cor. E.

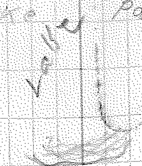
22+71 Edge of lake

13+20 Set approx $\frac{1}{16}$ cor. E.

0700 started East from approx. cor. $\frac{15}{22}\Big|\frac{14}{23}$ 138-27

Dobeiner - 1-16-40

$\frac{1}{4}$ cor. falls in lake



Look for:
At 2459.8' M.C.
on W. side of lake
Y. Pine 4", N20W 68 lks
Burr Oak 6", S81°30' 121 lks

Party:
Prochnicki & Notes
Meelberg axe
Roiger - axe
Anderson pickets
Daves - axes

var. 6° (continued on var. from pickets)

138-27 | 138--27

52+83 Set approx Sec. cor. 14/13 / 23/24 in Lake Eagle

47+30 Edge of lake

44+00

41+26 Edge of lake on E. side

39+60 Set approx 1/16 Cor. E.

36+40 Cont E. from 1/4 cor.

Sec. cor. in lake
Dist. 5283.3'

At 4755.3' M.C.
Ash 7" N 80° 30' W 121 lks
Ash 8" S 37° 15' W 98 lks.

Look for:
At 4431.9' M.C.
cor. on E side of
Lake.
Elm 6" N 19 W 114 lks
" 5" N 80 E 50 lks

1/16

138-27 | 138--27

East between 11/141 | 138-27

5 | 26+54 | Set approx. 1/4 Cor E. - 3" Birch Stake

13+20 | Set approx 1/16 Cor. W. - quit for day.

12+40 | Leave Bog

8+00 | enter Bog

51 | Crossed logging trail

2+00 | Started east from

10/15 | 11/14 | 1939

11-21-39

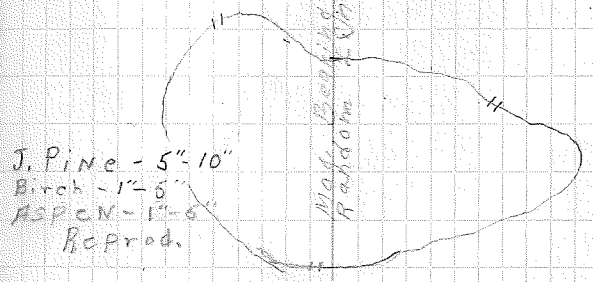
Party

DeiMan - chf.
Prochnow - ch. - Notes
Anderson - Chn
Rothstein - axe
Higbie - axe

E

Look for:
X, Pine N 65 W, 105 lks
Dist. 40.22 chs.
66
2413 7
2413 2
26543.2 Feet

found:
No evidence



Var. 6° 6'

138-27 | 138-27

53+09 Set approx. Sec. Cor. 11|12 / 14|13 138-27
3" birch stake

52+42 Intersect brushed N-S line
Chained south on well brushed line
222 ft. to squared ash stake
located 56 ft. N.E. from
18" fire scarred elm - recently
blazed (May be old B.T., but no
scribing found). Old blazed line
leads east from stake but
fades out. Paced dist. E. to
Lake shore from stake = 520.'

39+60 Set approx. 1/16 cor. E.

26+64 Continued East from approx 1/4 cor. 1/4

11-22-39
Party
Deiman - chf.
Prochnow - ch. - Notes
Anderson - ch.
Rothskien - axe
Hibgie - axe

Look for:
W. Pine 10", N40E, 40 lks
Aspen 10", N67W, 45 lks
Y. Birch 8", S35E, 7 lks
Elm 6", S75W, 50 lks
Distance 80.45 chs.
66
" 5309.7 Ft.

(Dist. from intersection brushed lines east to temp. sec. cor. we set = 67')

Mag. Bearing N. 83.04 E.

Random Line

Found: old elm (18") - may be B.T. Located S. 35° W. - 56'

138-27 $\frac{7}{18}$ 138-

26+40 set Appr. 1/4 cor. on ~~—~~ on Center 1/4 line section 7. Appr. 1/4 cor. 14+85 ft. south.

23+10 quit for day

13+20 set Appr. CCC. W. 1/16 cor (on offset)

9+90

Due to swamp too much water had to offset from sec. cor. — went North 1485'. The mile between $\frac{7}{18}$ is short — is 191' short so started at 1+91'

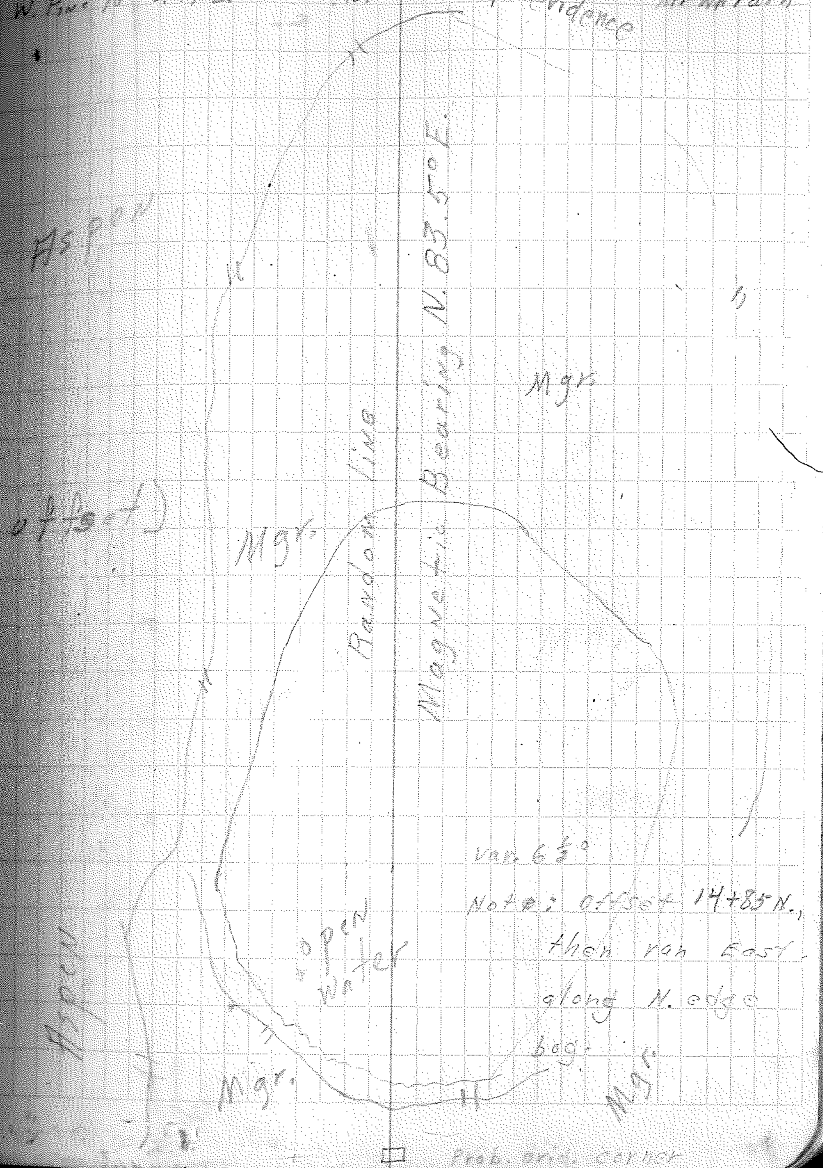
3+30 set 1st Tally stake — set 14+85 N. at

