

STATE OF MONTANA
DEPARTMENT OF INDIAN AFFAIRS

27-516-01 62-511-01
FIELD PARTY DIARY

INDIAN BOOK

6

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 $1\frac{1}{2}$ see inside of back cover.

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~~6216-02~~

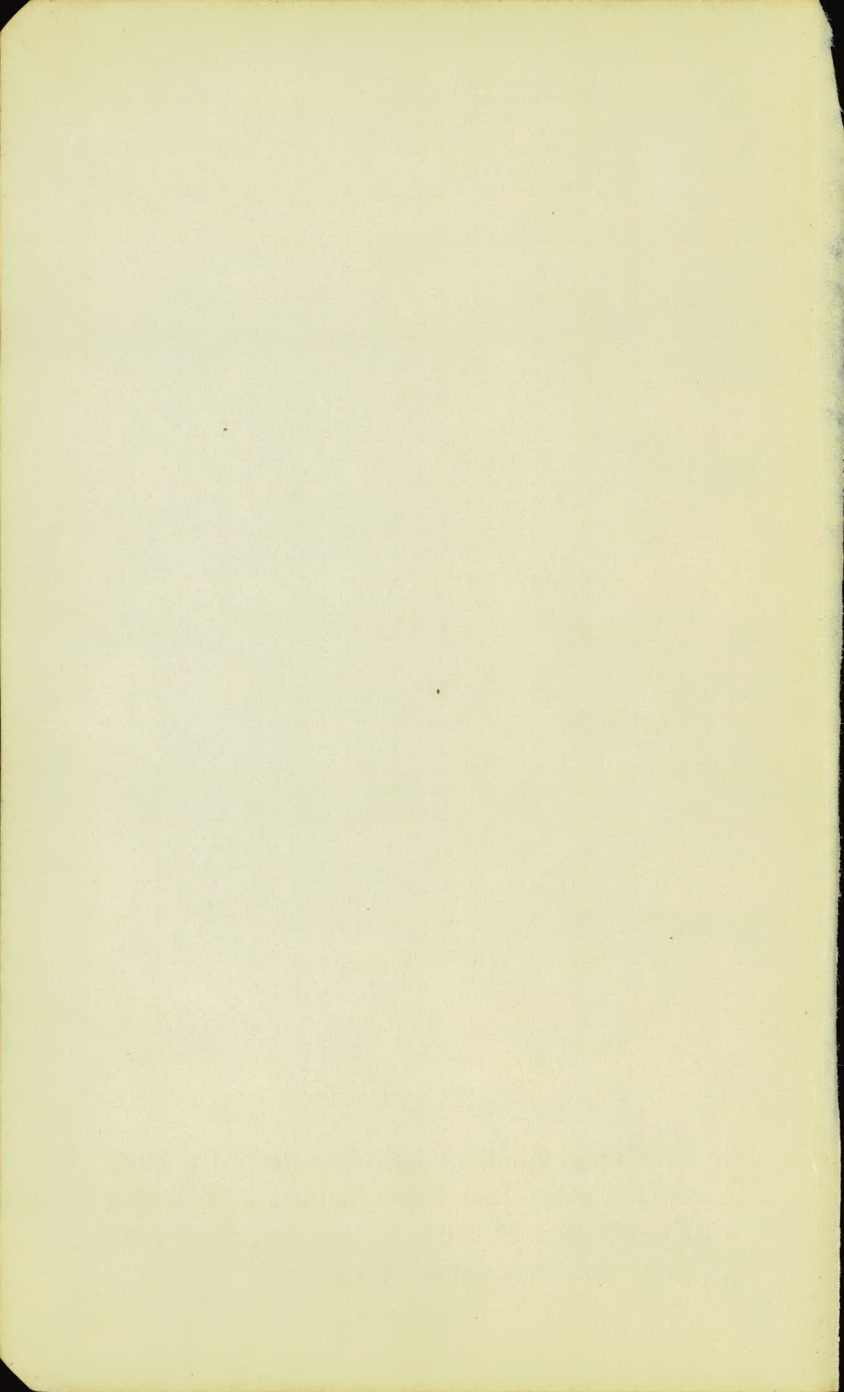
27516-01 Hemp

62-511-01 Ramsey

62.16-02 Smelling

This Field Book is manufactured of a High Grade 50% Rag Paper having a WATER RESISTING SURFACE, and is sewed with Bing Special Enamel Waterproof thread.

