

Vol. 29

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning

Roadway 16 feet wide. Side Slopes 1 on 1.

For Single Track Embankment.

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

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

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Res " " 744

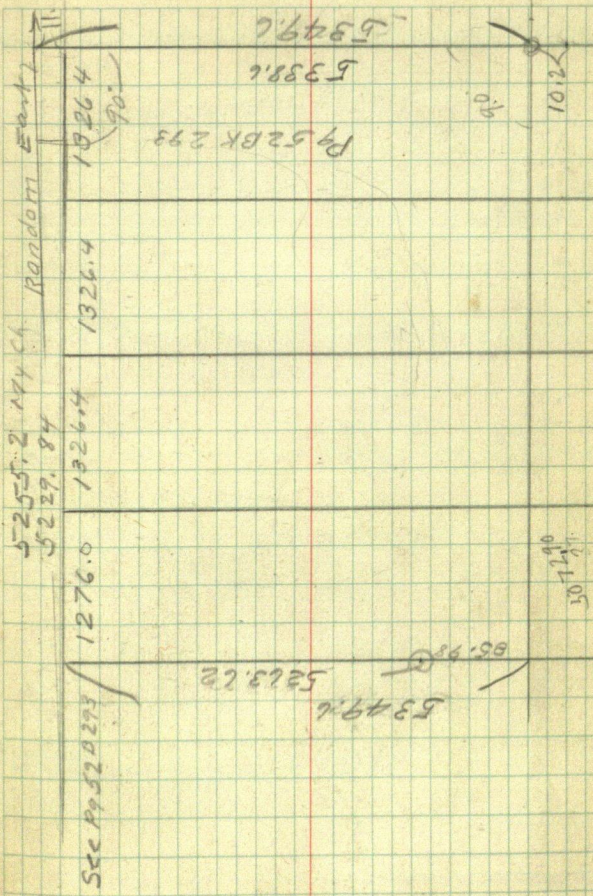
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2

5.2.6.3.6.2
5.3.5.4.2.1
5.2.4.3.2.2
5.9.0.6.2

5.3.5.4.2.4
5.2.6.3.0.2
5.2.9.0.6.2



Sec 6 T138. - 26
Kalri

5

Random 5255.2

5625-6
4000 $\frac{1}{4}$
VP2058 $1\frac{1}{2}$ E 54.12
" 8 N 81 W 54.78

85:98'

Random 5306.58

8

June 6

2100.2
339.8
2440.0

9

June 7-1950

Mike's Notes.

Otto & I check chain of lines
of section 6-138-26

beg @ I.M. Trp cor. NW cor sec
6-chain 5-300 + 224.6 hub
300 pin - 600 pin - 867.1 hub
900 pin 1200 pin 1291.25 hub
1500 pin 1800 hub 2100 pin
2100.2 hub offset E 35 ft.

Tower hub 1291.25 set hub
2100.2 duffles center

Tower 2100.25 BS N and Turn
L 35 ft.

Tower hub 35 ft east continue.
line south parallel to first transect
beg at offset hub chain south

339.8 hub = 2440 spike set hub
3356.7 - find hubs do not line
up. So L & R and continue

S with chain @ 3900 pin
on S road back 4148. old hub
4447.6 old hub @ 5280. shake
in bag quit for night

mike

10

June 9 1950

Mikes Notes

Otto + I

drive cars to End of E Wood
lake Lv cars Walk East
to Temp NE Cor Sec 6
beg a thapon Temp. Co. Line
11. ft N of NE corner check chain
old line South

@ 300 pin 493.65 hub @ 500 pin
800 pin 1100 pin. 1165.9 old hub -
1200 pin - 1500 pin 1800 pin
2086.0 hub 2100 pin 2400 pin
2640 hub 2700 pin 2847.8 hub
3000 pin 3200 pin 3500 pin
3600 pin 3900 pin 4200 pin
4228.05 hub - 4500 pin 4800 pin
5100 pin 5349.1 - 9.8 West of
SE Cor Sec. 6. @ 5359.8 hub

beg @ SE Cor Sec 6 chain
West @ 9.8 cross N4S random line
@ 300 pin @ 600 pin @ 900 pin 1200
pin 1320 stake not on line
1334.8 hub - 1500 pin 1624.6

Hub. @ 1800 min 2100 min 2400 min
2554.5 Hub 2700 min 3000 min
3300 min 3600 min 3900 min
4200 min 4260 min - 4560 min
4860 min sent for right

Mike

12

June 10th 1950

At over Hub, 4447.6 on Town
line see page 9 this book
BS N and. @ 5354.35 at stake
corner 31.2 ft E +
@ 5441.35, S to S line extended

We beg. 4860 W we continue
the south line of Sec. 6 West
@ 5044.9 old hub, @ 5160 min
@ 5281.2. W corrects N 87 ft +
@ 5312.4 intersect two lines
@ 5441.35 south

At 2100.2 San Range line
return Range line South

@ 299.8 min 2400 min + 268.85
@ 2668.85 Hub.

$$\begin{array}{r} 3230.75 \\ 368.15 \\ \hline 3598.90 \end{array}$$

$$\begin{array}{r} 2968.85 \\ 261.95 \\ \hline 3230.75 \end{array}$$

13

June 12th 1950 Monday.

Lx Walker in my car 6 o'clock
 drive to Mikes then on to 50 lakes
 store get lunch. drive to Wood
 lake Otto's car right behind me
 Mikes car ahead.

Crew

John Nygard

Mike Schulze

Otto Nelson

Harold Curo

Toren hub 2668.85 continue

W line see 6. 138-26 South

+ 300 min = 2968.85 + 261.95

3 230.75 hub 60° apik + 368.15

3 598.90 hub 60° apik + 397.3

3 996.20 hub 60° apik S side of

road.

Starts to rain hard at 2 o'clock

Otto goes home John & Mike

Leave @ 2-15. I follow Mike

to fifty Lake Store buy grub 1.89

get supper early and drive

back to Trailer House Playore

night at T. H.

Harold Curo

14
$$\begin{array}{r} 4727.75 \\ 301.4 \\ \hline 5029.15 \end{array}$$

$$\begin{array}{r} 4596.2 \\ 131.55 \\ \hline 4727.75 \end{array}$$

Tues. June 13th 1950

up Early Lv T.H. drive
to where we left off. yesterday
Mike + John get there the
same time I do. Otto get
there a little later.

Tower hub 3996.2

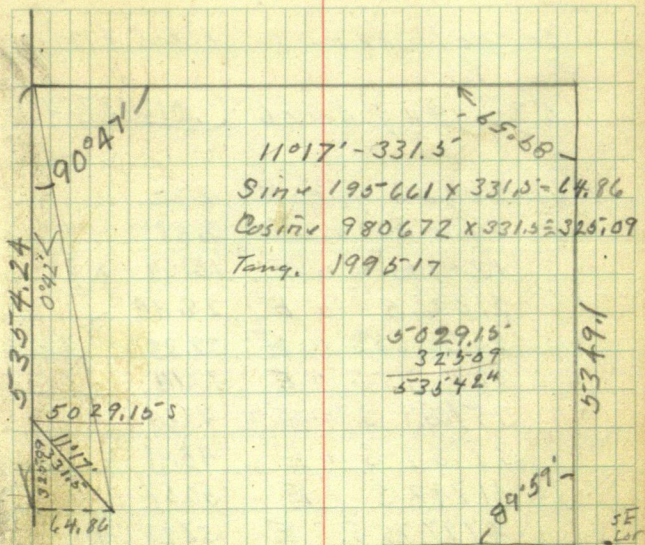
Side road, continue Range
line S. @ 4174.8 hub 60' spike
@ 4296.2 stake + 300 = 4596.2
stake + 131.55 = 4727.75 hub
at edge of big bog. + 301.4 = 5029.15
hub on island in big bog.

Tower 5029.15 corner bears

Left $11^{\circ}17'$ - 331.55

P.M.

Tower Twp Cor. Site South
on railroad and Turn
Left $90^{\circ}47'$ to hub on Temp
County line



Tower hub at SE Cor on
 cut out lines the SE Cor Sec 6
 bears S $89^{\circ}54'E$ 9.95
 We set a $2\frac{1}{2} \times 36"$ I M at pt for
 True SE Cor Sec 6 - 138-26

$11^{\circ}17'$

Sine $195661 \times 331.5 = 64.86$

Cosine $980672 \times 331.5 = 325.09$

16

See page 48

Correction for West line
see 6.

5354.24 / 64.86 (0.012113764

Hub 224.65 goes E 2.72

" 667.1 S " E 8.68

" 1291.25 S " E 15.64

" 2100.25 " E 25.44

" 2668.85 S " E 32.33

" 3230.75 S " E 39.14

" 3598.9 S " E 43.60

" 3996.2 S " E 48.41

" 4174.8 S " E 50.57

" 4727.75 S " E 57.27

" 5029.16 S " E 60.92

" 5354.24 S " E 64.86

32.43

2 / 5354.24 \ 2677.12 = $\frac{1}{4}$ 2 / 2677.12 \ 1338.56 = $N. \frac{1}{16}$ Goes E 16.21 to $\frac{1}{16}$ Cor

2677.12 +

1338.56 =

4015.68 = S $\frac{1}{16}$ Cor

5354.24 \ 4015.68 = Goes East 48.64

Page 48

See Page 48

32.43

Sec 31-139-26

5385.9

5255.2

2677.12

2676.92
0.02'

5272.3

0.02' Sec 6-138-26

2667.05

2680.96
0.06'

should be. 5278.24

5278.54

985.00

Correction East line
Sec. 6- 138- 26

page 10. this book says south
on Random line from Random
Town line @ 5349.1 hub

See page 15.

Over hub. 5349.1 cor set's

S $89^{\circ}54'E$ 9.95

= E $0^{\circ}06'S$

Sine $001745 \times 9.95 = .02$

Cosine $999998 \times 9.95 = 9.95$

$5349.12 \div 9.95 = 5376.0119 \approx 0^{\circ}06'$

hub	493.65	South goes	East	.92
"	1165.9	"	"	2.17
"	2086.	"	"	3.88
"	2640	"	"	4.91
"	2847.8	"	"	5.30
"	4228.05	"	"	7.86
"	5349.1	"	"	9.95

chained from a point 11 feet
N of NE Cor sec 6

$$5349.1 - 11 = 5338.1 \text{ Total Length of E line}$$

$$2 \overline{) 5338.1} \quad \underline{2669.05} = \frac{1}{4}$$

from Cor 11 ft South of Line

$$2 \overline{) 2669.05} \quad \underline{1334.525} = \frac{1}{2}$$

from Cor. 11 ft S. of Random Line

$$2669.05 +$$

$$1334.53 =$$

$$4003.58 = 5\frac{1}{16} + 11.5$$

dist. from Cor. 11 ft S of Ran. line

$$0^{\circ}42' =$$

$$\text{Sine } 0.12217 \times 2677.12 = 32.71$$

$$\text{Cosine } 999925 \times 2677.12 = 2676.92$$

$$\text{Tang } .012218$$

$$0^{\circ}06' =$$

$$\text{Sine } 0.01745 \times 2680.05 = 4.98$$

$$\text{Cosine } 999998 \times 2680.05 = 2680$$

$$\text{Tang } 0.01745$$

20

^{2 8}
26 77,12
1012113764

1070848
06272

^{4 3 2 4}
12113764

267712
24227528
12113764
84796348 8
84796348 9
7268,25,84 7
24227528 8

32429999

128635

3379
1624,25 1624,25
3649 220
198915 1863 05
53 8487765

2042,15 2620,34
1951060
1463295
975030
29265,90 14010
775530

1278110

E+W § Sec 6

775.95
223.4
229.5

June 14 1950 Wed
up early go to cabin
figure Otto John + Mike
come we go to hub 2677.12
S on Range line W side Sec.
6 - Tower 2677.12 Turn
90° and chain E 32.43 set
spike for $\frac{1}{4}$ cor in W wheel
fract of road.

At still at 2677.12 Turn
SE angle 90°47' parallel
to N line Then back 0°02' =
90°45' and run E on E+W §
Sec 6 our line cuts .42 N of
pt for $\frac{1}{4}$ cor @ 212.80 hub on
We have to offset 5'-S of true line
to get by 18" N.P. @ 512.80 stake
We set back on true random
as soon as we get by N.P. + 263.15 =
775.95 hub. + 223.4 = 999.35
hub 2 ft W of big 30" N.P. we
offset S 18" to get around N.P.
+ 287 = 1286.35 + 337.9 = 1624.25
hub.

H.J.C.

22

E + W $\frac{1}{2}$ Sect. - 138 - 26

June 14, 1950 Continue

 $1624.25 \text{ hub} + 220 = 1844$
E road. $1624.25 + 220 + 18.8 = 1863.05$ $\text{hub} + 1 = 1864.05 \text{ hub at}$
stake line E side road $1624.25 + 364.9 = 1989.15$ $\text{hub on brink} + 53 = 2042.15$ $\text{hub on stake line } 38 \text{ ft}$
W of water edge.

Otto leaves around 3 o'clock

E+W

44

3551.75 - 2702.8
107.2 = 3658.95
3658.95 - 3205.75 = 453.2

June 15th 1950 Thur

up early shave & have breakfast get stake rod & bolts. put them in the car. drive to where the road or street leaves the main road and wait for crew.

Otto bring out another man Bob Cocks

Over hub across bay. Take stake reading to hub 2042.15

Stake reads 5.91 to hub under. π 2633. Lake is 15 ft N + 80 W.