1+91 started East from sect. cor. $\frac{12\ 7}{13\ 18}$

July 13, 1939 Party
Michgolgon
Holland
Diemer
House
Hoffman
Nolan
Meinrath

Look for: W. Pine 10" S. 44°E. 227 lks.

found: No evidence



Var. 6 1/2°

Note: offset 14+85 N., then ran East along N. edge bog.

138-27 | 138--27

138-27

53+80 offset 14+85' south. $\frac{7 \mid 8}{18 \mid 17}$

39+60 set appr. E 1/16 cor.
38+00 Quit for day

26+40 continued East on offset 14+55 N of line. Var. 6½°

77 chains long - Original notes.

10

Look for:
W. Pine 5" N.47°E. 11 lks.
Aspen 8" N.35°W. 34 lks.
" " S.68°E. 20 lks.
" " S.46°W. 20 lks.

found:
No evidence

Aspen

Random line

Magnetic Bearing N.85.5°E.

Aspen

138-27 138-27

26+40 Set approx. 1/4 stake. 1/4 Cor. 8/17

13+20 Set Approx W 1/16 stake

0+00 Started east from Appr. C.C.C. sect cor. 7|8 18|17

9° 9'

Date July 19, 1939

E Nov. 8, 1939

Party:

Look for:

Birch 6" N 19½° E. 30 lks. — Found

R. Oak 6" S. 31° E 13 lks — No evidence

Random line

Magnetic Bearing N. 84 5° E.

Aspen - 1"-5" reprod.

Aspen

Mile - 53+13 - G.P.

Var. 5½°

◇ Approx. cor.

138--27 138--27

138-27

62+80 Set temp. Sec. Cor. 3" Aspen $\frac{8}{17} \big| \frac{9}{16}$

39+60 Set up approx. E. 1/16 cor.

35+00 Quit for the Day

26+40 Continued East from approx. 1/4 cor. $\frac{8}{17}$ 138-27

Party: Nov. 8, 1939 12
Becker - T compass.
Delman - Picket.
Prechnow - Chain. Notekeeper
Johnson - "
Minnerott - Brusher.

E

Look for:

Aspen	9"	N55E	100 lks
"	9"	N50W	56 lks
W. Pine	10"	S78E	130 lks
"	8"	S28W	81 lks

Found:
No evidence

Random Line
N. 84.5° E. Magnetic Bearing

Var. 5 1/2°

138-27 138-27

West bet. 35/2 T 138-27

24+00 Enter Tam. Swp.

13+20 set Temp. E 1/16 Cor (2" Aspen stake)

3+80 Hit Trail running N & S.

1+96 leave willow swp.

0+00 started West from 35|36 / 2|1 (Probable true cor)

13

June 29, 1939
Woods chf.
Estren Notes
Holland ch.
Oleman axe
Riggs- axe

Look for
Tam. 4" N 16 W 9 lks
J. pine 4" S 27 W 9 lks

Found:

Mag. Bearing S 89° W.
Random Line.

Found 4" pine stake squared on 4 sides
Yellow tag on Northside of stake 35|36 / 2|1
1½" stake with ~~orignal~~ scribing 2' tall
2" stake N 15° W Keeled orig. B.T. it is
sticking in old stump
2" stake N 11° E Keeled orig. Bt it is
sticking in old stump.
Var. 6° Started line West.

52+80 Set temp. sec. cor. $\frac{3}{}\big|\frac{2}{}$ 138-27 a
squared

50+60 old logging trail

36+96 Set picket west edge pot-hole. Started measuring west from picket.
(Triangulated across lake)

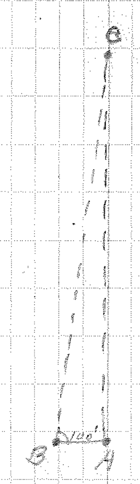
28+82 Reached east edge pot-hole

Look for.
Aspen 7" N 78 E 8 lks.
Aspen 8" S 17 E 8 lks.
Aspen 7" S 44 W 14 lks.
W. Birch 5" N 47 W 20 lks.

Found:

From B:
Bearing of Line BA = N. 6° W.
Bearing of Line BC = N. 89° W.

(Calculation by Morse)



Angle ABC = 83°

Tang. ABC = $\frac{AC}{BA} = \frac{AC}{100'}$
(Tangent of 83° = 8.14)
$8.14 = \frac{AC}{100}$
AC = 8.14 X 100 = 814', dist. across lake.

138-27 138--27

West bet. $\frac{34}{3}$ T 138-R 27.

26+40 Set App 1/4 stake w/ squared Aspen

12+68 West edge of pot-hole lake

6+37 edge of pot hole lake

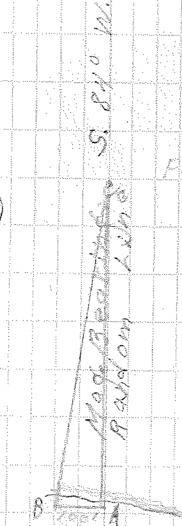
0+00 Started W. from temp. cor $\frac{34|35}{3|2}$ $\frac{139}{138-27}$

1/4/7 1939
Wood-chm.
Diemsah-ch
Holland-ch
House-axe
Paylke-axe

Look for
Spruce 4" N 14 W 16 lks.
Spruce 4" S 46 E 16 lks.