Made in U. S. A.



July 21 Harrison, Brand Hughes, Johnson
Slope Stake 6+50 to 12+83.67 275-16-01
2 Hours and over to 7+50 SR 62-511-01
2 Hours. Rest of 4 Hours in A.M.
Harrison spent waiting for
McMillan at his office.

Aug. 3- Harrison, Arundel, Brand
Johns Slope Stake Sta. 3+00
to Sta. 17+00 S.P. 62-511-01
9-Hours

Aug 4 Clear warm, Harrison, Arundel
Brand, & Johnson Slope Stake
17+00 to 30+00 S.P. 62-511-01
9 Hours.

Aug. 5 Cloudy, Rain in A.M. delayed
1/2 Hr. Harrison, Brand, Johnson
Arundel slope stake 30+00
to 47+00 S.P. 62-511-01 9hrs

Aug 6 Clear warm, Harrison, Brand
Johnson Arundel slope stake
47+00 to 53+00 S.P. 62-511-01 9hrs

Aug. 7 Cloudy. Warm, Harrison,
Brand, Arundel Johnson Stake
Sewer rt. Sta. 75+66 to 81+50
Slope Stake 81+00 to 85+00
9hrs

62-16-02

Sat Aug 8 - 1942

Harrison, Arundel, Brand
Johnson slope stake Lt. Side
Sta. 85+00 to 95+00 test
1/2 Hr. for Rain in A.M. 8 hrs.

Mon. Aug. 10 Clear. Mild Harrison, Arundel
Brand Johnson slope stake
95 to 105 7 Hrs Run - 62-511-01
Line, and X-See. Sta. 10+00
to Sta. 12 2 Hrs Borrow Pit
B. S.P. 62-16-02

Aug. 15 - 1942 Rain A.M. Harrison
Johnson, Frederickson
Arundel final X-See.
81+80 to 83+35

Aug. 18 - Tues Cloudy Warm
Harrison, Frederickson
Johnson, Arundel, grade
stake for Sewer Sta
79 to 80 1-Hr.

Wed Aug 19, 1942

Capt. Wm Harrison
Johnson Frederickson
Arundell Set Grade stake
for Sewer Sta- 79+39.5
79+59.5 1 Hour.

Thurs Aug 20- 1942 Clear Hot
Harrison, Johnson, Frederickson
Arundell, Run curb 52
to 80 7 Hours.

Fri Aug 21 1942 Cloudy warm
Harrison Frederickson Johnson
Arundell Slope stake
52 to 61 Hard going

Mon Aug 24 Harrison, Johnson
Arundell Frederickson
Slope stake 62- to 50+00
Clear windy.

Tues Aug 25-1942 Cloudy
Windy as well, Harrison
Frederickson Johnson around
slope stake 70 to 80
9 Hours.

Wed Aug 26-1942 Cloudy Rain
marked distance on Blue top
sta 9+00 to 105 Reset cut stakes
sta 80 to 81+50 Elevations
of nails sta 25+50 26+35
7 Hours.

Sat Aug 29- Harrison, around
Frederickson Mc Briele
3 Hours on 27-516-01
Rain

Mon Aug 31 Harrison around
Frederickson, Ed. Nyquist
Blue Top 4+00 to 12+83.7
S.P. 27-516-01 5 Hours
0+00 to 14+00 4 Hours
S.P. 62-514-01

Tues Sept 1 1942

Rain all day Harrison
in office following grade

Frederickson Sta 0700 to 12+83 S.P. 27.516-01

2-Hrs.

Harrison 8 Hrs. 0700 to 104+50 S.P. 62-511-01

Syversen 2 Hrs. 62.511-01

Wed Sept. 2 1942 Cloudy-Cool

Harrison, Frederickson

Arundell Syversen & Sec.

for Comm. with T.H. 8

and 27.516-01 4 Hours.