+ 155.3 = 2788.3 hub on stake line

+ 114.5 = 2902.8 hub, + 302.95 =

3205.75 hub on stake line - W side road

+ 36 = 3241.75 road 3205.75 + 46 =

3251.75 hub E side road

@ 3355 end of bay. @ 3551.75 stake

+ 107.2 = 3658.95 hub

3658.95 + 165 = entering

3658.95 + 255 = L.V. "

3658.95 + 300 = 3958.95 pin + 22.1

3981.05 hub + 8 to open pond

24

$$\begin{array}{r}
 4999.75 - 3981 \\
 170.85 - 319 \\
 \hline
 5170.60 - 4200
 \end{array}$$

Tower Lake on Hub Stads
 held on hub 3981.05
 reads 319 pond 10 ft W
 of hub. 4300 + 170 = 4470 extra
 top 4550 Lv drop @ 4600 pin
 @ 4600 + 99.75 = 4699.75 on top
 + 300 = 4999.75 + 170.85 =
 5170.60 hub

Tower hub 2640 S on West
 Line chain 40 ft set pt
 Tower pt Turn 90 and set
 pt $\frac{1}{4}$ H. 68 E.

Tower hub 5170.60 E on
 E & W BS W transit tilt &
 Turn R. $41^{\circ}54'$ - 136.50 to $\frac{1}{4}$
 Cor E side Rec. 6

This to $\frac{1}{4}$

N.P. 16 N $49^{\circ}E$ 12'39"

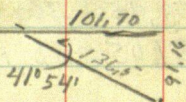
N 15 N $23^{\circ}45'W$ 45'39 $\frac{1}{4}$ "

24 5170.60

Sin = 667833 x 136.5 = 91.14

Cos = 744312 x 136.5 = 101.70

5170.60 + 101.70 =



June	Time Sheet		Kalvi Sec. 6-138-26										1950
	7	8	9	10	11	12	13	14	15	16	17	18	
					^{Sun} 0	1	1	1	1			0	
Harold Cunniff													
Mike Schulze	1		1	1	0	5	1	1	1			0	
John Nygard					0	5	1	1	1			0	
Otto Nelson	1		1	1	0	5	1	1	1			0	
Bob Cocks	-	-	-	-	0	-	-	-	1			0	

26

June 16th 1950 Fri

up early fig course or angle
to run S $\frac{1}{16}$ line sec. 6-138-24

Mr. Ke + John come at 8 o'clock
Otto + Bob a little later

Starts to rain we wait then
drive to hub 3996.2 on W side
sec. 6. π over 3996.2 chain
S 19.48. to 4015.68

π over 4015.68 B.S. S Turn Left
89°48' and run E on $\frac{1}{16}$ line
 π still @ 4015.68 Turn 90°
and run E 48.64 set spike
for S $\frac{1}{16}$ Cor W side sec. 6.
Continue our line S 89°48'E
it runs .25' S of $\frac{1}{16}$ Cor
@ 467.7 set hub then move
it N. 25' B.S. on $\frac{1}{16}$ & continue
S $\frac{1}{16}$ line E

Now S $\frac{1}{16}$ Take Ties

Brick 6. N 27°45'E 20.75

" 8 S 80°13'E 30.00

180-3.1
1 174.7

24.465
11 19.65
13.8365
1.20
1500.61

27

June 16th 1950

Continue E @ 300 stake + 167.7 =
467.7 hub. @ 600 stake @ 600.20 hub
close to brink + 280 = 880 stake +
170 = 1050 pin + 69 = 1119.0
hub. + 264.65 = 1383.65^{24.465} hub
+ 120 = 1503.65 pin + 102.7 =
1606.35 hub on W brink + 272 =
1878.35 hub + 200 = 2078.35 stake
+ 176.9 = 2255.25 hub +

28

Continue S $\frac{1}{4}$ line Sec 6

Monday June 19-1958

up early drive to Rio
River get 60th epoches \$1.10

drive to fifty Lakes get gunk
\$1.38 drive on to Cabin on

Wood Lake then back to S $\frac{1}{4}$
cor W side Sec 6-138-26

where Otto and Mike have
left their cars. I walk East
on S $\frac{1}{4}$ line to hub 2255.25 E
where I find Mike with Heller
T. Mike gives me his notes
for to day so far.

Mikes

Monday June 19th 1958

Otto Nelson, John Nygard
Bob Cocks + I Lr cañon Hwy
@ S E + W $\frac{1}{4}$ line walk E to hub

2255.25

Heller T @ hub 2255.25

B.S. West + run East 300

2225.25 + 300 = 2555.25 Mike

mike

I get here in time to help

Mike Chain - $2533.25 + 96.8 =$

2630.05 hub, $+300 = 2932.05$

stake $+ 240.65 = 3192.70$ hub.

@ 3232.05 stake $+ 180 = 3412$ stake

@ 3450 ender bag 3680 2nd bag.

@ 3712 stake $+ 6 = 3718$ hub. $+300$

4018 pin $+ 248.3 = 4266.3$ hub

$+ 441.2 = 4707.5$ hub.

June 20. 1950

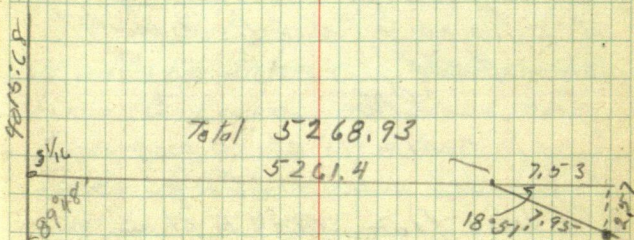
I Lv Otto's cabin on Wood Lake @ 7:53 drive S around Wood Lake find Otto & Mike's cars near E & W & see in Lv my car and walk S $\frac{1}{4}$ mile where I find Bob John Otto and Mike working
beg at hub 4707.5 chain E 143.2 To hub 4850.7 under T. (Heller)

T over hub 3989.3 S of pt 11 ft N of NE Cor. hub
chain S 25.28 to 4014.58
S of pt 11 ft N of NE Cor and 4003.58 S of corner pt for S $\frac{1}{4}$ cor.
Town 4003.58 S run E 7.47 to true $\frac{1}{4}$ cor.

Back on route near hub of S $\frac{1}{4}$ + E line Sec. 6

this intersection hub is
4012.05 S of pt 11 ft N of car
and 5261.4 E

Lower hub 5261.4 E on S Vic
line car sets R. $18^{\circ}51' - 7.95$ ft



$18^{\circ}51'$

$$\text{Sine } 923092 \times 7.95 = 7.57$$

$$\text{Cosine } 946368 \times 7.95 = 7.53$$

$$\begin{array}{r} 5261.4 \\ 7.53 \\ \hline 5268.93 \\ 5255.2 \\ 3 \overline{) 13.73} \quad 4.58 \\ \underline{12} \end{array}$$

$$\begin{array}{r} 5255.2 \\ 4.58 \\ \hline 5259.78 \\ 5244.36 \\ 4.58 \\ \hline 5268.94 \\ 5273.52 \end{array}$$

32 June 20-1950

Tie to S $\frac{1}{16}$ Cor bet 5-6
138-26

I try to fig. courses of
N&S lines of Acc 6 - hard to
do in field

P.M.

I go to cabin to check my fig.
Mike Bob John + Otto go to
S $\frac{1}{16}$ line from 4018 E chain xx
73.22 to 3944.78 E

Over 3944.78 BSW Turn
90°02' and run N0°02'E

From 3944.78 chain South
1.92 set pt for $\frac{1}{16}$ cor center
SE $\frac{1}{4}$ continue

N0°02'E on E $\frac{1}{16}$ line

@ 248.3 N hub chained from $\frac{1}{16}$ Cor.

At 248.3 continue N
until quitting time Mike

June 21-1950

as there is something
haywire with the lines
around the outside of Sec
6. I will have to re-run
them to find out. Otto says
No. I will run them or go
home

Otto & Bob continue E $\frac{1}{2}$ line
N. Mike John & I re-run Co.
line E from Twp Cor. 1 mile
N over spike at NE Cor Sec 6
Turn 90° and run South
1 mile to SE cor

Over SE intersection hub
BS North and run W- 90° to
hub on S line

34

June 22 1950

Otto and Bob come to cabin

Looking for Mike 7:57

I Lr Cabin drive E around S
 side of Lake to E & W $\frac{1}{4}$ line where
 I find Otto, Bob, Mike & John.
 I take John with me, Otto Bob
 and Mike continue E $\frac{1}{4}$ line
 N. John & I drive to S $\frac{1}{4}$ corner
 W side of Sec 6, where we correct
 the W line over at Hub 35989.5
 goes E 43.60 to true W. line Aug 6
 Town S $\frac{1}{4}$ W side Aug 6 Site N
 on true Sec line Turn R. $90^{\circ}55' =$
 $S 89^{\circ}05' E$ to true S $\frac{1}{4}$ line. $90^{\circ}53'$
 to random S $\frac{1}{4}$ line $S 89^{\circ}07' E$

574154
 487765
 1296.6
 $\overline{3}$
 2926590
 2926590
 4399883
 975530
 977650
 487765
 $\overline{1632436}$

Correction S $\frac{1}{16}$ line

35-

$$257 \div 5268.93 = .000487765$$

$$= 0^{\circ}$$

Hub 467.7 E goes S .23

" 600.2 E " S .29

" 1119.0 E " S .55

" 1383.65 E " S .68

" 1606.35 E " S .78

" 1878.35 E " S .92

" 2255.25 E " S 1.10

" 2652.05 E " S 1.29

" 3192.70 E " S 1.56

" 3718.0 E " S 1.81

" 4266.3 E " S 2.18

" 4707.5 E " S 2.30

" 4850.7 E " S 2.37

" 5261.4 E intersect East main
line @ 4012.05 S, chained from
point 11 ft N of NE corner goes
S 2.57

$$2620.34 \times .000487765 = 1.28$$

$$1296.6 \times .000487765 = .63$$

36 June - 22 1950

fig

OK.

	US.	US	US	US	Total Mych
Total US	1269.84	1320	1320	1320	5255.2
5229.84	1276.9	1326.4	1326.4	1326.4	OK
	My ch.	My ch.	My ch.	My ch.	

	US	US	US	US	Total Mych
Total US	1277.43	1320	1320	1320	5269.74
5237.43	1282.87	1325.62			

	US	US	US	US	Total Mych
Total US	1285.02	1320	1320	1320	5264.28
5246.02	1289.72	1324.86	1324.83	1324.86	

	US	US	US	US	Total Mych
Total US	1292.61	1320	1320	1320	5268.83
5252.61	1296.60	1324.08	1324.08	1324.08	OK
	My ch	My ch	My ch	My ch	

	US	US	US	US	Total Mych
US	US	US	US	US	5273.37
5260.2	1300.2	1320	1320	1320	
	1303.46	1323.30	1323.30	1323.30	

S. line of line 6

$$5273.37 - 5260.2 = 13.17 \text{ long}$$

$$13.17 \div 5260.2 = .002503707$$

$$1300.2 \text{ US} \times .002503707 = 3.26 = 1303.46 \text{ F}$$

nt. for cor.

$$1320 \text{ US} \times .002503707 = 3.30 + 1320 = 1323.30 \text{ F}$$

nt for cor on N45 &

June 22 - 1950

37

Fig.

S $\frac{1}{16}$ line Sec 6

$$5268.83 \text{ Mych} - 5252.61 \text{ US} = 16.22 \text{ Long}$$
$$16.22 \div 5252.61 = .003087988$$

$$1292.61 \text{ US} \times .003087988 = 3.99 + 1292.61 =$$
$$1296.60 \text{ E to point for W } \frac{1}{16} \text{ cor on S } \frac{1}{16} \text{ line}$$
$$1320.45 \times .003087988 = 4.08 + 1320 =$$
$$1324.08 \text{ pt for S } \frac{1}{16} \text{ cor on N + S } \frac{1}{2}$$

E + W $\frac{1}{2}$ Sec 6.

$$5264.28 \text{ Mych} \div 5245.02 \text{ US} = 19.26 \text{ long}$$
$$19.26 \div 5245.02 = .003672054$$
$$1285.02 \text{ US} \times .003672054 = 4.72 + 1285.02 =$$
$$1289.72 \text{ E pt for W } \frac{1}{16} \text{ cor center W } \frac{1}{2}$$
$$1320.45 \times .003672054 = 4.85 + 1320 = 1324.85$$

center of sec. E + W

N $\frac{1}{16}$ Line

$$5259.74 \text{ Mych} - 5237.4345 = 22.31 \text{ Long}$$
$$22.31 \div 5237.4345 = .004259722$$
$$1277.4345 \times .004259722 = 5.44 + 1277.43 =$$

pt for cor center NW $\frac{1}{4}$ Sec 6 1282.87

$$1320 \times .004259722 = 5.62 + 1320 = 1325.62$$

pt for cor center N $\frac{1}{2}$ sec 6

38

June 22 1968

U.S. Ch

1269.84	1320	1320	1320
	5229.84		

1277.43	5237.43		
---------	---------	--	--

1285.02	5245.02		
---------	---------	--	--

1292.61	5252.61		
---------	---------	--	--

1300.2	1320	1320	1320
	5260.2 U.S.		

 $5273.37 \text{ Mych} - 5260.20 \text{ U.S.} =$
 13.17 long
 $13.17 \div 5260.2 = .002503707$
 $1300.2 \times .002503707 = 3.26 +$
 $1300.2 = 1303.46$

June 22 1950

39

5229.8445ch

3928.8 E

1276

2602.4

1276.00

1326.4

1326.4

1326.4

My ch.