Found;
No Evidence

(calc. by Morse)



From B.
Bearing of line B.A. = N 6° W
Bearing of line B.C. = N 87 W
Angle A.B.C = 81°

Tang. ABC = $\frac{AC}{BA}$ = $\frac{AC}{100'}$
(Tang. 81° = 6.31)
6.31 = $\frac{AC}{100}$
AC = 6.31 x 100 = 631'
dist. across lake

Var. 6°

138-27 138--27

4 | 3 138-27

52+80 Set temp. sec. cor. a
Squared 3" Dry Aspens

35+40 Left Willow swamp.

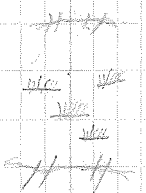
32+00 Entered Willow swamp
quit for Day July 9 1939
Finished line to sec cor, 33 34 / 4 3
July 10 1939

26+40 Continued west

12

Look For:
W. pine 20" N23E 15 lks
W pine 24" S65E 37 lks
W. pine 22" S37W 34 lks
W. pine 15" N65W 35 lks

Found:



138-27

138-27

	west	between	$\frac{33}{4}$		138-27
26+40	Set approx. ¼. cor. E. 3" aspen.				
13+20	Set approx. 1/16. cor. E.				
0+00	Started	west	from	temp. cor. $\frac{33 \mid 34}{4 \mid 3}$	

Look for:
W. pine 9 in N 52 E 12 lks.
Ash 6" S 27 W 29 lks.

Found

Party 17
Deiman - chf
~~Froehnow - ch - Not~~
Anderson - ch
Higbie - axe
Rothstein - axe

No evidence

Aspen - 0 - 1
Reprod.

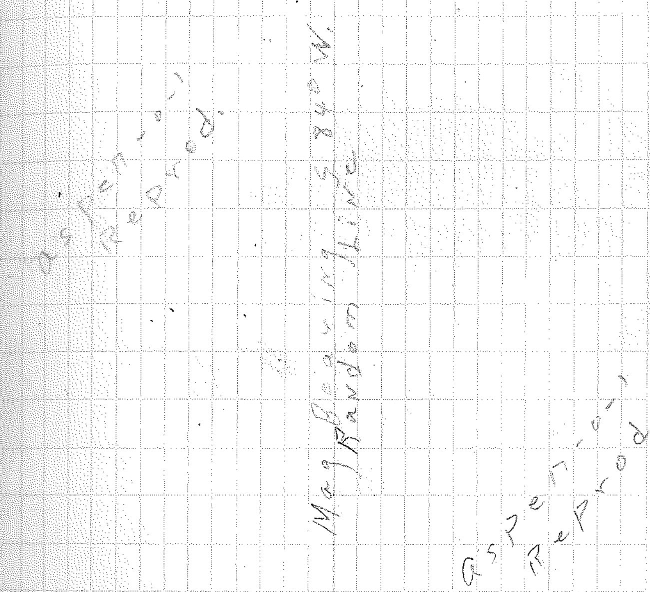
Magnetic Bearing S. 84° W.
Random Line

Aspen - 0 - 1
Reprod

Var. 6°

52+80	Set temp. Sec. Cor. 3" Aspen Stake	$\frac{31\|33}{5\|4}$	138-27
39+60	Set approx. 1/16 cor.		
36+00	quit for the day		
96+40	Continued West		

Aspen 8" N68E 23 lks.
Aspen 10" S23E 8 lks.
Aspen 8" S75W 21 lks.
Aspen 8" N7W 14 lks. found:
Dist. 52+80 No evidence



West bet. $\frac{32}{5}$

26+40 Set approx. $\frac{1}{4}$ cor. W.

13+20 Set approx. $\frac{1}{16}$ cor. W.

0+00 Started W. from temp. sec. cor $\frac{33 | 32}{4 | 5}$ 13[illegible] 2[illegible]

Aspen 12" N20W 20 lks
Blk. oak 12" S22W 19 lks
Dist. 26+40

found
No evidence

Aspen No. 1
Reprod.

Mag. Bearing S 84° W

Random Line

Aspen No. 1
Reprod.

Var. 6½°

138-27 | 138--27

52+80 set temp sec. cor 21/32 6/5 138-27
3" Birch stake

45+00 Reached W shore of pond

40+40 Reached E. shore of pond

39+60 set approx 1/4 cor E

35+00 Left Spruce swamp.

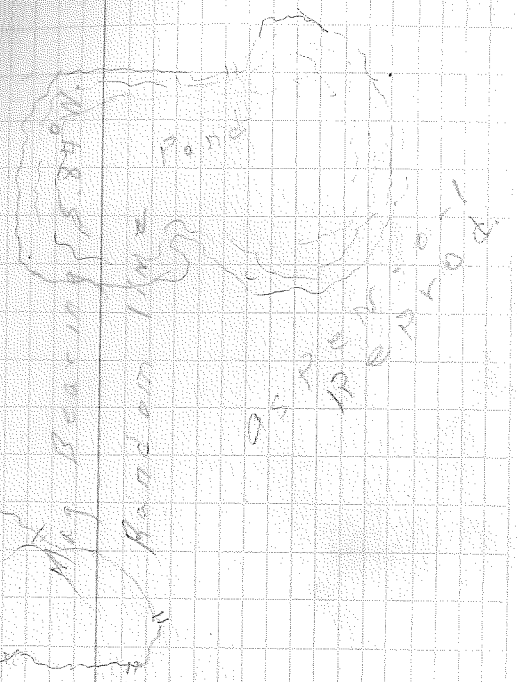
32+82 Entered spruce swamp.

Jr 40

20

Aspen 6" N46E 21 lks.
W. Birch 6" S6W E 26 lks.
W. pine 18" S45W 7 lks.
W Birch 5" N27W 11 lks.
Dist. 52+80

Found.
No evidence



VA. 7°

West between $\frac{31}{6}$ T. 138-139 N. R. 27 W.

26+40 Set approx ¼ cor. W.