S.P. 27.516-01

Tues Sept. 8. Cloudy-Cool

Harrison, Arundell

Frederickson, Syversen

8 Hours on 27.516-01

Wed. 9 Harrison, Syversen

Frederickson, reset slope

stakes 12+50 to 25+00 Lt.

staked Frost Bail Sta

10+50 to 12+60 3 Hours

Thurs Sept. 10 - Clear Whiskey
Harrison, Frederick by
Syverson, Jr. Murphy
Set Parrin's stakes 1750
to 9+00 & 8 Hours.
Murphy started to day

Fri Sept 11 - Harrison, Frederick
Syverson Parrin's stakes
0+00 to 1+50 - 0+00
to 0+02 Rt Rod OS
Curve Pole Tops 14 to
26 Line sta 26 to
Sta. 27. 4 Hours on
27-516-01 4 Hours on
62-511-01

Sat Sept. 12. 1942 Harrison
around Frederickham staked
Sub Cut sta 50+90 to
54+10 - Line 27 to 47
Pole Tops 26 to 47
reset part stakes 5 to 6+00
1 Hour on 27-516-01
6 Hours on 62-511-01

Mon. Sept. 14-1942 Clear. Warm
Harrison, Frederickus.
Syracuse. Eckstead Run
line 0+00 to 26+52
Blue Tops 9+00 to 12+83
SP 27-516-01 0+00 to
Sta 16+00 62-511-01
Blue top 0+30 to
1+00 Lt SP 27-516-01
Time 4 Hours on each
job.

Tues. Sept. 15 Rain in A.M.
Sunshine in P.M. Harrison
worked in office signing
grades and elev. for
curves. Eckstead and
Syracuse worked 2 Hours
Frederickus. Home at
1^o clock. Harrison
5 Hours on 62-511-01
3 Hours on 27.
Went out to Co. Road "C"
but it was too wet to work.

wed Sept 16 - 1942 Harrison
Lunduchon Eeckite spruce
Run line 0500 to 11700
6246-02 2 Hours Run
line star 84 to 92 S. 17
62-511-01 - Staked culverts
for Eeckite star 68465
incl. 85+50 6 Hours.

Thurs Sept. 17 1942 Cloudy
Job a wet. Crew stayed
Home - Harrison over
Job with Welch. Home
Sat 2 o'clock 5 Hours.
figuring Grades.

Fri Sept 18 Cloudy - Cool
Harrison spruce Eeckite
Run Elev on Great Lakes Put
left star 2.5 + 3 Hours.

Mon. Sept. 21 - Cloudy - Cool

Rain at 4.15 P.M. Harrison

Frederickson Eickstead

Sydney Lind X Sec. Sub

Est. 84+90 to 88+60

staked file out lit at

sta. 85+50 -

Reset Prov. stakes 1 Hour

sp. 27.516-01 1 Hour

set Prov stakes sta

16. to 25 S.P. 62.511-01

7 Hours.

Tues. Sept. 22 - Harrison ✓

Frederickson Eickstead

Prov. 13 Tops at R.R. X-129

23+75 to 28+50 Live

and 13 live (grading)

Sta. 45 to 60 - S.P. 62.511-01

8 Hours. Sydney

came out at 3:00 o'clock

He had checked cement

for 2 Hours. This

time for the day 4. Hours

Clear and mule in A.M.

collected in P.M.

Wed Sept 23 Cloudy cool
Rains in P.M. Harrison
Ludwickson Erickson
Syverson but on job
to not come back
to office time for
Archibald and Syverson

2 Hours on 62-511-01

Harrison Frederickson
Plattner over X Sec.

0400 to 12 & 83.7 and
0400 to 7450

4 Hours on 27-516-01

4 Hours " 62-511-01

Thurs Sept 24 1942 Cloudy cold

Harrison Ludwickson
Erickson Syverson line

sta 61 to 78 grading

Blue Laps 61 to 74.

8 Hours - 62-511-01

Tried. Sept. 25-1942

Harrison, Frederickson
Syracuse, Eckstein

Thin Luck line 26+00
to 45+00 set Pot.