5255.2 mych

5259.74

5264.28

5264.28

389° 05' E

True

5268.83

1303.46

1323.30 $\frac{1}{3}$

1323.3 $\frac{1}{3}$

1323.30 $\frac{1}{3}$

2626.76

5273.87

3950.07

$1320 \times .002503707 = 3.30 + 1320 =$

1323.30

40

June 22-1958

N. 111° E

0°07'

0°07'

Sine 002036 x 5255.2 = 10.70

Cosine 999998 x 5255.2 = 5255.18

1276.1 } 215.9 N

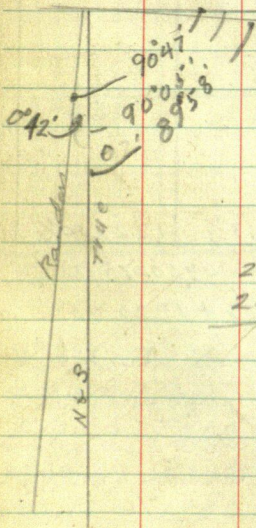
2602.4 } x 002036 = 5.30 N

3928.8 } 8.00 N

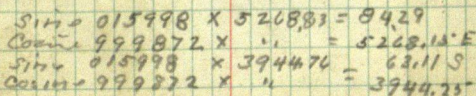
1276	} x 999998 =	1276.00	E
2602.4		2602.39	E
3928.8		3928.79	E

Random

0°07'


~~2832.05~~
~~2620.34~~
~~31.71~~

41



42

June 22-1950

Mike's notes on E $\frac{1}{4}$ line

Bob & Otto - Mike bog @ hub

248.3 continue E $\frac{1}{4}$ line N $+ 300 = 548.3 + 300 = 848.3 +$ $130. = 978.3 \text{ hub} + 140 + 280$ $= 1298.3 \text{ stop @ } 1030 \text{ enter bog}$

@ 1268. Lv bog (wet) @ 1306.4 N

hub intersection hub

1304.85 N and 3976.05 E

Tower $1306.4 + 300 = 1606.4 + 193.15$ $1799.55 \text{ hub} + 300 = 2099.55 +$ $230.5 = 2330.05 \text{ hub} + 297.5 =$ $2627.55 \text{ hub} + 90 = 2717.55 \text{ stop}$

@ 2720 enter bog @ 2930 Lv bog

 $2717.55 + 230 + 173 = 3120.55$

hub on bank N of road @ 310.2 ft

road Tower 3120.55 old Back

lot line Sta 52 bears N $68^{\circ} 51' E$

9.65 ft. continue cutting

line to lake do not chain

quit @ 5-P.M.

2473
N 5 1/4

11361
1838
1319.7

761.6
199.6
961.2
174.9
1136.1

43

June 23-1950

Mike-John + I drive E around
S side of lake Lr cars do not
wait for Otto walk S

Tower hub 2652.05 chain
W 31.71 to 2620.34 E

Tower 2620.34 E BS S 89°05' E
and run N 0°16' N

Otto & Bob arrive later

N @ 400 stake + 61.6 = 461.6 hub.
+ 300 = 761.6 stake + 199.6 = 961.2 N
hub + 174.9 = 1136.1 hub on stake
line @ 1118. & road.

1136.1 + 183.8 = 1319.9 about 4 ft to
water

Bob Cocks cut his leg around
Hocklock. - I go to trailer house and
get tap + Bandage for it

We drop this line for now it
hits a point of land over lake
We will start the W 1/4 line
Mike can finish this line
later

Harold Cline

44

$$\begin{array}{r} 574.6 \\ 128.75 \\ \hline 703.35 \end{array}$$

June 23-1958 Friday
P.M.

We go to SW $\frac{1}{4}$ corner = center
SW $\frac{1}{4}$. Tower 1383.65 chain
W 87.05 to 1296.6 E

Tower 1296.6 E BS N 89° 07' W
and run N 0° 18' W

from hub 1296.6 E we chain
5.63 set point for $\frac{1}{4}$ center SW $\frac{1}{4}$
run N 0° 18' W @ 164.6 hub, + 70 =

234.6 center bog, + 340 =

574.6 stake over bog, + 128.75 =

703.35 hub, + 300 = 1003.35

stake + 77.8 = 1081.15 hub, +

278.75 = 1359.9 spike hub at

intersection of Random E & W E

1289.40 E of W seen line

1359.9 + 300 = 1659.9 stake + 76 =

1735.9 hub

$$\begin{array}{r} 2208.45 \\ 300.4 \\ \hline 2508.85 \end{array}$$

$$\begin{array}{r} 1815.9 \\ 360.9 \\ \hline 2175.9 \end{array}$$

45-

June 24, 1950

Harb + I go to Brainerd

June 26 - 1950 Monday
in office at Walker in A.M.
rains so do not go to Wood Lake

June 27 - 1950

I pick up Mary at Walker
drive to Pine River where we
get breakfast. 9a drive to
green house to Mary drive on
to Wood Lake. arrive @ 8:30.

find Mike, Otto John + Bob
on W. side line.

Mikes notes Tower. 1735.9
cause hub to be set over lake +
bog. beg. @ hub 1735.9 chain N.
@ 1815.9 stake @ 1825 enter bog.
@ 2155 Lr bog. @ 2175.9 stake + 32.55
2208.45 hub. + 300.4 = 2508.85 hub. +
278.85 = 2787.7 hub. + 300 = 3087.7
stake + 105.2 = 3192.9 hub + 300 =
3492.9 stake

46

June 27 1950

P.M.

Mike Otto and Bob continue
W $\frac{1}{4}$ line N from stake 3492.9 +
287.6 = 3780.5 hulk on stake
line N side Road, @ 3762 \pm road
X over 3780.5 B.S.S. Back set line
sta sets E 8.8 ft Sta ④

set double center on N side Co. line
set one on line on S side of Co. line
X over 261.45 E of W wood lake
B.S. E on on Random Co. line

set Pt at intersection of W $\frac{1}{4}$
line + Co. line from 3780.5
chain 160 = 3940.5 but at
intersection

from 261.45 chain E 71.9
to intersection = 333.35 E of W
Wood Lake,

P.M.

John + I rough chain son
range line from Twp Cor. to hut
marked 2640 we do not get that
so we rechain this N $\frac{1}{2}$ + cut

$$\begin{array}{r} 2300.25 \\ 270 \\ \hline 2570.25 \\ 11.35 \\ \hline 2581.60 \end{array}$$

$$\begin{array}{r} 1167.1 \\ 223.85 \\ \hline 1390.95 \\ 9.15 \\ \hline 1400.10 \end{array}$$

$$\begin{array}{r} 1890.95 \\ 109.3 \\ \hline 2000.25 \end{array}$$

$$\begin{array}{r} 1590.95 \\ 91.5 \\ \hline 1600.10 \end{array} \quad 47$$

out the brush. Otto John + Bob

cut brush Mike + I chain

From Trip cor. South @ 224.4 ^{old} hub

$$+570 = 274.4 \text{ pin} + 300 = 574.4 + 11.70 =$$

$$586.1 \text{ old hub} + 81 = 667.1 + 200 =$$

$$867.1 \text{ pin} + 200 = 1067.1 + 223.85 =$$

$$1390.95 \text{ old hub} + 300 = 1690.95 \text{ pin}$$

$$+ 9.15 = \cancel{1599.95} = 1600.10 \text{ old hub}$$

$$1590.95 + 300 = 1890.95 \text{ pin} + 109.3$$

$$2000.25 \text{ diff. hub} + 300 = 2300.25$$

$$\text{pin} + 270 - 1.35 = 2578.90 \text{ hub old}$$

hub marked 2640

$$2578.9 + 8.7 = 2587.6$$

$$2568.8$$

N.G.

48

June 28 1950

Otto Mike & Bob go continue
N+S & N

John goes with me we

Re-chain N $\frac{1}{2}$ mile W side Sec 6

@ 224.4 hub @ 300 pin @ 600 pin

900 pin 1200 pin + 91 = 1291. hub

@ 1500 pin @ 1600 hub @ 1800 pin

@ 2100 pin @ 2400 pin N edge ^{old} road

+ 168.8 = 2568.8 to Mike's hub

marked 2668.85

Correction West line Sec 6

5235.54 S. Cor sets E 64.86,

$64.86 \div 5235.54 = .012341262 =$

$0^{\circ}42'$

@ 1313.85 S goes E 16.21 to N $\frac{1}{16}$ W side 6

26 27.7 S goes E 32.43 to $\frac{1}{4}$ Cor W side Sec 6

39 46.53 S " E 48.64 to $\frac{3}{16}$ " W. " " 6

52 54.24 S " E 64.86 to NW cor Sec 6

I send John to help

Mike Otto & Bob,

Mikes Notes

beg @ 1319.9 N hub on stak

June 28-1950

Line - Continue N+S & North
intersect E+W @ $1386.53^{\circ}N$
and $26.20.75^{\circ}E$. Set hub over
lake on point 3 ft W of water
60 ft across point - set hub
over lake on next point
102. N of shore Lake 73 ft East
@ 263.7 hub Lake 88 ft E
@ 324.53 hub on seawall
Lake 34 ft N.

I try to figure correction
over since we found 100 feet
difference in $N \frac{1}{2}$ Mile W side to
P.M.

Mike and Crew go run $N \frac{1}{4}$
line

50

June 29 - 1950

Mike + John start work
continuing N 1/4 line West
Otto + Bob does not come
until later.

I work on fig. next page

S $\frac{1}{16}$ line

57

June, 29, 1950

figuring. The SE $\frac{1}{16}$ Cor
Center SE $\frac{1}{4}$. old Notes say
Tower 3944.78 run N $0^{\circ}02'E$
run S. 192 set out for $\frac{1}{16}$ cor Center SE $\frac{1}{4}$
Note: 3944.78 E goes E 2.63 ft
and Then S 8.20 ft to True $\frac{1}{16}$ Cor
Center SE $\frac{1}{4}$.

old notes page 43 this book says
Tower 2652.05 chain W 31.71 to hub
2620.34. then 1.28 correction on
page 35 this book.

Note 2620.34 E goes E 2.07 to
2622.41 E and south 13.84 to
True $\frac{1}{16}$ cor Center S $\frac{1}{2}$ Sec 6

W $\frac{1}{16}$. Old notes page 44 this book
says. Tower 1383.65 E chain W
87.05 to hub 1296.6 Then S. 63
to $\frac{1}{16}$ center SW $\frac{1}{4}$.

Note: 1296.6 E goes E .78
to 1297.38 Then south 19.48
to true $\frac{1}{16}$ cor Center SW $\frac{1}{4}$

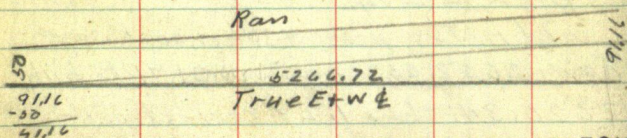
Main.

True
Correction .004254173 + 2.57

52 E & W $\frac{1}{4}$

June 29 1950

as the E & W $\frac{1}{4}$ was started
50 ft N of where it should
have been because of mistake
in Otto & Mikes chaining We
hit out 91.16 ft to far N on E side
Sec. 6.



Corrections $91.16 \div 5266.72 = .00781511$
+ 50 feet.

$1290.25 \times .00781511 = 10.08 + 50 = 60.08$ S
to W $\frac{1}{4}$ Center W $\frac{1}{2}$ Sec. 6.

$2615.74 \times .00781511 = 20.44 + 50 = 70.44$ S
to Center Sec. 6.

$3941.23 \times .00781511 = 30.80 + 50 = 80.80$ S
to center E $\frac{1}{2}$ Sec 6

$5266.72 \times .00781511 = 41.16 + 50 = 91.16$ ft S
to $\frac{1}{4}$ on E side Sec. 6

@ $2042.75 \times .00781511 = 15.96 + 50 = 65.96$

5278.45

54

July 5-1950

I drive To wood lake
find no one stay at
cabin Otto comes at
5. says he left two
men working some
dam place

Correction E line Sec 6
525424 into 64862

July 6-1950

Mike John - Bob + I

Tower I-M-239-? Silo won
90° and run. S 44° 24' E 195.85
to big spike. Continue S 44° 24' E +
332.35 = 528.20 to Sta ① Dip.

Tower Sta ① 528.20 B.S. N 44° 24' W
and run S 18° 30' E 215.4 to Sta-2
stake marked 743.6

Tower Sta-2 B.S. N 18° 30' W on stat-
run. N 59° 01' E 96.6. to Sta ③

T still @ Sta 2 run S 14° 01' W 93.34
spike on S side st. E side Road.

Tower Sta 3. angle of Road 160° 28'
÷ 2 = 80° 14' sine = 985507 into
66 = 66.97

Tower Sta 3 B.S. S 59° 01' W and run
N 39° 28' E 320.1 Sta ④

T over 4 B.S. S. 39° 28' W - run N 37° 09' E
ang made 177° 40' ÷ 2 = 88° 50'
sine = 999793 into 66 = 66.01

Tower Sta 4 B.S. S 39° 28' W run
N 37° 58' E 292.9 to Sta 5

56

10.5"

July 6 1950

Tower Sta 5 B.S. S $37^{\circ}58'W$
 run S $52^{\circ}29'E$ 180.5 old Sta (4)

SW Cor of lot 8 bears

N $43^{\circ}35'E$ 74.2

ang. $90^{\circ}28' \div 2 = 45^{\circ}14'$

Sine = 709981 into 92.96

Calc sine = 704221 " = 93.72 L

Tower old Sta 4

B.S. N $52^{\circ}29'W$ on Sta 5^{old}
 run S $75^{\circ}28'E$ 100 to Sta 7

ang. $157^{\circ}01' \div 2 = 78^{\circ}30\frac{1}{2}'$

$78^{\circ}30'30'' = \text{sine} = 979896$

into 66' = 67.35

Tower old Sta 7 angle $159^{\circ}32'$

$\div 2 = 79^{\circ}46'$ sine = 984092 into

66' = 67.07.

At still @ old Sta 7 B.S. N $75^{\circ}28'W$
 and run N $84^{\circ}04'E$ 125 to old Sta 8

Tower old Sta 8 B.S. S $84^{\circ}04'W$

run N $55^{\circ}04'E$ 220 to Sta (9)

Ang. $150^{\circ}59' \div 2 = 75^{\circ}29\frac{1}{2}'$

Sine = 968111 into 66 = 68.17 ft.