16+00 Cross dry creek bed

13+20 Set approx 1/16 cor. east

0+00 Started W. from temp sec. cor $\frac{31|32}{6|5}$

W. Birch 6" N 21 W 5-Lks.
W. Birch 8" S 70 E 13-Lks.
Dist 26+40

found - 20" Hb with old blaze about 200' N.W. of cor.

Mag. Bearing S 94 W.

Random Line

Var. 6½°

138-27 138--27

54+61.7	Offset N. (6½° var.) 146' to iron pipe section corner $\frac{35\,|\,36}{1\,|\,6}$
52+69	Set approx. sec. cor. – a 3" aspen blazed on 3 sides.
39+60	set approx. W. 1/16 cor.
26+40	continues W. from approx ¼ cor.

Pine 24' N.49E 48 lks
aspen 8' S58E 75 lks.

Dist. 79.83 chs
or 5269'

Found:
fire scarred
Pine stump
N.E. 32' Marked
B.T.

Mag Bearing S84W.

Random Line

26+40 Set Approx 1/4 Cor w. 2" Aspen. 9/16 138-

20+20 Leave willow swp.

16+10 Entered willow swp.

13+20 Set Approx W. 1/16 stake

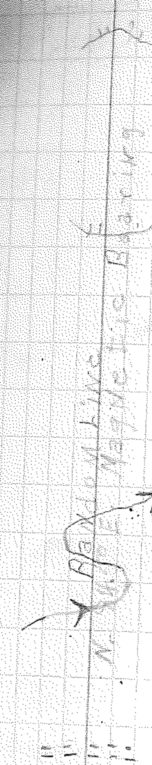
9+57 Crossed creek again
8+79 Crossed creek again
7+79 Crossed dry creek

4+65 Crossed logging trail

0+00 Started East From 8|9 / 17|16 138-27

39.80 - (9°21' / 5°41')

...:
...ch 6" S60W 09lks. found:
...no 6" N2W 13lks. No evidence



Aspen 1" to 5"
Rep'rod.

Cont'd the random line - no evidence of good corner

138-27 | 138-27

52+80 Set temp. Sect. Cor. 9/10
3" Birch Stake 16/15 138-27

49+45 Crossed old logging trail
49+05 Leave Willow & Mgr. SWP.

42+10 Entered Willow & Mgr. SWP.

39+60 Set MPP not 1/16 Cor. stake.

33+00 Enter Aspens 5" ~ 10"

26+40 Continued East from Set MPP not 1/4 Cor. 8" Aspen 2 138-27

Date 11-14-39
Party
Belman-Cht.
Frechnow-Cht.
Note
Minnerath-Ch.
Mickelsen-axe
Higbie-axe

79.61 Ch.
66
7966
66
5926

Found:
No. evidence.

30" S 30 E 41 lks.
24" N 12½ E 43 lks.
18" S 27½ E 43 lks.
16" N 44½ W. 25 lks.

Random Line
N 84.5° E Magnetic Bearing

26+37 Set APProx. 1/4 cor. 10/15 138-27

25+50 → 3" Birch stake
Cross trail leading to cabin

13+20 Set APProx 1/16 cor. W.

0+00 Started East from 9/16 | 10/15 138-27

E

Date 11-15-39

Party
Delman-chf.
Prochnow-ch & Notes
Minnerath-ch
Mickelson-axe
Higbie-axe

Look for:
At 26+37' dist.
Aspen 5" S41E 10 lks
" 8" N20W 10 lks

Found:
No evidence

Aspen 5"-10"
Birch 1"-6"

~~Look for:
At 7[illegible]' hit Lake
according to ori. notes~~

Random Line N 89° 32' E
Magnetic Bearing
Var. 5 1/2°

52+73	Set approx Sec. cor. 10/11 15/14	138-27
52+04	Cross logging trail	
	3" Birch stake	
47+65	Cross trail going E from Lake Road	
44+66	Cross Lake Road	
44+00	Offset Back S. to Line	On the offset back to line hit the lake shore road at 400 feet.
43+88	Cross Lake on E. Side.	
39+60	Set Approx. 1/16 cor. E. (on offset)	
35+25	Cross Logging trail to cabin	
	Due to Lake had to offset from 1/4 cor. North 12+39'. On the offset at 200 feet crossed road along lake.	
28+		
26+88	Reach Lake	
26+37	Set Approx. 1/4 cor. 10/15	138-27

Date 11-15-39

(26)

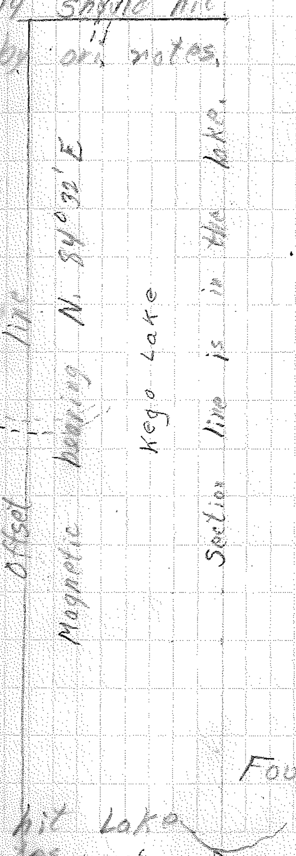
Party:
Deiman - Chf.
Prochnow - Chain + Note Keeper
Minnerath - Ch.
Mickelson - axe
Higbie - axe

E

Look for: Dist. 5273'
W. Pine 6" N 46½ E 19 lks.
" 4" S 17½ E 115 lks.
" 4" S 27½ E 80 lks.

Found:
No Evidence

Look for:
At 4514' should hit Lake - by ori. notes.



Look for:
At 2866' hit Lake
by ori. notes
Aspen 4" N 52 W 35 lks & W. Pine 20" S 75 W 32 lks

Found:
No evidence

138-27 138--27

East between 12/13 138-27

2+63 Reached W. shore of Lake Mitchell and set picket

0+00 Started E. from temp. sec. cor 11|12 / 14|13

Look for: Reach at 604!

Found: No evidence.

aspen-5" N65 W. 50 lks

W. Birch 7" S.16 W. 34 lks.

Var- $6\frac{1}{2}°$

138-27

36+40 Approx 1/4 cor. in lake. E.