Blue Tops from 26+00
to 45+00

8 Hours

S.P. 62.511-0/

Mon. Sept. 28. Clear. Cool

Harrison, Defters, Syracuse
and Eckstein Reset

stakes on 100' Radius
Level. 0+0 to 0+50

1 Hour. S.P. 27.516-0/

Reset pot. Stakes sta

25 to 26 S.P. 62.511-0/

1 Hour. Run line sta

80 to 105 set B. Tops

80 to 95 6 Hours

Frederickson 7 Hours

S.P. 62.511-0/

Tues. Sept. 29. Glen Mild.
Harrison, Dayton, Eckeladt
syrusum set stakes for
Culverts at sta 75+ and
67+ Blue Top. sta
95 to 105+50 Run line
sta. 53 to 60 Check
Permenant stake at sta
25+00 8 Hours on
sp. 62-511-01

Wed Sept 30. 1942
Harrison, Eckeladt
syrusum, Dayton, set
Culvert. Stakes sta 103+
back line from 45 to 53
and from 59 to 68
sp. 62-511-01 8 Hours

Thurs Oct. 1. 1942
Harrison, syrusum, Eckeladt
Dayton, Reset Pt. B. Top. sta.
35 to 45 Set Point B. Top. 45
to 67+50 S.P. 62-511-01
9 Hours.

Fri Oct 2-1942 Clearwater
Rm level sta. 67+50
to sta. 80 - started 60
out let at sta 85+50
S.P. 62-511-01 8 Hours.

Sat Oct. 3 Harris, Eickstadt
syrusm, Dayton's Pt.
Rm level sta 67+50
to 89+00 Rain in p.m.
8 Hours 62-511-01

Sun.

Mon. Oct. 5. Harris Eickstadt
Dayton Charge gravel sta
79+60 to 80+25
Rm in two radius
curves at stee 80
m in radius curves
sta 25+15, connecting
with great lakes level
Rm in 100' radius
curve

at steel 9 + 32 back
to 0 + 95 and set
12 blue tapes. time

3 Hours 27-516-01

6 Hours 62-511-01

Tue Oct 6, 1942 Harrison
Eichstadt, Dayton. Pine
back line. Dist. 89-105
Set Elev for sp. H. 79+16
Set Pst. 13 Tapes at mile
Stn 0+40 to 1+00 3 P.
27-516-01 3 Hours 5 Hours
62-511-01 square CR Cement

Wed Oct. 7, 1942 Clear Windy
Harrison, Eichstadt
Dayton Set Pst. 13 Tapes
Stn 89+00 to 105+50
instructive at New Brighton
Road. square checking
Cement

Thurs Oct 8-1942

Harrison and Eckstadt
Pnt. 13. Laps cut miles
of So. Road "C" and
V.T. H# 8 6 Hours
on 27-516-01 and
2 Hours Pulling in
Pants on 62616-02
Dayton did not
show up for work

Fri Oct 9-1942 Chew. Malt
Harrison Eckstadt Harrison
set Post stakes Sta. 403
to 105+54. Grade change
min in 50' R Curve
5 Hours 62516-01
Set Point and run 3 Stn
of ~~line 24-27 SP 6216-02~~
3 Hours.

Set

Oct 17. 1942 Harrison Eckstadt
superior, Dayton set Post. 13. Top
Sta. 1+00 to 12+87. SP. 27-516-01
1 Hour 0+00 to Sta 10+00
1 Hour sp. 62-514-01

Mon. Oct. 19. 1942 Harrison
Eckstadt superior, Dayton
set B. Top Sta 10+00 to 50+00
left side Superior worked
until 12:00. 4 Hours rest
8 Hours sp 62-511-01

Tues. Oct. 20. 1942 Harrison
Eckstadt superior, Dayton
set B. Top Sta 50 to 69+00
Had hard time getting
it in set around
level 56 to 62
8 Hours

Wed Oct. 21. 1942 Cloudy Cold
Harrison, Eckstadt, Superior
Dayton set Post. Sta 60
- 63+00 to 80+00 ~~but~~
Checked four from Sta 26

to sta 35 found new
sign and low tree
form settled to go back
and make adjustments
also marked form up on
down. 8 Hours

Thurs Oct. 22 1942 Cloudy
Cold. Harrison, Eckhardt
Sykes, Dayton, st
Prot. B tops sta
80 to 105+00 Run in
Radius Curve at 105
8 Hours

Fri Oct 23 1942 Cloudy Cold
Harrison, Eckhardt
Dayton, Sykes, st
4. Radius Curve at sta
80 - checked forms for
check sta 55 to 68
set Echo Hubs for Curve
at sta. 47+52
8 Hours

Wed Oct. 28-1942

Harrison Dayton Eckstadt
Checked Prof Blue Taps
Stn 80 to 105 4 Hours.

Mon. Nov. 9 1942 Harrison
in office arranging notes
3 hours.