Over old Sta 9 ang. $154^{\circ}02'$
 $2 = 77^{\circ}01'$ Sine 974435 into 66' =
 67.73

Over old Sta 9 B.S. $53^{\circ}04'W$ run
 $N 81^{\circ}01'E 125$ to sta 10 old.

58

July 7-1950

Mike + John arrive @ 800

We drive to Sta 10-Old

T over Sta 10 Take angle

$152^{\circ} \div 2 = 76^{\circ}$ sine 970296
into 66 = 68.02

T over old Sta 10 BS. $S 81^{\circ} 01' E$ hub
on Co. line random bears $N 6^{\circ} 11' W 30.75'$
run $S 70^{\circ} 58' E$ 100 to old Sta 11

T over old Sta 11 BS $N 70^{\circ} 58' W$ on 10
and run $S 43^{\circ} 28' E$ 125 to old 12

T still @ 11 take angle $152^{\circ} 30' \div 2 =$
 $76^{\circ} 15'$ sine = 971342 into 66 = 67.95

T over old Sta 12 Take angle $160^{\circ} 30'$
 $\div 2 = 80^{\circ} 15'$ sine 985556 into
66 = 66.97

T still at Sta 12. BS $N 43^{\circ} 28' W$ and
run $S 23^{\circ} 57' E$ 100 to Sta Old 13.

T over old 13 BS $N 23^{\circ} 57' W$ and run
 $S 7^{\circ} 57' E$ 100 to old. 14

π still @ 13 Take angle. $164^{\circ} \div 2 =$
 82° Sine 990268 into 66 = 66.65

Now old 14. Take angle. $154^{\circ} 01'$
 $\div 2 = 77^{\circ} 00' 30''$ Sine 974402 into 66 =
 67.73.

π still at 14 BS N $7^{\circ} 57' W$ and run
 S $18^{\circ} W$ 100' to Sta 15 old.

Now Old Sta 15. BS N $18^{\circ} E$ and run.
 S $2^{\circ} 27' W$ 100. to old Sta 16-

Take angle. $164^{\circ} 28' \div 2 = 82^{\circ} 14'$
 Sine 990827 into 66 = 66.61

π over 16 Take angle. $167^{\circ} 57' \div 2 =$
 $83^{\circ} 58\frac{1}{2}'$ Sine 994461 into 66 =
 66.37

π still @ old Sta 16 BS N $2^{\circ} 27' E$ and
 run. S $9^{\circ} 35' E$ 300 to Sta 17 old.

Now old 17 BS N $9^{\circ} 35' W$ and run
 S $30^{\circ} 02' E$ 100 to old Sta 18

π still @ 17 take angle. $159^{\circ} 33' \div 2 =$
 $78^{\circ} 46\frac{1}{2}'$ Sine 980870 into 66 = 67.29

Over Old Sta 18 Take angle
 $155^{\circ}30' \div 2 = 77^{\circ}45'$ sine

977231 into 66 = 67.64

Still @ 18 B S N $30^{\circ}02'W$ and
 run S $54^{\circ}31'E$ 150 to Old Sta 19

Over Old Sta 19 B S N $54^{\circ}31'W$
 and run S $43^{\circ}32'E$ 250 to old
 Sta 20

Take angle $169^{\circ} \div 2 = 84^{\circ}30'$
 sine 995396 into 66 = 66.31

Over Old Sta 20 Take angle
 $140^{\circ}34' \div 2 = 70^{\circ}17'$

sine 941372 into 66 = 70.11

Still at old 20 B S N $43^{\circ}32'W$ and
 run S $54^{\circ}07'E$ 52.9 to (Sta 20+)

Over Sta 20+ B S N $4^{\circ}07'W$ run
 S $34^{\circ}01'W$ 52.9 to old Sta 21

Take angle $141^{\circ}51' \div 70^{\circ}55\frac{1}{2}'$
 sine 945091 into 66 = 69.83

Over old Sta 21 Take angle
 $129^{\circ}32' \div 2 = 64^{\circ}46'$ sine 904579

into 66. = 72.96

Over Sta 21 BS N $34^{\circ}01'E$ and run
S $84^{\circ}28'W$ 275 to old Sta 22

Over Sta 22 BS N $84^{\circ}28'E$ and
run S $55^{\circ}27'W$ 100 ft to Sta 23.

Over 22 Take angles. $150^{\circ}59' \div 2 =$
 $75^{\circ}29\frac{1}{2}'$ sine 968111 into 66 = 68.17

At station Sta 22 - hub 2095.6
E of N $\frac{1}{4}$ Cor W side sec. 4 bears
S $52^{\circ}50'W$ 16.1 ft.

Over Old Sta 23 BS N $55^{\circ}27'W$
and run S $43^{\circ}58'W$ 200 to old 24

Take angle $168^{\circ}31' \div 2 = 84^{\circ}15'$
sine 994969 into 66. = 66.33

Meet Otto at intersection on Pine
River Cross Lake road # 50 Lake road
with our chicks

I get 9225 - 9 days.

Continued on page 71

July 10 1950 Monday

I Lr Walker stop at Pine
River get 60¢ apibus 1.10
get Cig. + Breakfast

drive on to Wood Lake where
I find Mike + John working
on N $\frac{1}{4}$ line

Otto + Bob do not show up

I work in cabin Mike + John
finish running N $\frac{1}{4}$ line + seal
and come to cabin where we
eat our lunch. I eat all of Johns
fish, he should bring more if he
wants any.

PM

Mike + John with W. N. T go
to West side of Wood Lake on Ca.
line and run lake shore

Mike + John come in at 3 PM.

I Lr at 5:05 drive to Walker
82 for Gas Pine River

Otto + Bob do not show up.

July 11-1950

I Lr Court house at Walker at
7-05 drive to Wood Lake Gas
1.00 at Pine River. Arriv at
Cabin on Wood lake at 8-10.

Mike & John go continue Lake
shore.

Otto & Bob come late go
to help Mike

I work on plat. Herts Brothers
& Sisters Lr for home to day
Some to Chicago some to Goodman
Wis.

Mike's Notes for July 10-1938

Meet Harold at cabin @ noon

P.M.

John & I take Warren-Knight π
drive in on south road to nearest
point of Col. line entering lake to return
lake shore lot line

π over I.M. at lot stake 73 B.S.
west on I.M. on true Col. line plate
set on 90° run.

S $17^\circ 02' E$ 221 ft to old hub

Over old hub run S $15^\circ 27' E$ 244.9
to hub - 465.9

Over 465.9 run S $11^\circ 28' W$ 295.4
to hub 761.3

Over 761.3 run S $42^\circ 19' E$ 275.4
to hub 1036.7

Over 1036.7 run S $71^\circ 30' E$ 257.45
to hub 1288.15

Mikes Notes for Tue July 11-1930
A.M.

A. M.

John + I go back to lot line hub

1288.15-

Tower Sub. 263.7 N of lake on N45 E
entirely. Lake shore line with @
@ 1244.25 @ 293.6 N of lake on E

Tower hub 12 88.13-13 S 71° 30' W

1417. S 14° 04' W 194. To but 1482.15

Tower 1482.15 @ 1456.85 ft on lot
two intersection N + S & — N of Lake
T still at 1482.15 RHH S 15° 38' W
242.4 to hub 1724.55

@ 15-98.2 ft intersects N $\frac{1}{4}$ 10th

@ 25-71, 35-E

T over 1724.55 - 4m S 8° 14½' E
255.2 to hub. 1979.75-

π over 1979. 75-hub 549°51'W
N6.2 to hub 2095.95°

Tower 2095.93 - hub. N 15° 28' W
158.85 to hub. 2254.8
quit for dinner

66

July 11-1950

T over 2254.8 run N $14^{\circ}12'W$
192. to hub 2446.8

T over 2446.8 Needle reads 6-30
run S $49^{\circ}34'W$ 480.5 to hub 2927.3

T over 2927.3 run N $81^{\circ}30'W$
220.7 to hub 3148.00

T over 3148.00 run S $44^{\circ}28'W$
207.95 to hub 3355.95

T over 3355.95 run home

July 12-1950

John + Mike continue lake
shore Otto + Bob pick rocks
Mikes Notes

Tower 3355.95 run $S 18^{\circ} 58' E$
213. to hub 3568.95

Tower hub 3568.95 run
 $S 56^{\circ} 45' E$ 284.3. to hub 3853.25

Tower 3853.25 run. $N 80^{\circ} E$
165.4 to hub. 4018.65

Tower 4018.65 run. $N 82^{\circ} 20' E$
99.05 to 4117.7

Tower 4117.7 run $S 26^{\circ} 44' W$
58.1 to hub. 4175.8

Tower 4175.8 run. $S 25^{\circ} 04' W$
388.65 to hub at intersection
of E + W \perp at 4564.45 on lat line
and 2042.75 E on \perp

T still over 4175.8 continue
 $S 25^{\circ} 04' W$. 47.4 = 436.05 to
hub. 4611.85

T over 4611.85 run. $S 3^{\circ} 45' W$
243.9 to hub 4855.75

@ 4611.85 Lake L 50 ft. + 100
Lake L. 55.

68

Tower 4853.75 Lake N 30° E
88 ft. run. N 70° 01' E 298.15
+ 43.4 = 341.55 to 5197.3
+100 Lake 112 L. 30 ft. 4853.75
+ 200 Lake L 50

Tower 5197.3, continue
N 70° 01' E 202.2 to hub
5399.5 @ 5197.3 lake 50 L
+100 - Lake 80 L

July 13-1950

I work on plot Bob cuts weeds
Mike + John Continue Lake
shore Otto does not come

Mikes Notes

From hub 5399.5 run $N68^{\circ}30'E$
103 to intersection of shore line
with random N + S \angle @ 1318.6 N
and 5502.5 along stake line
Continue shore line $N68^{\circ}30'E$
+ 121.45 to hub 5623.95

@ 5399.5 Lake lies 80 ft Left

" 5502.5 " " 70 " "

From hub 5623.95 run $N70^{\circ}10'E$
@ 54.1 intersection hub on E + W
 \angle @ 2784.75 E and 5678.05 along
shore line + 102.6 set hub
5780.65 on shore line

@ 5623.95 Lake lies 40 ft Left

@ 5678.05 " " 40 " "

From 5780.65 Lake lies
 $N20^{\circ}W$ 30 ft

run $N70^{\circ}30'E$ 142.4 to hub
5923.05

@ 5850 Lake lies 40 ft Left

July 13-1950

T over 5923.05 Lake lies
N 20° W 30 ft run N 43° 20' E
259.3 to hub 6182.35

@ 5971 cross small creek
running NW + SE

@ 6000 Lake lies 35 ft left

@ 6100 " " 25 " "

T over hub 6182.35 lake
lies N 53° 20' W 40 ft

run N 20° 40' E 276.5 to
hub 6458.85

@ 6300 ft lake lies 30 ft left

@ 6400 " " 10 " "

@ 145 " 6337 ft enters
bog.

Set temp hub 186.8 or

6369.15 set on rock reef
in bog for purpose of taking
stadia heading of bog.

@ 210 Lv bog.

T over hub 6369.15 Take
stadia of bog N 66° E 40 - N 90° E 70
S 56° E 85 - S 43° 30' E 105 - S 20° E 160
S 10° E 210 - South 240 - S 9° W 80
bog completed time 4.52 quit

July 14-1950

Mike and John arrive around 8 - Otto + Bob right behind them

Otto goes far. stakes Bob cuts weeds

I go with Mike + John. We work on road line. We drive South road around lake to old Sta 24 see page (61) this book

Turn Sta 24 B.S. $N 43^{\circ} 58' E$ and run. $S 64^{\circ} 29' W$ 300 to 25

Take angle $159^{\circ} 30' \div 2 = 79^{\circ} 45'$
Sine 984041 into 66 = 67.07

Turn Sta 25 Take angle $139^{\circ} 32' \div 2 = 69^{\circ} 46'$ sine 938292 into 66 = ~~67.12~~ 7034

Still at 25 B.S. $N 64^{\circ} 29' E$ and run $S 24^{\circ} 01' W$ 100 to old Sta 26

Turn old 26 B.S. $N 24^{\circ} 01' E$ and run. $S 6^{\circ} 29' E$ 175 to Sta 27

Take angle $149^{\circ} 30' \div 2 = 74^{\circ} 45'$
Sine = 964787 into 66 = 68.41

Turn over old Sta 27 BS N $6^{\circ}29'W$
and run S $15^{\circ}55'E$ 250 to
old Sta 28.

Take angle $170^{\circ}33' \div 2 =$
 $85^{\circ}16\frac{1}{2}'$ sine 996602 into 66 =
66.23 in bog.

Turn over old 28 BS N $15^{\circ}55'W$
run S $28^{\circ}26'E$ 300 to 29

Take angle $167^{\circ}30' \div 2 = 83^{\circ}45'$
sine 994056 into 66 = 66.39

Turn over old 29 BS N $28^{\circ}26'W$
and run S $23^{\circ}24'E$ 100 to
old Sta 30

Take angle $175^{\circ}02' \div 2 =$
 $87^{\circ}31'$ sine = 999061 into 66 =
66.06

Turn over old Sta 30 BS N $23^{\circ}24'W$
and run S $9^{\circ}26'E$ 250 to old
Sta 31

Take angle $166^{\circ}01' \div 2 = 83^{\circ}00\frac{1}{2}'$
sine 992546 into 66 = 66.5

July 14-1950

P.M.