13+20 approx. 1/16 Cor. E. in lake

8+51 Edge of lake

4+61 Edge of lake

0+00 Started East from 14|13 / 23|24 138-27

(Date - 1-11-40)

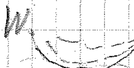
Party.
Prochnow - Ch & Notes
Anderson - Chf. & Pickets
Reiger - axes & Ch.
Yoegger - axes.
Meelberg - axes

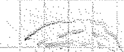
1/4 cor. in lake

Found

No evidence

Lake

At 877.8' Mc. on W. side lake.

Elm 9" S19W 53 lks.
Burr Oak 7" N28W 31 lks.


At 316.8' M.C. on E side Lake
W. Ash 7" N64E 76 lks.
Burr Oak 7" S65E 65 lks.
Used Approx cor.
See Page 6. - cor. in Lake

51+15 Hit section line -
50+35 Set stake with chainage distance on.
51+61 Cross Mitchell Lake Road at curve

38+60 Set approx 1/4 cor. E.

32+12 Edge of Lake.

26+40 Con't East from 1/4 cor.

Dist. 5267.5' to sec. cor.

Look for:
Reest. cor. is I.P.
Found:
Sec. cor. 236' No
Came off 2+36 S
3 B.T. Resurvey
20" N.Pine SW
18" " NW
16" " SE
cor. in road.

Hawley

At 3300' N.C. on E side Lake.
Elm 8" N52E 102 lks.
" 7" S4E 85 lks.

Lake

T. 138 R. 38

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

26+40 set Approx ¼ cor. S.

Few Norway & W. pine

13+20 set. Approx. ¼ cor. S.

Few Norway & W. pine

				S 36 139-03	S 31 139-27
00+00	start at	South 4 Twp. corner.	From I.P.	S 1 139-27	S 6 139-27

Date: March 26, 1940
Party: Anderson
Yzgerchn.
Minnerath
Weisschn.
Hesse

(1)

S.

Look for,
Ha 6" S65E - 14'
Hb 6' S84W - 20'

Found:
No Evidence

AW Bm

Ha

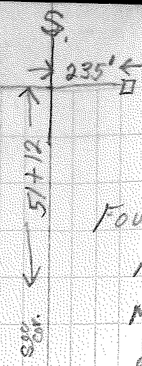
⊕ I.P.

52+80	Set approx. sec. cor. stake. 1/12 138-2[illegible]	
51+12	Crossed picket line going East into T.138-2[illegible] The approx. cor. stake is 235 [illegible] West.	
	BM A few Norway & W. pine	
39+60	set Approx. 1/4 cor. S.	
	BM & A few Norway & W. pine	
26+40	Cont'd. south on Range Line.	

Date: March 27, 1940
Party: Anderson
Yager
Minnerath
Hesse
Weise

2

[illegible]cket line from T. 138-27



[illegible]ok for:
Aspen 12" N68E - 14'
" 11" S35E - 24'
" 6" S37W - 40'
" 10" N57W - 11'

Found:
Random line in T.138-27
Missed that line's approx. sec. cor. by 88'S. and 235'W.!

26+42 set. approx ¼ cor. S.12 | 138-28

H a

13+20 set. approx. ¼ cor. S.

H a

0+00 Contd. South on Range line from 1/12 | 138-28

Date: 4/1/40
Party: Minnerath
Reese
Wiese
Yager

3

Look for:
Aspen 6" S52E, 6'
" 9" S35W, 10'

Found:

H a

H a

52+81	set. approx. sec. cor $\frac{12}{13}$ S.		138-28
51+89	cross random line going E. + W.		
	Their sec. cor. is 163' E. of our line		
48+10	enter willow Swamp		
39+60	set. approx. ½ cor. S.		
26+ ~~80~~ 40	Cont'd South on Range line. 12		138-28

Date: 4/2/40
Party: Minnerath
Becher
Pracknow
~~Hesse~~ Wiess Yager

Look for:

Found:
No evidence

26+40 set. approx $\frac{1}{4}$ cor. S.

Ha

16+01 Hz.

13+20 set. approx $\frac{1}{16}$ cor. S.

9+90 enter Bm

00+00 contd. South on random line

Date: 4/2/40

5

Party: Minnerath
Becker
Procknow
Hesse
Yager
Wiess

look for

Found:

Ha

Bm

52+80	set. approx. Sec. cor. S.
51+40	road — 156' to old line E.
	156' E to a approx. sec. cor. Stake.
26+00	contd. South on Random line

Date: 4/3/40
Party: Minnerath
Prochnow
Becker
Hesse
Wiess
Yager

look for:

Found:

S 65° W

6

26+40	Set Approx $\frac{1}{4}$ cor.	$\frac{6}{7}$	13[illegible]-28
13+20			
13+20	Set Approx $\frac{1}{16}$ Cor.		
9+25	Hi HT Small trail		
0+00	Started E. From B.T. - 10" P.	$\frac{6}{7}$	131-28

DATE: Jan 16, 1940. (7)

Party: Worlie
D.E.man
Schultz R.
Schultz D.
Meelberg
Kortehaas

Look For
B.oak 10' N.20°E 171HS.
W.maple 10' S.80°W. 201KS

Found B.T. on Random line
~~iron pipe~~ N.17°W.
65'

Random line
Mag. N.83°30'E

B.T. W.Pine 10"

52+80	Set Approx. Sec. cor.	6/5 7/8	13+28
39+60.	Set Approx 1/16 cor.		
56+90	continued E on same lines	6/7	

Date:

8

Look For
W. Birch 6' N. 35° E. 21 lks.
W. Birch 6' N. 45° W. 52 lks.
W. pine 30' S 50° E. 24 lks.
W. Birch 10' S 32° W. 22 lks.
Dist 79.35

party: Dieman
Schultz A.
Schultz D.
Meelberg
Worlie
Kortekaas.

Found No Evidence.

Random line
Mag. Bear N 88° 20' E.

26+40 SeT Approx. 1/4 Cor. 5/8

13+20 SeT Approx. 1/16 STake.