Tues Nov-10. Clear Cold
Harrison Eckstadt
Syracuse Dayton staked
side culverts. 0+00
to 101+ Set cut
stakes Stn 77 to 79+16
1 Hour 27-516
7 " 62-511-01

Thurs Nov 12. 1942 Clear Windy
Harrison, Dayton, Eckstut
Symons '84 B. tops for
ditch grade stns 80+00
to 94 and stns. 53
to 63

Fri Nov. 13 Harrison, Eckstut
Symons, set Culvert
stakes for side Culverts
sta 3+ to 101+
SD 62-511-01 8 Hours

Mon. Nov. 16 Clear Mild
Harrison, Eckstut
Symons, Dayton, set
Radius Grade stakes
for 4 Radius curves
sta 80+ staked
sub grade at sta 53+04
on Cleveland ave.
staked side Culverts
sta 85+40 and 101+89
8 Hours of 62-511-01

Tue Nov. 17- 1942

Harrison, Eckhardt
Squaw, Dayton, changed side
Culvert Sta 42+00 and
shaded Culvert at Sta
32+81 rest of day spent
in travelling over job
& Hours Exp 62.51-01

Wed Nov. 18.

Clear mild

Nov. 23 Herrings Eckstadt

Waynes, Terminal & See
Sub Cut Rt. and Lt. on
Cleveland canal, sta

53+024 8 Hours 62-5110

Nov. 24 - 7 Clear mild

Herrings Eckstadt
Waynes' set Blue Top
in special Ditch Rt
sta. 75 to 79 set

Blue Top on Cleveland
canal approach, and
Checked tile outlet

from house into
Rt. Ditch sta. 61+50

8 Hours 62-51101

Nov. 25. Harrison and Doughton
in office Platting
original X-Sec. S.P. 62-51-01
8 Hours.

Nov. 30. 1942 - Harrison, Frederickson
Platting orig X-Sec. Sta.
75 to 53 S.P. 62-51-01 8 Hours

Dec. 1. 1942 Harrison, Frederickson
Platting orig X-Sec. Sta.
53+00 to 75+00 8 Hours.

Dec. 2. 1942 Harrison
Frederickson Plat
orig. X-Sec. Sta. 75 to 92
S.P. 62-51-01 8 Hours

Dec. 3. Harrison, Frederickson
Plat orig. X-Sec. 92 to 105+54
Check orig. X-Sec. 0+00 to
12+83.7 S.P. 27-51-01 2
Check orig. X-Sec 62-51-01 5
0+00 - 8+00

Fri. Dec. 4. Cloudy - Mild
Harrison and Fredericksen
checking ^{orig.} plotting X- Sec. Sta. 8+00
to sta. 50+00 8 Hours

Mon. Dec. 7 Harrison and
Fredericksen checking
original X- Sec. Sta 50+00
86+00 S.P. 62.511-01 8 Hours.

Tue Dec. 8 Harrison and Fredericksen
check orig X- Sec. 86+00
to 90+00 Arrived
Received Superintendant at
10. o'clock finished checking
to 105+04.4 Harrison
Dotted orig sta 0+00
to 16+00 Harrison 7 Hours
on S.P. 62.511.01 1 Hour on
S.P. 27-511-01. Arrived
4 Hours 62.511.01 2 Hours
on. 22.511-01

Wed Dec. 9. 1942 Cloudy, cool
 Harrison, Dayton measured
 Culverts on S.P. ^{Greiser} 62-511-01
 2 - Hours 1 - Home Checking
 Culverts on S.P. 62-16-02
 Harrison 5 Hours in office
 making up Culvert dope

Harrison	7 Hours	S.P. 62-511-01
"	1 "	" 62-16-02
Greiser	2 "	" 62-511-01
"	6 "	62-16-02
Dayton	2 "	" 62-511-01
"	6 "	" 62-16-02

Fredrickson Taking orig. on 62-511-01
 0x00 to 20x00

Thurs. Dec. 10. Harrison, indexing
 note Books S.P. 62-511-01
 8 - Hours. Fredrickson
 making orig. X. Sec. 62-511-01
 8 Hours. 20x00 to 50x00

Friday Dec. 11. 1942

Harrison working up
Culvert Final 8 Hours
Frederick making orig X-Sea
50+00 to 90+00 8 Hours.