T over old Sta 31 BS N $9^{\circ}26'W$
 set up at intersection of E & W

☉ 77.2 ft S of Sta 30 + 1863.45 E on ☉
 runs $8^{\circ}10'E$ 200 ft to old Sta 32

Take angle $178^{\circ}44' \div 2 = 89^{\circ}22'$ since
 999939 into 66 = 66.00

T over old Sta 32 BS N $8^{\circ}10'W$ run
 S $64^{\circ}26'E$ 100 to old second Sta 32

Take angle $123^{\circ}44' \div 2 = 61^{\circ}52'$
 since 881853 into 66 = 74.84

T over old Sta 32* BS N $64^{\circ}26'W$
 run S $75^{\circ}24'E$ 100 Sta 33

take angles $169^{\circ}02' \div 2 = 84^{\circ}31'$
 since 995424 into 66 = 66.30

T over old 33 BS N $75^{\circ}24'W$
 and run S $87^{\circ}54'E$ 100 to old 34

Take angle $167^{\circ}32' \div 2 = 83^{\circ}46'$
 since 994088 into 66 = 66.39

Tower 34 BS N $87^{\circ}54'W$
 run N $70^{\circ}36'E$ 100 Sta 35
 Take angle. $158^{\circ}30' \div 2 = 79^{\circ}15'$
 sine 982450 into 66 = 67.18

Tower Sta 35 BS S $70^{\circ}36'W$
 and run N $59^{\circ}46'E$ 200 to 36
 Take angle $169^{\circ}12' \div 2 = 84^{\circ}36'$
 sine 995562 into 66 = 66.29

Tower Sta 36 BS S. $59^{\circ}46'W$
 and run N $67^{\circ}35'E$ 300 to Sta 37
 Take angle. $172^{\circ}11' \div 2 = 86^{\circ}05\frac{1}{2}'$
 Sine 997674 into 66 = 66.15
 @ 151.1 intersect N+SE @ 1136.1 N of random S 46

Tower old 37 BS S $67^{\circ}35'W$
 and run N $67^{\circ}06'E$ 200 to 38
 Take angle $179^{\circ}31' \div 2 = 89^{\circ}45\frac{1}{2}'$
 sine 999991 into 66 = 66.00

Tower 38 BS

July 17 - 1950

rains I stay in Walker work in
office

Mike + crew do not work

July 18 1950

I & Walker get to Wood Lake
at 10 o'clock

Mike & Otto with John & Bob
work on road from sta 19 to 22

From 19 run. $S 43^{\circ} 32' E 227.25'$

From 22 run $N 84^{\circ} 28' E 265.05'$

I fig pt for IM on E & W &

Sec. 31 - Viz @ 1298 E on E goes N. 64

hub 2621.2 E goes N 1.30 center 31

" 3944.4 E " N 195

5256.55 E goes N 2.6 then E 12.4 to
 $\frac{1}{4}$ on E. side 31.

at 1312.1 N on E line Sec 31 goes E 6.2

@ .00 on cor line goes S. 11 feet to
SE cor Sec 31.

Mike Otto & John take IM
and set same in P.M.

rains Mike's Notes

Aug 18. After noon start mon.
corners. Drive 2X24" pipe @ corner
to Sec. 30-25-31-36-139-26-27

Tue J.P. 14 $N 57^{\circ} 04' E 1396'$

" 14 $S 59^{\circ} W 25'$

July 19-195-

rains hard in night

Milko + John arrive @ 8 Otto + Bob

8-43- Bob cuts weeds.

John Milko + I work on road

Tower 38 see page 74

Tower 38 B S S $67^{\circ}06'W$ and run.

N $67^{\circ}37'E$ 300 to Sta 39

Take angle. $179^{\circ}30' \div 2 = 89^{\circ}45'$

Sine 999990 into 66 = 66.

Tower Sta 39 B S S $67^{\circ}37'W$ and
run. N $65^{\circ}38'E$ 100 to Sta 40

Take angle. $178^{\circ}02' \div 2 = 89^{\circ}01'$

Sine 999853 into 66 = 66.01

Tower Sta 40 B S S $65^{\circ}38'W$ and run
N $52^{\circ}59'E$ 100 to Sta. 41

Take angles $167^{\circ}20' \div 2 = 83^{\circ}40'$

Sine 993897 into 66 = 66.41

Tower Sta 41 B S S $52^{\circ}59'W$ + run
N $41^{\circ}10'E$ 100 to Sta 42

Take Angles $168^{\circ}10' \div 2 = 84^{\circ}05'$

Sine 994673 into 66 = 66.35

15.4 N of Sta 40, 2205, 75-6-80 64W

T over 42 BS S $41^{\circ}10'W$ & run
 N $27^{\circ}26'E$ 100 to Sta 43
 Take angle $166^{\circ}08' \div 2 = 83^{\circ}04'$
 Sine 992687 into 66 = 66.49.

T over 43 BS S. $27^{\circ}26'W$ & run
 N $4^{\circ}42'W$ 375 to Sta 44
 take angles $147^{\circ}52' \div 2 = 73^{\circ}56'$
 Sine 960940 into 66 = 68.68

T over 44 BS S $4^{\circ}42'E$ & run
 N $2^{\circ}41'W$ 100 to Sta 45
 Take angle $177^{\circ}59' \div 2 = 89^{\circ}$
 Sine 999848 into 66 = 66.01

T over Sta 45 DS $52^{\circ}41'E$ & run
 N $4^{\circ}44'E$ 150 to Sta 46
 Take angle $172^{\circ}45' \div 2 = 86^{\circ}22\frac{1}{2}'$
 Sine 997999 into 66 = 66.13

T over Sta 46 BS S $4^{\circ}44'W$ & run
 N $46^{\circ}E$ 200 to Sta 47
 Take angle $138^{\circ}43' \div 2 = 69^{\circ}21\frac{1}{2}'$
 Sine 935803 into 66 = 70.53

A over 47 BS S46°W and run
 N 50°34 E 50.90 176.10
 SAT. AUG. 26TH, 1960

CORRECT E. & W. & @
 OUTSIDE ROAD LINE.

A over HUB. 1624.26 FT. E.
 b.s. W. Plate set on 90°
 RUN SOUTH 62.67 FT. TO TRUE
 LINE.

A over HUB 62.67 FT. SOUTH
 b.s. on flag @ HUB 1624.26
 TURN 90° EAST & RUN TO
 OUTSIDE ROAD LINE INTER-
 SECTION @ 183 FT. or 1807.25
 FT. E. & 123.1 FT. SOUTH FROM

OUTSIDE ROAD angle PT.
 OPPOSITE STA. 30.

A over HUB 1864.05 FT E. ON
 BACK LOT LINE. b.s. west.
 Plate set on 90° TURN S.
 on 0° 64.57 FT. TO POINT FOR
 LINE INTERSECT BACK LOT
 LINE WITH TRUE @ 67.26° E
 or 1874.6 FT E. & 66.6 FT. S.

Lake Angle $118^{\circ}08' \div 2 = 59^{\circ}04'$
 sine 857766 into 66 = 76,94
 road to PT will come in around here

Travel 47 BS S 46° W and run
N 25° 34' E 50.90 Sta 48A

1. 10T stake H 48 45 lies
7.9 ft. N. of true Q.

N. E S Q. between Sta's.
36 & 37.

Travel I M. @ intersection
of true Q & back lot
line. b.s. on flag @ Sta. 34
Plate on 90° turn S: to 0°
66 ft. set Hub.

Travel still on I M. b.s. N. on
I M. @ Int. of lot shore line
@ true Q.

Set pins for Int. of out-
side road line with true
Q.

Travel 66 ft Hub out
side road line. Sight on
iron out side road angle
opposite Sta. 34.

Since 857766 into 66 = 76,94
road to Pt will come in around here

N 11° 2' E of Lake 12.1 N of Sta 48

Over 47 BS S 46° W and run
N 25° 34' E 50.90 Sta 48A

Take angles 159° 22' = 71° = 79° 41'

INT. OUT side road line
@ 115.2 FT. E. Road Angle
iron opposite Sta. 36 &
1063 FT N. of S. 1-16 line.
drive 2" iron pipe

Over Hub 3205.75' FT. E.
on E. & W. Q. b S. W. on flag
Plate set on 90° turn
south to 0° run 75.05' FT
to true Q.

Over Hub 3251.75' FT. E
b. S. W. plate on 90° turn S.
to 0° set Hub @ 74.41' FT.
INT. OUTSIDE road line
with true Q. @ 3197.25'
FT E. @ 52.9 FT. W. of road
Angle iron opposite
Sta. 39.

Since 857766 into 66 = 76,94
road to Pt will come in around here

12.11 N of Sta 48
199.2 E of Lake

\bar{A} over 47 BS S 46° W and run
N 25° 34 E 50.90 sta 48 A

Ch. from Angle Pt. out-
side road line: opposite
Sta. 22. 132.9 ft. to true
1-16 line & outside road
intersection.

ch OUT-side road line from
anglt PT. OPPOSITE STAGNS
116'. 0ft. N to true N. 1-16
line of OUT-side road line
intersection.

since $857766 \text{ into } 66 = 76,94$

road to Pt will come in around here

π over 47 BS S 46° W and run
N 25° 34 E 50.90 Sta 48.4

115.2

$$\begin{array}{r} 73 \\ 2 \overline{) 147} \\ 99 10 \\ 29.25 \\ \hline 70.75 \end{array}$$

$$\begin{array}{r} 38 \\ 2 \overline{) 76} \end{array}$$

1211 N of Lake 1211 N of Lake

Course angle 118.00 $\div 2 = 59.04$
Sine 857766 into 66 = 76,94
road to Pt will come in around here

Π over 47 BS S 46°W and run
N 25°34' E 50.90 to Sta 48A

Take Angles $159^{\circ}32' \div 2 = 79^{\circ}46'$
Sine 984092 into 66 = 67.07

P.M.

Π over 48A BS S 25°34'W + run
N 3°32' E 51.05 to Sta 48

Take angle $157^{\circ}59' \div 2 = 78^{\circ}59\frac{1}{2} = 79^{\circ}$
Sine 981627 into 66 = 67.24

Π over Sta 48 BS S 3°32'W + run
N 1°53'W 250 to Sta 49

Take angles, $174^{\circ}33' \div 2 = 87^{\circ}16\frac{1}{2}'$
Sine 998869 into 66 = 66.07

Π over 49 BS S 1°53'E + run
N 3°37'E 300 to Sta 50

Take angles $174^{\circ}31' \div 2 = 87^{\circ}15\frac{1}{2}'$
Sine 998852 into 66 = 66.08

Π over 50 BS S 3°37'W + run
N 65°28'E 150 to Sta 51

Take Angles $118^{\circ}08' \div 2 = 59^{\circ}04'$
Sine 857766 into 66 = 76.94

road to Pt will come in around here

N 1/2 Sec 189, 2 E of Lake 12 1/2 N of Sta 49

446 3/20, 35' N 24 52
 N 68° 31' E 965

Tower 51 BS S 63° 28' W + run

N 64° 07' E 250 to Sta 52

Take angles $171^{\circ} 20' \div 2 = 85^{\circ} 40'$

Sine 997141 into 66 = 66.19

Mike redd N 74° 07' -

74 00

Tower 52 BS S 64° 07' W + run

N ^{56° 35'} 46° 35' E 100 ft to Sta 53

Take angle $162^{\circ} 28' \div 2 = 81^{\circ} 14'$

Sine 988317 into 66 = 66.78

Tower 53 BS S 46° 35' W + run

N ^{35° 06'} 25° 08' E 125 to Sta 54

take angle $158^{\circ} 34' \div 2 = 79^{\circ} 17'$

Sine 982559 into 66 = 67.17

Tower Sta 54 BS S 25° 08' W + run

N ^{13° 04'} 3° 08' E 100 Sta 55

Take angle $158 \div 2 = 79^{\circ}$

Sine 981627 into 66 = 67.24

Tower 55 BS S 3° 08' W + run

N 3° 42' W 150 to Sta 56

take angle $173^{\circ} 10' \div 2 = 86^{\circ} 35'$

Sine 998223 into 66 = 66.12

Mike got N 6° 14' E

Tower Sta 56 BS S $3^{\circ}42'E$ 1 run

$\begin{array}{r} 41^{\circ}05' \\ N 31^{\circ}10'E \end{array}$ $\begin{array}{r} 127.17 \\ 126.9 \end{array}$ Sta 57.

Take angle. $145^{\circ}08 \div 2 = 72^{\circ}34'$

Sine 954066 into 66 = 69.18

Tower Sta 57 BS S $31^{\circ}10'W$ 4 run

N $16^{\circ}02'E$

60 spikes

Take angle. $164^{\circ}54 \div 2 = 82^{\circ}27'$

Sine 991331 into 66 = 66.58

Mike got N $26^{\circ}E$ 209.9, -58

Tower 60 spikes BS S $16^{\circ}02'W$

S $84^{\circ}14'E$

16.02

100N6

82

July 20 1950 Thr

Mike and John continue
running Lake shore - Bob
cuts weeds Otto works with
stakes - I work on plat

Otto bring us our Checks
I get \$200⁰⁰

July 20-1950 Continued from

page 70: Mike's Notes

John & Mike

Tower 6458.85 BSS 20°40' W
run N 14°30' W 152.55 To
6611.4.

@ 6458.85 Lake lie 15' Left

@ 6500 " " 15 "

Tower 6611.4 run N 14°30' W
289.65 to hub 6901.05

@ 6611.4 Lake 20 Left

@ 6700 " 8 "

@ 6800 " 12 "

@ hub 6901.05 Lake N 36° W 30

Tower 6901.05 run N 54°30' E
78.8 to 6979.85

Tower 6979.85 continue N 54°30' E
213.5 to hub 7193.35

@ 7100 lake 30 Left

Tower 7193.35 Lake N 40° W 20

Var. 7° E run N 9°50' E 174.9
to hub 7368.25

@ 129.45 intersect, N 1/2 @
7322.8 on shore, 3' W E of
wood Lake.