0+00. Continued EasT on same line from sec. 4|5 / 7|8

Date: 1-20-41

Look For
Pine 10' N.40°E. 55 lks. ..
Pine 10' S.60°W 23 lks. ..
DisT 40.43

Party: Berglund.
Meelberg.
SchulTz.
KorTekaas.
Evans.
Wonjie.

Found. No Evidence.

Random line:
Mag. Bear. N.89°30' E

52+90 set approx. sec. cor. E $\frac{5|4}{8|9}$ 138-28
set 4" aspen Stake

39+60 set approx $\frac{1}{16}$ cor. E.
1" aspen stake

33+00

26+40 continues East on same line - From

Date: 1-21-41

party: Shints
Shults
Melberg
Yager
Kortehaas

...For
...m 12' N5°E. 56 lks.
...spen 12' N68°W. 67 lks.
...pine 8' S29°E 38 lks
...pine 18' S39°W. 58 lks.
Dist.

Found: No Evidence

Random line:
Mag. Bear. N 83° 30' E.

26+40	Fell in lake	4/9	138.25
01+00	Enter Lake.		
	H a		
13+51	set approx ½ cor		
	H a		
0+00	continue E. on same line	5|4 / 8|9	135.25

DATE 1/24/41

party Shints
Schultz
Berglund
Hortenhaas.
Worlie

Look For
N. pine. 10' S30°W. 30 IHS.
N. pine. 20' N.40°W. 20 IHS.
Dist. 30.90

Random line.
Mag. Bear. N.83°30'E.

53+86	Fell in lake				4/9 3/10 7	138-28
~~39+60~~	Fall in lake					
96+40	continued E. on Lake				4/9	138-28

Date: 1/24/41

party: Shints
Schults
Berglund
Worlie
Kortekaas.

00 M Fr.
Fell in lake
DIST 79.60

Random line
Mag. Bear. N. 83°34' E

16+40	Set Approx 1/4 cor			$\frac{3}{10}$	138-28
15+00	Enter Willows.				
13+49	Hit Lake Shore				
0+00	Continued E on Same line			$\frac{43}{10}$	138 28

Date: 11/27/41

party: Deiman.
Schults.
Kortekaas.
Meelberg.
Worlie

…ok For
…m. 4' N 15 E. 161 Ks.
…m. 4' South. [illegible] Ks.
DIST 4207

Mag. Bearings 30' E.

52+80	Set Approx. Sec. cor.			3/10 11	138-28
39+60	Set Approx 1/16 Stake				
33+00	left Willows.				
26 p 41	Continued E on Same Line			3/10	- 138-28

Date: 1/27/41

party: Deiman.
Schwitz.
VerTekaas
Meelberg
Worlie.

...k For
...rch 6' N. 65 E. 28 lks.
...pen 7' N. 60° W. 20 lks.
Fir 4' S 32° E. 32 lks.
...pen S 55° W. 15 lks.
DIST 80.15

Hand line
Mag. Bear. N. 82° 30' E.

26+40 Set Approx. 1/4 cor. 2/11 138-25

13+20 Set Approx 1/16 stake

0+00 Continue E. on same line 3/10 2/11 138-26

Date: ~~27~~ Jan. 28, 1971. (15)

Party: Leiman.
Schults
Hortehaas
Meeberg
Worile.

Look for
W. Birch 6' South 25 lks.
W. Birch 8' N. 70° W. 75 lks.
Dist. 40.43

Boundary line
Mag. Bear. N. 89° 3[illegible]' E

53+80 ~~[illegible]~~	SET Approx sec. COR.			2/1 11/12	138-28
40+30	Leave swamp				
39+60	SET Approx. 1/4 stake				
31+00	Enter swamp				
26+40	continued E. on same line			2/11	23 [illegible]

Date: Jan. 28, 1946

party: Deiman.
Schults
Korteker
Meelber
[illegible]

Look For
H. pine 10" S. 10 E. 150 lks.
H. pine 10" S. 40 W. 126 lks.
open marsh North.

Random line
Mag. bear. N. 82°30' E.

26+40 Set approx ¼ cor. 1/12 138-28

13+20 Set approx. ½ Stake

0+00 Continued E. on same line 2/11 1/2 138-28

P- Upland Conifers

Pw- White Pine   Ps- White Spruce   Pc- Cedar
Pn- Norway Pine   Pba- Balsam
Pj- Jack Pine   Psb- Black Spruce.

H- Upland Hardwoods

Ha- Aspen   Hb- Birch   Hm- Mixed Hardwoods

B- Brush types

Bh- Hazel Brush predominating
Bm- Mixed Brush, willow, dogwood, fire cherry, alder

O- Open wild land types

Ogr- Upland Grass predominating
Obh- Lake beach, dry mud flats, devoid of vegetation
Obn- Newly burned over areas
Osl- Slash   Osf- Sweet Fern

S- Swamp types

St- Tamarack   Ss- Spruce   Sc- Cedar
Shm- Swamp mixed hardwoods, black ash, red elm, basswood.

S- Swamp Brush types

Sw- Willow   Sal- Tag Alder   Sb- Bog or dwarf birch

M- Marsh types

Mgr- Wild Hay meadow   Mse- Sedges
Mbl- Blue joint   Mre- Reeds
Mct- Cat tails   Mlt- Labrador tea & Leatherleaf

Improved land types

C- Crop Lands   P- Stump Pasture

NW	NE	NW	NE		6	5	4	3	2	1	
NW		NE			7	8	9	10	11	12	
SW	SE	SW	SE	1 Section	18	17	16	15	14	13	1 twp.
NW	NE	NW	NE		19	20	21	22	23	24	
SE		SE			30	29	28	27	26	25	
SW	SE	SW	SE		31	32	33	34	35	36	

330'..........5 chains.
990'..........15 "
1650'..........25 "
2310'..........35 "
2970'..........45 "
3630'..........55 "
4290'..........65 "
[illegible]'..........75 "

DATE: Jan. 23, 1941.

party: Deiman.
Schultz
Korteman.
Meelberg.
Worfie.

Look For
W. Birch 7" S. 50° W. 24 lks.
W. Birch 7" N 34° W. 36 lks.
DIST 33.35

Random line.
Mag. Bear N. 83°30' E.

50+65 SeT Appro Sec. Cor.
HiT N.&S. line - picket line between T. 138 R. 28 and T. 138 R. 27. Also met the picket line from T. 138-27

H2

89+60 SeT App $\frac{1}{16}$ Stake

37+41 HiT Road

H2

[illegible] ~~SeT App [illegible]~~ Continued E. on same line. $\frac{1}{2}$ [illegible]

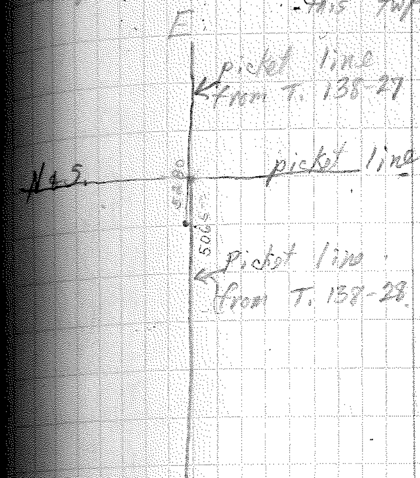
E.

Date: Jan. 28, 1941 18

Party: Deiman
Schultz
Kortekaas
Worlie
Meelberg

N.&S. picket line - see page 7.
Between T. 138 R. 28 & R. 27.

Refer to page ~~2~~ 27 of this twp. book.



Random line.
N 88 22' W [illegible]

26+40 set approx. ¼ cor. 20/29 E.

13+20 set approx. 1/16 cor East

0+00 Started East 10/20/29 139-58

52+80 set approx sec. cor. 20|21 / 29|28
5" birch stake E.

39+60 found no cor. but found 11
Tally where 39+60 should be.

26+00 contd. East H.B. ~~West~~

26+48 set approx. ¼ cor. E. 21/28

13+20 set approx ¼ cor. E.

started E from 20/24/26

21 | 22
28 | 27

52+00 Cross winter road

52+80 set approx. sec. cor. E.

39+60 set approx. 1/16 cor. E.

38+90 Cross small creek

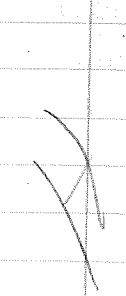
37+60 Cross STUART Lake road

26+40

22
27

25+50 enter swamp willow

13+20 set approx ½ cor. E



0+00 started east from approx cor. 2/22/25/27

22	23
27	26

138-28

35+60 Leave marsh

38+30 enter marsh grass

39+60 left willow swamp

22/27

23
26

16+60 enter Jack pine

13+20 set approx ¼ cor. E.

1+90 cross track trail

80+00 started E. [illegible] 22/23/27/26 138-28

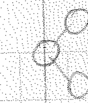
	23 | 24
	26 | 25

53+46 to - I.p. is 45' S. of 26 138-2...

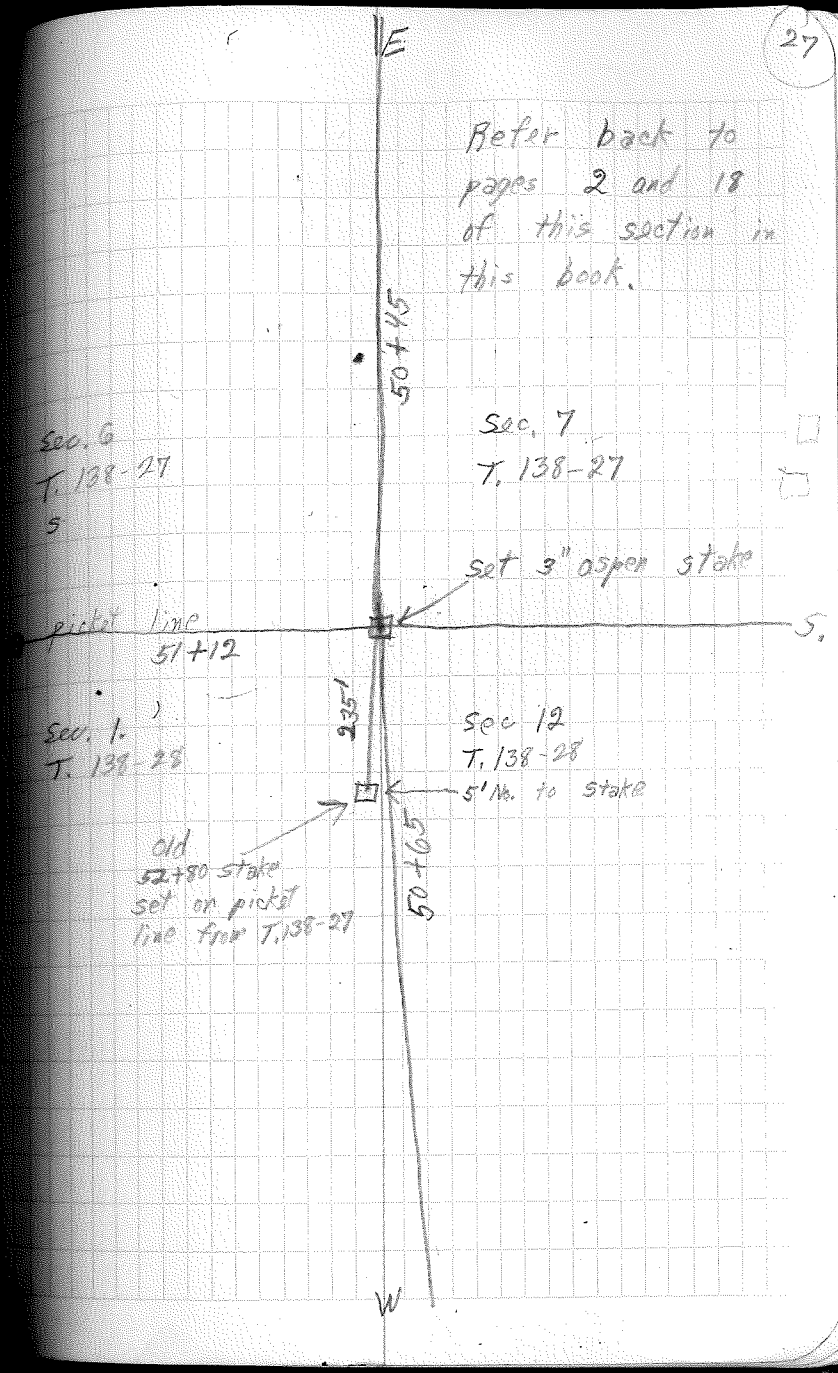
53+84 to center of road line

58+00 enter willow Swamp

47+70 cross winter road.