@ 7250 Lake follows lot line.

Tower 7368.25 Lake N 80° W
20 ft. run N 7° 45' E 170.35
to hub 7538.6

@ 7400 Lake 20 Left

@ 7500 " 40 "

Tower 7538.6 Lake N 65° W
70. run N 8° 30' E 180.3 to
hub 7718.9.

@ 7600 Lake 20 Left

Tower 7718.9 Lake S 60° W
40. run N 84° 20 W 169.75
to hub 7888.65

@ 7800 Lake 30 Left

Tower 7888.65 Lake S 20° W
25. run N 79° 20 W 131.55
to hub 8020.2

Tower 8020.2 Lake South
60 ft. run N 9° 10' W 233
to hub 8253.2.

@ 8100 Lake 40 Left

@ 8200 " 30 "

Tower 8253.2 Lake N 80° W
35;

run N $60^{\circ}30'W$ 107.2 to hub
8360.4

@ 8300 Lake 40 Left

Turn over 8360.4 Lake N $80^{\circ}W$
30. run N $0^{\circ}20'E$ 308.5 to
hub 8668.9

@ 8400 Lake 25 ft Left

@ 8500 " 30 " "

@ 8600 " 40 " "

continued on page 89

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Mike's Notes N $\frac{1}{4}$ line Sec 6

Wed. June 28th 1950

Otto, Bob, John & I start N $\frac{1}{4}$ lineTower hub 1291.5 on West side stake
chain S 22.85 set hut 1313.85

Tower 1313.85 F.S. South on f199

Var. on "O" turn Left on SE angle

90°33' & run East on N $\frac{1}{4}$ linefrom hub 1313.85 S turn 90° &
run East 16.20 set spike for $\frac{1}{4}$ Cor.
.15 ft south of our line run at 90°33'
hub 309.6 E we set this hub. .155
on true random.At hub 309.6 BS on $\frac{1}{4}$ spike
and run East

Thur. June 29th 1950

Otto Bob John & I continue E
on N $\frac{1}{4}$ line

At 309.6 run E $110 + 300 + 60.85 =$
 780.45 hub. $+ 81.8 + 300 + 122.3 =$
 1284.55 hub at intersection
 of N $\frac{1}{4}$ line & W $\frac{1}{4}$ line at pt 2620.95
 ft N of S $\frac{1}{4}$ line continue East
 $300 + 172.3 = 1756.85$ hub $+ 338.75 =$
 2095.6 E hub on back stake line
 E side road.

N $\frac{1}{16}$ line

87

Mikes - Notes

@ 2054 = Φ road. That hub 2095.6 E
Continue E on N $\frac{1}{16}$ line + 130 + 218.1 =
2443.7 hub. + 83.1 = 2526.8 hub
intersect lot stake line @ 2571.35 E
at pt. 1598.2 on stake line Lake is 20 ft
east. cause hut to be set over lake
& continue N $\frac{1}{16}$ line back 138-26
East quit for night

Fri June 30th 1950

Bob, John & I begin @ hub over lake
on N $\frac{1}{16}$ line & continue N $\frac{1}{16}$ line E
over hub 35 ft E of lake continue
East + 141.2 = 176.2 ft E hub + 110 ft
@ 199.2 E intersect Back lot line
@ 212 Φ road. @ 564.2 E inter-
sect E $\frac{1}{16}$ line at a point 2101.3 N
of S $\frac{1}{16}$ line continue E 118.2 to
hub 682.4 + 250 + 220 + 90.35 =
1242.75 hub. + 309.8 = 1552.55
ft E hub quit for day.

88 N $\frac{1}{16}$ line Mike's Notes

Monday July 10 1950

John & I reach the cabin on
Wood Lake @ 8 o'clock. @ 8-20 North
Harold or Otto have arrived so
We drive to E side of Wood Lake
to N $\frac{1}{16}$ line. Walk in on line to
hub 1552.55 E (of lake) & continue
N $\frac{1}{16}$ line East 277.65 ft =
1830.2 ft E of Lake intersect
E line of Sec. 6 at 1337.7 S
of random Colline

Correction of N $\frac{1}{16}$ line
random goes South to true line

$$7.83 \div 5260.96 = .0014883243$$

@ 1283.13 E goes S 1.91 = $\frac{1}{16}$ NE
hub on stake line intersection is

2095.6 E goes S 3.12

hub on stake line at lake is

2571.35 E goes S 3.83

@) hub over lake is 3740.91 E

hub 3740.91 E goes S 5.57

@ 229.10 E of Lake pt for $\frac{1}{16}$
Center NE $\frac{1}{4}$

229.10 E = 3935.01 E goes
South 5.86 to True $\frac{1}{16}$

hub 1756.85 E goes S

Mike's Notes Continued
from pg. 85 Lake Shore

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July 21-1950

Tower Hub 8668.9 Lake N80°W 40ft
run. N 7°50'W 61.7 to IM on
S bank of Canal 100 ft from E of
canal

T-still 8668.9 run N 7°46' E
253.1 to hub 5404.6 on Co. random
line at E Lake shore line

Tower 5404.6 run S 12°33' E 139
ft to hub 9061. Tower 9061. on
E Wood Lake shore line

@ 9061 Lake East 60 ft

Run S 46°9' E 319.7 to 9380.7

@ 70 ft or 9131 ft enter bog

Lake 15 ft Left @ 100 Lxbog

@ 185.7 at hub 9246.7

for stadia purpose reading bog
& Island.

Tower 9246.7 Lake lies N 40° E 10 ft
stadia reading of bog.

N 42°35'W 120 - N 58°30'W 110

N 75°W 115 west 110

S 69°30'W 105 - S 44°W 80 - S 28°W 100

S 14°W 85 - S 8°E 70 - S 1°W 40

S 69°30'W 20 - N 30°30'W 18

@ 9300 lake 20 left

Tower 9380.7 Lake N60°E 40

run S 4°30'E 471.7 to 9852.6

@ 65 ft bog enters lake 10 ft Left

@ 471 L v bog.

Set hub @ 65 ft or 9443.7 Lake

lies E 10 ft @ 9500 lake 15 Left

@ 9600 Lake 20 Left

Tower 9443.7 lake Station
of bog, N 52°30'W 55 - N 63°30'W 105

N 77°30'W 155 - S 75°W 170

S 38°30'W 190 - S 22°W 215 - S 8°W 270

Tower 9852.6 lake Station
reading to lake over bog.

N 12° E 208 bog T to bog 30 ft

N 28°30'E 180 " " " " 30 "

N 42°30'E 185 " " " " 40

run N 62°E 289.2 ft to hub 10141.8

at 98 enter bog. 210 L v bog. @ 154
ft Aug - R - 40 ft.

Tower 10141.8 lake Station of
bog, N 85°30'W 90 ft N 30°W Lake

35 ft run N 70°E 244 to 10385.8

@ 10200 Lake 40 Left 10300 Lake 15 Left

Continued on page 94

Monday 24-1950

Ed + I drive to Wood Lake Cabin
arrive at 10 AM. Work on Plat

Mike John + Otto set I.M. at
40 corners in Section 31-139-26
& Sec 6-138-26. Bob cuts weeds

Tue. 25-1950

I work on Plat

Mike Otto John continue
setting iron corners. Bob cuts weeds
rain boys get wet - so do not work
in P.M.

Wed. July 26-1950 Bob cuts weeds

Mike Otto + Bob. set I.Ms in A.M.

Ed + I go to Brainerd to check

Plat get I.M. at shop \$10.00 Lu

some of the I.M. in Brainerd Load

to heavy. Arrive Wood Lake around

3 - Lu after 9. Mike + John.

finish running Lake Shore

Otto get truck Load of rock

+ Lu after we get back

Thur. July 27, 1950

Mike & John go to run out
Island & check road line
Bob cuts weeds. Otto does
not come to work this morning

Check Road Mike & John

Turn Sta 48A BS S $25^{\circ}34'W$
run N $3^{\circ}32'E$ to Sta 48

Turn 48 BS S $3^{\circ}32'W$ run N $1^{\circ}55'$
W to Sta 49 - 230 ft

Turn Sta 49 BS S $1^{\circ}55'E$ run
N $3^{\circ}35'E$ to Sta 50 - 300 ft

Turn Sta 50 BS S $3^{\circ}35'W$ run
N $65^{\circ}26'E$ to Sta 51 - 150 ft

Turn Sta 51 BS S $65^{\circ}26'W$ run
N $74^{\circ}06'E$ to Sta 52 - 230

Turn 52 BS S $74^{\circ}06'W$ run
N $56^{\circ}34'E$ to Sta 53 - 100

Turn Sta 53 BS S $56^{\circ}34'W$ run
N $35^{\circ}06'E$ to Sta 54 - 125

Turn Sta 54 BS S $35^{\circ}06'W$ run
N $13^{\circ}04'E$ to Sta 55 - 100 ft

Turn 55 BS S $13^{\circ}04'W$ run
N $6^{\circ}14'E$ to Sta 56 - 150 ft

Tower Sta 56 BS S $56^{\circ}14'W$ run

N $41^{\circ}05'E$ - 127. // to 57

Tower 57 BS S $41^{\circ}05'W$ run

N $26^{\circ}E$ 209.9 to Sta 58,

Island

Tower Lot line hub 6901.05 BS, S

$140^{\circ}30'E$ on hub 6611.4 run.

N $60^{\circ}30'W$ 198.55 ft to hub on
S end of island 10 ft N of water

Tower hub 198.55 BS, S $60^{\circ}30'E$
run N $4^{\circ}30'E$ 85.4 ft to hub in
center of island

Tower hub 85.4 BS S $4^{\circ}30'W$

take Stadia of Island

S $22^{\circ}15'W$ 88

S $42^{\circ}30'W$ 70

N $67^{\circ}W$ 58

N $17^{\circ}W$ 67 ft

N $7^{\circ}30'E$ 80 ft

N $41^{\circ}30'E$ 110 ft

N $61^{\circ}30'E$ 115 on sharp pt N $72^{\circ}30'E$ 90

S $81^{\circ}40'E$ 66

S $49^{\circ}E$ 85 -

S $23^{\circ}30'E$ 110

S $9^{\circ}30'E$ 115

S $5^{\circ}30'W$ 105

Lake Shore Continued
from Page 90 July 26-

π 10385.8 Lake lies N60°W30

run N9°15'E 202.2 to hub 10588.00

@ 10400 Lake 25' Left

@ 10500 " 30 "

π over 10588 13559°15'W

Lake lies West 25' ft

run N26°30'W 202.2 to hub
10790.2

@ 10600 Lake 25' Left

@ 10700 " 30 "

π over 10790.2 Lake lies N70°W8

N20°E 65' intersecting of bog & Lake

N39°E 60' edge of bog.

run N84°50'E 181.1 to 10971.3

@ 10850 bog Lake 10' ft

@ 10900 " 12 "

π over 10971.3 bog North 40' ft.

run N76°30'E 146.4 ft to 11137.7

@ 11000 bog 50' left

π over 11137.7 bog N30°W 50

run N43°15'E 182 to 11319.7

on back lot the 58 & 60 d spike

@ 11200 bog Left 70

at spike at sta 58 bog hits N 53° W
90 ft bog hits road 170 ft N
of sta 58.

96

Monday July 31, 1950

Stormy Lv Walker for
Wood Lake Gas oil - 3.30

Breakfast and Cig. at Pine
River 65¢ think I past
Mike on the Road from Pine
River to Wood Lake Mike
going the other way
at Fifty Lakes get Eggs
Bread + cookies have flat
tire onto Wood Lake

No one there Work on plot
arrive around 10 o'clock,
at 12-30 go to Troiter house to
eat. Cloudy and rain

Aug 1 - 1950

Work on Plot nobody
shows up.

Lake Shore Co Line - South
 on Wood Lake, hub, iron 00 on
 Coline - old Sta 2946.9 Coline
 Run S E on lake shore,

@ 3000 Lake, Left 60

@ 3100 " " 40

3173.75 = ^{hub} 221 - " 40

@ 3300 Lake 35 Left

@ 3400 " 30 "

@ 3418.65 = 465.9 = 30 Left

@ 3500 Lake 30 Left

@ 3600 " 40 "

@ 3714 = hub 761.3 = 50 Left

@ 3800 Lake 50 Left

@ 3900 " 30 "

@ 3989.5 = 1036.7 = 40 Left

@ 4100 Lake 40 "

@ 4200 " 50 "

@ 4240.9 = 1289.15 = Mt. N19°E 70
 S 83°E 65 ft. S 40°E 55 ft.

@ 4300 Lake 40 Left

@ 4434.9 = 1482.15 = 40 Left

@ 4500 Lake 30 Left

@ 4600 " 20 "

@ 4677.3 = 1724.15 Lake 35 Left

@ 4800 - Lake 30 Left

@ 4932.5 - old hub = hub 1979.75

N 45° E 54 - S 52° E 32 ft

@ 5000 Lake 30 Left

@ 5048 = 2095.95 - new hub

S 40° E 18 ft S 49° 39' W 15 ft

@ 5100 Lake 35 Left

@ 5207 " 45 "

@ 5300 " 40 "

@ 5399.5 = S 20° W 88 ft

5500 " 40 Left

5600 " 30 "

5700 " 15 "

5800 " 20 "

5880. = new hub 2927.3

Lake lies S 45° E 20 - S 25° W 20

@ 6000 - Lake 10 Left

@ 6100.46 " 40 "

@ 6200 " 10 "

@ 6300 " 40 "

6308. " 50 "

@ 6400 " 20 "

@ 6521.30 " 40 "

@ 6600 " 30 "

@ 6700 " 30 "

@ 6740 enter drain @ 6780 LV

@ 6805.5- Lake 15- Left

@ 6900 " 30 "

@ 7000 " 40 "

@ 7069 " N 26° 53' E 40

S 83° E 30 @ 7127, Lake 35- Left

@ 7200 Lake 68 Left

@ 7300 " 40 "

@ 7400 " 20 "

@ 7450 " 20 "

@ 7500 " 38 "

Aug 2-1950

Mike & John come at 8
go check Lake shore Viz.

T over Sta 58 on road line
BS S 26° W on Mag at Sta 57

I Mon Co line out side of road
bears N $47^{\circ}11'E$ 110.3 ft

T still @ Sta 58 run S side
East Wood. lake Viz

run S $44^{\circ}04'W$ 182 to hub 11137.7

T over 11137.7 run S $77^{\circ}17'W$ 166.4
to hub 10971.3

T over 10971.3 run N $84^{\circ}W$ 181.1
to 10790.2

T over 10790.2 run S $25^{\circ}44'E$ 202.2
to hub 10588.

T over 10588 run S $10^{\circ}02'W$ 202.2
to hub 10385.8

T over 10385.8 run S $70^{\circ}46'W$ 244
to hub 10141.8

T over 10141.8 run S $62^{\circ}45'W$
289.2 to hub 9852.6

T over 9852.6 run N $3^{\circ}45'W$ 471.7
to hub 9380.7

T over 9380.7 run N $45^{\circ}23'W$ 319.7
to hub 9061.0

Tower 9061. run $N 11^{\circ} 48' W$ 139
 to hub on Coline + E stake line
 T still @ 9061. run $S 16^{\circ} 48' W$ - 51.1
 to I.M. at canal

@ Hub on Coline marked 5404.6
 Lake lies East 100 ft
 Hub marked 5395.4 on Coline
 + West lot stake line lies West
 94.15 ft from hub 5404.6 +
 24 ft W of hub 5395.4 to lake

When John + Mike get back
 they go drive I ~~At~~ at outside
 of road at angle points then
 come back and work on
 the lots South of Coline
 here at the cabin

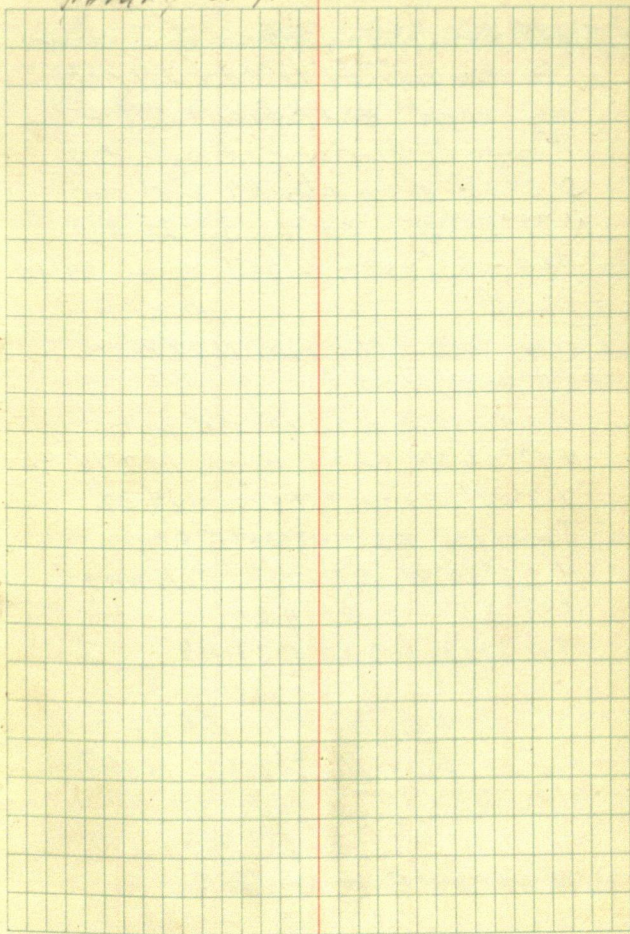
Tower spike on true line
 327.5 ft E of NW cor Aug
 Turn 90° and run S 33 ft
 set 2x30" pipe @ 144 ft
 SE along stake line set I.M.
 for SE cor lot 1 S of Coline
 Note this I.M. is 100 ft along stake
 line but is 121.3 for NE cor of said

Lot. because the NE cor of
Lot 1 was set at 90° to Coline
and not along Stokes line
on account of water

@ 200 int SE cor lot 2 S of
Coline

Friday Aug.

1950



104

Friday Aug, 1950

Mike, Otto - Bob and I drive
to corner of to 74th Street
on road 40 ft from Sta 50.

Turn I.M. Street cor B.S.

S $3^{\circ}35'W$ on sta. 49 and run

N $79^{\circ}50'W$ angle, $83^{\circ}25'NW$

$8960' - 83^{\circ}25' = 6^{\circ}35'$ Sine 993406

$= 33.22$

N $79^{\circ}46'W$

From street cor run N $79^{\circ}50'W$

$425 + 100 = 150$

Turn 150 B.S. $79^{\circ}50'E$ run

N $47^{\circ}05'W$ $125'$ angle, $147^{\circ}16' \div 2$

$73^{\circ}38'$ Sine 969478 = 34.39

Turn 125 B.S. $547^{\circ}05'E$ & run

N $28^{\circ}30'W$ $270.75'$ Take angle

$161^{\circ}25' \div 2 = 80^{\circ}42\frac{1}{2}'$ Sine =

986879.5 into 33 = 33.44

Turn I.M. 33 ft NW of NE cor
Lot 80 run N $61^{\circ}26'E$ to Main
Lake shore

Turn NE Cor Lot 80 run

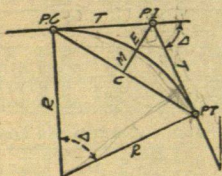
N $61^{\circ}26'E$ @ 33 I.M.

Checking

Tower 150 IM Lot 74 bears $S 46^{\circ} 53' W$
 angle point Sta 7718.9 bears $S 14^{\circ} 11' E$ 26.7
 S $14^{\circ} 11' E$ 26.7 21.65

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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CURVE FORMULAS

$$\text{Radius} = R = \frac{50}{\sin. \frac{D}{2}} \quad (1) \quad \text{Degree of Curve} = D \text{ and } \sin. \frac{D}{2} = \frac{50}{R} \quad (2)$$

$$\text{Tangent} = T = R \tan \frac{\Delta}{2} \quad (3) \quad \text{Length of Curve} = L = 100 \frac{\Delta}{D} \quad (4)$$

$$\text{Middle ordinate} = M = R(1 - \cos. \frac{\Delta}{2}) \quad (5) = R \text{vers} \frac{\Delta}{2} \quad (6)$$

$$\text{External} = E = T \tan \frac{\Delta}{4} \quad (7) = R \div \cos. \frac{\Delta}{2} - R \quad (8) = R \sec \frac{\Delta}{2} - R \quad (9)$$

$$\text{Long Chord} = C = 2 R \sin. \frac{\Delta}{2} \quad (10) \quad \Delta = \text{Central Angle}$$

EXPLANATION AND USE OF TABLES

Stations.—Given P. I.—Sta. 161+60.35 to find Sta. of P. C. and P. T. $\Delta = 62^\circ 10'$ $D = 8^\circ 20'$. From Table IV for 1° curve $T = 3454.1$ and $\div 8\frac{1}{3} = 414.49$ ft. From Table V correction = .36 or $T = 414.85$ ft. P. C. = Sta. P. I. — $T = 157 + 45.50$. Also from (4) $L = 746.00$ and P. T. = Sta. P. C. + $L = 164 + 91.50$.

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

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

Externals.—May be found in similar manner to tangents. Thus E for curve above is 115.37. For from Table IV for 1° curve $E = 960.6$ for $8^\circ 20' = 960.6 \div 8\frac{1}{3} = 115.27$ and from Table V correction = .10 or $E = 115.37$ ft. Or suppose $\Delta = 32^\circ$ and E is measured and found to be 42 ft. What is D ? From Table IV $E = 230.9$ and $\div 42 = 5.5$ or $D = 5^\circ 30'$.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

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

TABLE II.—INCHES IN DECIMALS OF A FOOT.

1-16	3-32	$\frac{1}{4}$	3-16	$\frac{1}{8}$	5-16	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.0032	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

TABLE III.—RADI, 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° 20'	819.02	1.528	6.105	2.10'
20	17188.8	.073	.291	0.10	30	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	9	637.28	1.965	7.846	2.70
40	3437.87	.364	1.454	0.50	20	614.56	2.037	8.136	2.80
50	3125.36	.400	1.600	0.55	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	10	573.69	2.183	8.716	3.00
20	2455.70	.509	2.036	0.70	30	546.44	2.292	9.150	3.15
30	2292.01	.545	2.181	0.75	11	521.67	2.402	9.583	3.30
40	2148.79	.582	2.327	0.80	30	499.06	2.511	10.02	3.45
50	2022.41	.618	2.472	0.85	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	441.63	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	274.87	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 IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.32	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

IV

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

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.3	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 IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

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

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

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92°	5933.2	2518.5	102°	7075.5	3374.9	112°	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93°	6037.8	2594.0	103°	7203.2	3474.4	113°	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94°	6144.3	2671.6	104°	7333.6	3576.8	114°	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95°	6252.8	2751.3	105°	7467.0	3682.3	115°	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.9
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96°	6363.4	2833.2	106°	7603.5	3791.0	116°	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97°	6476.2	2917.3	107°	7743.2	3902.9	117°	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98°	6591.2	3003.8	108°	7886.2	4018.2	118°	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99°	6708.6	3092.7	109°	8032.7	4137.1	119°	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	6808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100°	6828.3	3184.1	110°	8182.8	4259.7	120°	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

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

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.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	.79	.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	4.06
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	.628	.697	.771	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.266	.353	.440	.528	.617	.707	.797	.877	.977	1.07	1.18	1.29
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.63
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.140	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.33

VIII

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

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.90	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	416.63
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.69
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.00	276.59	342.69	388.43
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

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

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.067	.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	.176	.153	.133	.112	.096	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.108	.087	25	.552	.488	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

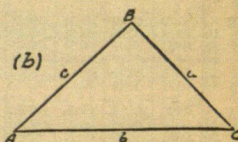
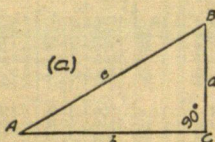
SLOPE REDUCTIONS.

When distances are measured on a slope they may be reduced to the equivalent horizontal distance by the following approximate rule:—subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction $= 15^2 \div 2 \times 250.3 = .45$ (by slide rule) or horizontal distance $= 250.3 - .45 = 249.85$. When vertical angle $= V. A.$ is measured horizontal distance $=$ slope distance \times slope distance $(1 - \cos. V. A.)$. Thus for slope distance of 248.7 ft. and $V. A.$ of $4^\circ 20'$ from Table VIII $\cos = .99714$ and correction $= 1 - .99714 = .00286$ per foot or total of $.286 \times 2\frac{1}{2}$ (near enough) $= .57$ and horizontal distance $= 248.7 - .57 = 248.13$ ft.

See fig. (a).

TRIGONOMETRICAL FORMULAS.

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



FORMULA FOR SOLVING TRIANGLES.