87+31 found Iron pipes. 23/26


E
Refer back to pages 2 and 18 of this section in this book.
50+45
Sec. 6
T. 138-27
S
Sec. 7
T. 138-27
Set 3" osper stake
picket line
51+12
S.
235'
Sec. 1.
T. 138-28
Sec 12
T. 138-28
5' N. to stake
old
52+80 stake
set on picket
line from T. 138-27
50+65
W

INDEX

T 138 - 37

DIRECTION		LOCATION	Page
EAST	BETWEEN	16 & 21	1
"	"	" "	2
EAST	"	15 & 22	3
"	"	"	4
"	"	14 & 23	5
"	"	" "	6
"	"	11 & 14	7
"	"	12 & 13	8
"	"	7 & 18	9
"	"	" "	10
"	"	8 & 17	11
"	"	" "	12
WEST	"	35 & 2	13
"	"	" "	14
"	"	34 & 3	15
"	"	" "	16
"	"	33 & 4	17
"	"	" "	18
"	"	32 & 5	19
"	"	" "	20
"	"	31 & 6	21
"	"	" "	22
EAST	"	9 & 16	23
"	"	" "	24

		138 - 27W		Page
East	between	10 & 15		25
East	"	11 & 14		26
East	"	12 & 13		27
East	"	13 & 24	Block	28 29
"	"	" "		30
	138 - 28 -	138 - 27		
South	between	1 & 6		(1)
"	"	" "		(2)
"	"	12 & 7		(3)
"	"	" "		(4)
"	"	13 & 18		(5)
"	"	" "		(6)
	138 - 28			
East	between	6 & 7		(7)
"	" "	" "		(8)
"	"	5 & 8		(9)
"	"	" "		(10)
"	"	4 & 9		(11)
"	"	" "		(12)
"	"	3 & 10		(13)
"	"	" "		(14)
East	"	2 & 11		(15)
"	"	" "		(16)
East	"	1 & 12		(17)
"	"	" "		(18)

138-28

			Pg
East	Between	20-29	19
"	"	" "	20
"	"	21 & 28	21
"	"	" "	22
"	"	22 & 27	23
"	"	" "	24
"	"	23 & 26	25
"	"	" "	26
Sec. 1412-138-28/		6 & 7-138-27	27

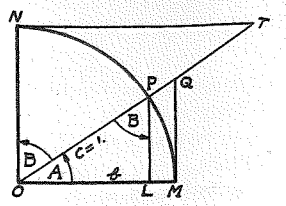


TABLE II

TRIGONOMETRIC FORMULAE

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

$R = OB = c = 1$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

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

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	3/32	1/8	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 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	483.8	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 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	5.33	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

D	For Sub-Chords Add									Excess of Arc per 100 ft.
	10	20	30	40	50	60	70	80	90	
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72

D	Long Chords				
	200	300	400	500
1	199.99	299.97	399.92	499.85
2	199.97	299.88	399.70	499.39
3	199.93	299.73	399.32	498.63
4	199.88	299.51	398.78	497.57
5	199.81	299.24	398.10	496.20
6	199.73	298.90	397.26	494.53
7	199.63	298.51	396.28	492.57
8	199.51	298.05	395.14	490.31
9	199.38	297.54	393.86	487.75
10	199.24	296.96	392.42	484.90
12	198.90	295.63	389.12	478.34
14	198.51	294.06	385.22	470.65
16	198.05	292.25	380.76	461.86
18	197.54	290.21	375.74	452.02
20	196.96	287.94	370.17	441.15
22	196.32	285.44	364.06	429.30
24	195.63	282.71	357.43	416.53
26	194.87	279.76	350.30	402.89
28	194.06	276.59	342.69	388.43
30	193.18	273.20	334.61	373.20
32	192.25	269.61	326.08	357.28
34	191.26	265.81	317.12	340.73
36	190.21	261.80	307.77	323.61
38	189.10	257.60	298.03	305.99
40	187.94	253.21	287.94	287.94
42	186.72	248.63	277.51	269.54
44	185.44	243.87	266.78	250.85
46	184.10	239.93	255.78	231.95
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

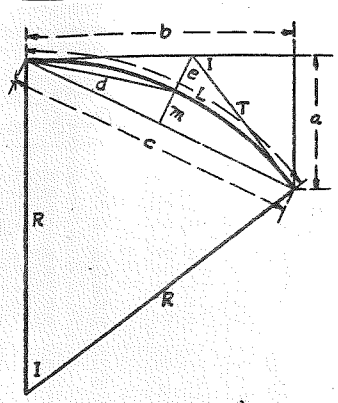


Table X

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

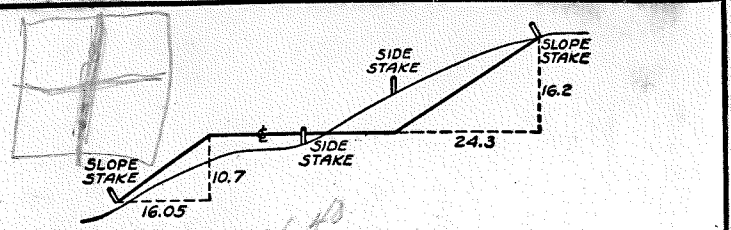
District	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
100	3.6	4.3	5.1	5.9	6.7	7.6	8.5	9.5	10.6	11.7
200	7.3	8.6	10.1	11.7	13.4	15.2	17.1	19.1	21.2	23.4
300	10.9	13.0	15.2	17.6	20.1	22.8	25.6	28.6	31.8	35.1
400	14.6	17.3	20.2	23.4	26.8	30.4	34.2	38.2	42.4	46.8
500	18.2	21.6	25.3	29.3	33.5	38.0	42.7	47.7	53.0	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
	60′	60′	50′	50′	40′	40′	30′	30′	20′	20′	10′	10′	
Deg.	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	cos	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
	60′	60′	50′	50′	40′	40′	30′	30′	20′	30′	10′	10′	
Deg.	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	cos	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 adjustmeat necessary.

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10

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EARGO
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