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

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
0	0	0	00	1	90	8	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	1	50	10	.1421	.1435	6.968	.98986	50
20	.0058	.0058	171.9	.99998	40	20	.1449	.1465	6.827	.98944	40
30	.0087	.0087	114.6	.99996	30	30	.1478	.1495	6.691	.98902	30
40	.0116	.0116	85.94	.99993	20	40	.1507	.1524	6.561	.98858	20
50	.0145	.0145	68.75	.99989	10	50	.1536	.1554	6.435	.98814	10
1	.0175	.0175	57.29	.99985	89	9	.1564	.1584	6.314	.98769	81
10	.0204	.0204	49.10	.99979	50	10	.1593	.1614	6.197	.98723	50
20	.0233	.0233	42.96	.99973	40	20	.1622	.1644	6.084	.98676	40
30	.0262	.0262	38.19	.99966	30	30	.1650	.1673	5.976	.98629	30
40	.0291	.0291	34.37	.99958	20	40	.1679	.1703	5.871	.98580	20
50	.0320	.0320	31.24	.99949	10	50	.1708	.1733	5.769	.98531	10
2	.0349	.0349	28.64	.99939	88	10	.1736	.1763	5.671	.98481	80
10	.0378	.0378	26.43	.99929	50	10	.1765	.1793	5.578	.98430	50
20	.0407	.0407	24.54	.99917	40	20	.1794	.1823	5.485	.98378	40
30	.0436	.0437	22.90	.99905	30	30	.1822	.1853	5.396	.98325	30
40	.0465	.0466	21.47	.99892	20	40	.1851	.1883	5.309	.98272	20
50	.0494	.0495	20.21	.99878	10	50	.1880	.1914	5.226	.98218	10
3	.0523	.0524	19.08	.99863	87	11	.1908	.1944	5.145	.98168	79
10	.0552	.0553	18.07	.99847	50	10	.1937	.1974	5.066	.98107	50
20	.0581	.0582	17.17	.99831	40	20	.1965	.2004	4.989	.98050	40
30	.0610	.0612	16.35	.99813	30	30	.1994	.2035	4.915	.97992	30
40	.0640	.0641	15.60	.99795	20	40	.2022	.2065	4.843	.97934	20
50	.0669	.0670	14.92	.99776	10	50	.2051	.2095	4.773	.97875	10
4	.0698	.0699	14.30	.99756	86	12	.2079	.2126	4.705	.97815	78
10	.0727	.0729	13.73	.99736	50	10	.2108	.2156	4.638	.97754	50
20	.0756	.0758	13.20	.99714	40	20	.2136	.2186	4.574	.97692	40
30	.0785	.0787	12.71	.99692	30	30	.2164	.2217	4.511	.97630	30
40	.0814	.0816	12.25	.99668	20	40	.2193	.2247	4.449	.97566	20
50	.0843	.0846	11.83	.99644	10	50	.2221	.2278	4.390	.97502	10
5	.0872	.0875	11.43	.99619	85	13	.2250	.2309	4.331	.97437	77
10	.0901	.0904	11.06	.99594	50	10	.2278	.2339	4.275	.97371	50
20	.0929	.0934	10.71	.99567	40	20	.2306	.2370	4.219	.97304	40
30	.0958	.0963	10.39	.99540	30	30	.2334	.2401	4.165	.97237	30
40	.0987	.0992	10.08	.99511	20	40	.2363	.2432	4.113	.97169	20
50	.1016	.1022	9.788	.99482	10	50	.2391	.2462	4.061	.97100	10
6	.1045	.1051	9.514	.99452	84	14	.2419	.2493	4.011	.97030	76
10	.1074	.1080	9.255	.99421	50	10	.2447	.2524	3.962	.96959	50
20	.1103	.1110	9.010	.99390	40	20	.2476	.2555	3.914	.96887	40
30	.1132	.1139	8.777	.99357	30	30	.2504	.2586	3.867	.96815	30
40	.1161	.1169	8.556	.99324	20	40	.2532	.2617	3.821	.96742	20
50	.1190	.1198	8.345	.99290	10	50	.2560	.2648	3.776	.96667	10
7	.1219	.1228	8.144	.99255	83	15	.2588	.2679	3.732	.96593	75
10	.1248	.1257	7.953	.99219	50	10	.2616	.2711	3.689	.96517	50
20	.1276	.1287	7.770	.99182	40	20	.2644	.2742	3.647	.96440	40
30	.1305	.1317	7.596	.99144	30	30	.2672	.2773	3.606	.96363	30
40	.1334	.1346	7.429	.99106	20	40	.2700	.2805	3.566	.96285	20
50	.1363	.1376	7.269	.99067	10	50	.2728	.2836	3.526	.96206	10
					82						74
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
°						°					
16	.2756	.2867	3.487	.96126	74	24	.4067	.4452	2.246	.91355	66
10	.2784	.2899	3.450	.96046	50	10	.4094	.4487	2.229	.91236	50
20	.2812	.2931	3.412	.95964	40	20	.4120	.4522	2.211	.91116	40
30	.2840	.2962	3.376	.95882	30	30	.4147	.4557	2.194	.90996	30
40	.2868	.2994	3.340	.95799	20	40	.4173	.4592	2.177	.90875	20
50	.2896	.3026	3.305	.95715	10	50	.4200	.4628	2.161	.90753	10
17	.2924	.3057	3.271	.95615	73	25	.4226	.4663	2.145	.90631	65
10	.2952	.3089	3.237	.95545	50	10	.4253	.4699	2.128	.90507	50
20	.2979	.3121	3.204	.95459	40	20	.4279	.4734	2.112	.90383	40
30	.3007	.3153	3.172	.95372	30	30	.4305	.4770	2.097	.90259	30
40	.3035	.3185	3.140	.95284	20	40	.4331	.4806	2.081	.90133	20
50	.3062	.3217	3.108	.95195	10	50	.4358	.4841	2.066	.90007	10
18	.3090	.3249	3.078	.95106	72	26	.4384	.4877	2.050	.89879	64
10	.3118	.3281	3.048	.95015	50	10	.4410	.4913	2.035	.89752	50
20	.3145	.3314	3.018	.94924	40	20	.4436	.4950	2.020	.89623	40
30	.3173	.3346	2.989	.94832	30	30	.4462	.4986	2.006	.89493	30
40	.3201	.3378	2.960	.94740	20	40	.4488	.5022	1.991	.89363	20
50	.3228	.3411	2.932	.94646	10	50	.4514	.5059	1.977	.89232	10
19	.3256	.3443	2.904	.94552	71	27	.4540	.5095	1.963	.89101	63
10	.3283	.3476	2.877	.94457	50	10	.4566	.5132	1.949	.88968	50
20	.3311	.3508	2.850	.94361	40	20	.4592	.5169	1.935	.88835	40
30	.3338	.3541	2.824	.94264	30	30	.4617	.5206	1.921	.88701	30
40	.3365	.3574	2.798	.94167	20	40	.4643	.5243	1.907	.88566	20
50	.3393	.3607	2.773	.94068	10	50	.4669	.5280	1.894	.88431	10
20	.3420	.3640	2.747	.93969	70	28	.4695	.5317	1.881	.88295	62
10	.3448	.3673	2.723	.93869	50	10	.4720	.5354	1.868	.88158	50
20	.3475	.3706	2.699	.93769	40	20	.4746	.5392	1.855	.88020	40
30	.3502	.3739	2.675	.93667	30	30	.4772	.5430	1.842	.87882	30
40	.3529	.3772	2.651	.93565	20	40	.4797	.5467	1.829	.87743	20
50	.3557	.3805	2.628	.93462	10	50	.4823	.5505	1.816	.87603	10
21	.3584	.3839	2.605	.93358	69	29	.4848	.5543	1.804	.87462	61
10	.3611	.3872	2.583	.93253	50	10	.4874	.5581	1.792	.87321	50
20	.3638	.3906	2.560	.93148	40	20	.4899	.5619	1.780	.87178	40
30	.3665	.3939	2.539	.93042	30	30	.4924	.5658	1.767	.87036	30
40	.3692	.3973	2.517	.92935	20	40	.4950	.5696	1.756	.86892	20
50	.3719	.4006	2.496	.92827	10	50	.4975	.5735	1.744	.86748	10
22	.3746	.4040	2.475	.92718	68	30	.5000	.5774	1.732	.86603	60
10	.3773	.4074	2.455	.92609	50	10	.5025	.5812	1.720	.86457	50
20	.3800	.4108	2.434	.92499	40	20	.5050	.5851	1.709	.86310	40
30	.3827	.4142	2.414	.92388	30	30	.5075	.5890	1.698	.86163	30
40	.3854	.4176	2.394	.92276	20	40	.5100	.5930	1.686	.86015	20
50	.3881	.4210	2.375	.92164	10	50	.5125	.5969	1.675	.85866	10
23	.3907	.4245	2.356	.92050	67	31	.5150	.6009	1.664	.85717	59
10	.3934	.4279	2.337	.91936	50	10	.5175	.6048	1.653	.85567	50
20	.3961	.4314	2.318	.91822	40	20	.5200	.6088	1.643	.85416	40
30	.3987	.4348	2.300	.91706	30	30	.5225	.6128	1.632	.85264	30
40	.4014	.4383	2.282	.91590	20	40	.5250	.6168	1.621	.85112	20
50	.4041	.4417	2.264	.91472	10	50	.5275	.6208	1.611	.84959	10
					66						58
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

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

TABLE IX.—CALCULATION OF EARTHWORK.

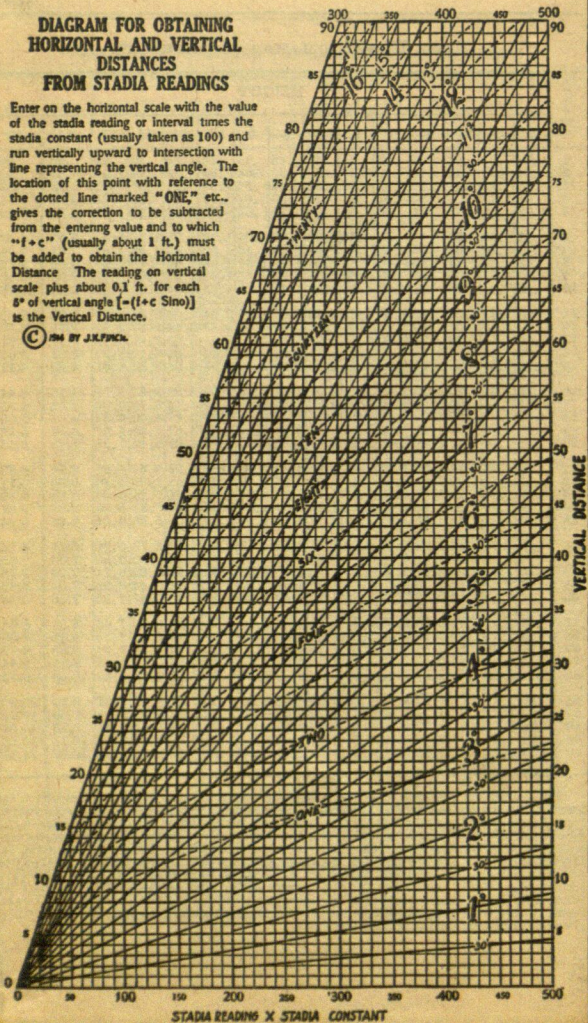
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.73	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	3.50	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

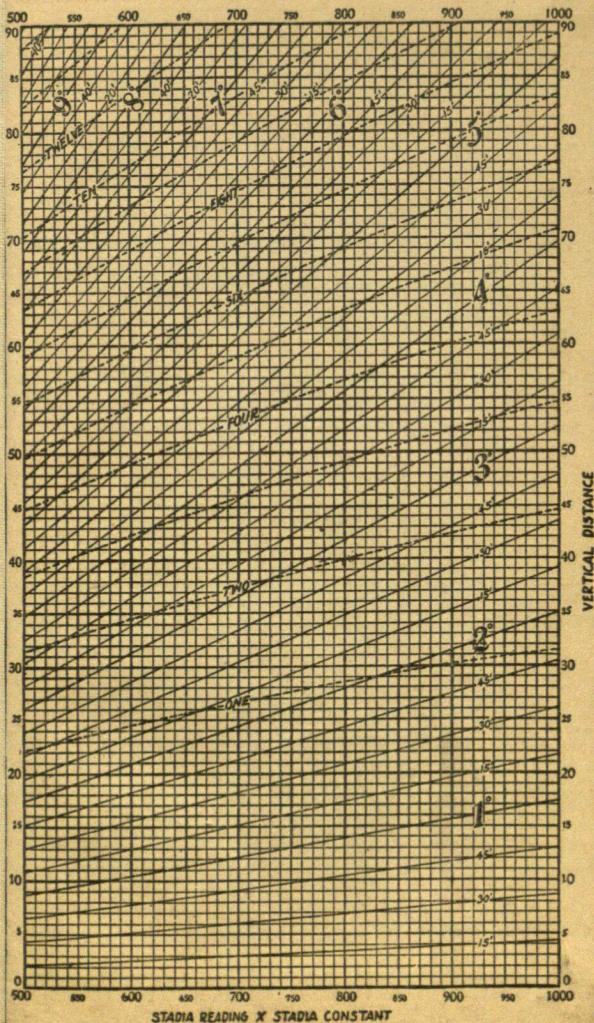
Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering 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) $= b$, and $\frac{1}{2}$ the roadbed $= w$, add the triangles formed by taking the distance out to each break in turn ($= w$) by the difference between the cuts (or fills) on each side of it ($= b$'s) always subtracting the outer from the inner.

DIAGRAM FOR OBTAINING HORIZONTAL AND VERTICAL DISTANCES FROM STADIA READINGS

Enter on the horizontal scale with the value of the stadia reading or interval times the stadia constant (usually taken as 100) and run vertically upward to intersection with line representing the vertical angle. The location of this point with reference to the dotted line marked "ONE" etc., gives the correction to be subtracted from the entering value and to which " $f+c$ " (usually about 1 ft.) must be added to obtain the Horizontal Distance. The reading on vertical scale plus about 0.1 ft. for each 5° of vertical angle [$-(f+c \sin \alpha)$] is the Vertical Distance.

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$$\begin{array}{r} 299.10 \\ 121.4 \\ \hline 178.6 \end{array}$$

$$\begin{array}{r} 3796.2 \\ 178.6 \\ \hline 4174.8 \end{array}$$

$$\begin{array}{r} 213.85 \\ 7.15 \\ \hline \end{array}$$

110

$$\begin{array}{r} 5.88. \end{array}$$

$$\begin{array}{r} 140 \\ 345 \\ \hline \end{array}$$

$$\begin{array}{r} 295.2 \\ 190 \\ \hline \end{array}$$

$$\begin{array}{r} 5.40 \end{array}$$

$$\begin{array}{r} 106.2 \\ 136.55 \\ \hline 3097.7 \end{array}$$

$$\begin{array}{r} 3192.9 \end{array}$$

$$\begin{array}{r} 170.10 \\ 3.4 \\ \hline \end{array}$$

$$\begin{array}{r} 29.10 \\ 80.0 \\ \hline 2.20 \end{array}$$

$$\begin{array}{r} 164.6 \end{array}$$

$$\begin{array}{r} 7.78 \\ 1003.35 \\ \hline \end{array}$$

40

$$\begin{array}{r} 280 \\ 1.25 \\ \hline \end{array}$$

$$\begin{array}{r} 1081.15 \end{array}$$

$$\begin{array}{r} 279.75 \\ 1081.15 \\ \hline 1359.90 \end{array}$$

$$\begin{array}{r} 298.85 \\ 20 \\ \hline \end{array}$$

$$\begin{array}{r} 278.85 \\ 2508.85 \\ \hline 2787.70 \end{array}$$

$$\begin{array}{r} 220 \\ 4.6 \\ \hline 215.4 \end{array}$$

91.

$$\begin{array}{r} 80 \\ 3.8 \\ \hline \end{array}$$

$$\begin{array}{r} 705530 \\ 14011069 \\ \hline 14011069 \end{array}$$

$$\begin{array}{r} 10028 \\ 80024 \end{array}$$

$$\begin{array}{r} 742 \\ 82 \\ \hline 215732 \\ 7946 \\ \hline 15892 \end{array}$$

$$\begin{array}{r} 2677 \end{array}$$

$$\begin{array}{r} 1015 \end{array}$$

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

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

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

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

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