Mon Dec. 14. 1942 Cloudy Mild
Harrison and Frederick
Pinning, set out on
A.P. 62.511.01 and Inking
in Sta & Elev. Sta. 0+00
to 40+00 2 Hours 27.516-01
6 " 62.511.01

Tues Dec. 15. Harrison and Frederick
inking in orig X-Sea.
Sta 40+00 to 105+54.
8 Hours.

Wed Dec. 16. Harrison, Dagle
Frederick, set out
core boring stabs. 4
Hours, Frederick pinning
in Pavement Slabs 4 Hours

Thurs Dec. 17 Fredman
Punching in Journal
grades & Hours. Harrison
off on overtime

Fri Dec. 18 Fredman
Punching in Journal
grades Harrison off
on overtime 8 Hours

Mon. Dec. 21. Harrison, making
out Estimate; Dayton
and Harrison made trip out
to Sta 13 to check steel find
on Great Lakes Pipe Mill
& Hours.

Tues. Dec 22. Harrison working
on monthly Estimate
4 Hours. 62-511-01 4 Hours or
S.D 1701-03

Wed. Dec. 23. 1942 Clear
& Mild. Harrison working on
Hard Shell S.P. 1701-03. 8 Hours.

Mon. Dec. 28. Cloudy - Mild
Harrison working on Hard
Shell S.P. 1701-03 8 Hours.

Tues. Dec. 29 Harrison working
in Topog and land base
S.P. 1701-03. 8 Hours.

wed. Dec. 30 - Harrison. Work. Sick

Thurs. Dec. 31. Harrison. Work. Sick

Jan. 4. 1942. Clear. Cold
Harrison making out
five sheets. 8 Hours
Tues.

Jan 5 1942. Clear cold.

Wed Jan. 6 Harrison, working on
Hard shell 1701-03 2-Hrs
6 Hrs on 0205.

Thurs Jan 7. Harrison Frederick's
Weyton, Martin's - making sand
Lies S.P. 0205 (56-156) 8 Hours

Fri. Jan 8. Harrison Martin's
Hughes - Frederick's - land
and lot Lies - Dayton absent.
S.P. 0205. (56-156) 8 Hours

Mon Jan. 11 Harrison, Martin's
Frederick's Dayton land
and lot Lies S.P. 0205. (56-156)
8 Hours

Tues Jan. 12. 1942

Harrison drawing
up plot of SW. 1/4 Sec.
23 for P/W 07 S.P. 0205 (56-156)
8 Hours

Wed Jan 13. Harrison inking
in Plot of SW. 1/4 Sec 23
S.P. 0205. (56-156) 8 Hours.

Thurs. Jan. 14. Harrison, Martin
Fruchier, Hughes
beating lots' in S.P.
0205 (56-156) 8 Hours.

Fri Jan 15. Harrison, working
on sketch of Hamiltons
colobium S.P. 0205 (56-156)
8 Hours

Mon Jan 18 Cloudy and Cold
Harrison working on
S.P. 0205. (56-156) 4 Hours
P. setting profile
S.P. 1700-03 4 Hours.

Tues. Jan 19-1943 cloudy cold
working on location
Profile Sta 870 to 966
S.P. 1701-03 8 Hours.

Wed Jan. 20-1943 Harrison
working on location
Profile S.P. 1701-03 8 Hours.

Thurs ^{Jan 21} Clear Cold Harrison
working Profile Sta.
870 to 968 S.P.
1701-03 8 Hours.

Fri Jan. 22-1943 Clear
mild Harrison
working on Profile
S.P. 1701-03 8 Hours.

Mon. Apr. 19th, 1943

Clear & cool

Van Loan
Fredrickson
Johnston

Set zone stakes for shouldering
2 hrs.

Tues. Apr. 28th, 1943

Set grade stakes for gravel
base at Cleveland Ave.

C.V.L.

1 hr.

O.S.

S.L.

May 10 - 1943 - Cold

Harrison
Johnson

Set stakes for fence line

St. Sta 8+25 to 12+47

Mary
Bissell

Checked ditch St. Sta

6+50 to 7+76. 4 Hours.

S.P. 62511-01 at stakes for

fence line Rt. end Sta. 26

to 46+50 staked 4 Radars

Curves at Sta 53 near

Brighter Road.

May 11 - Cold

Harrison and Bessell set
stakes for road in A. way

5 hours rest of crew walk

Van on 6216 in P.M.

Harrison Bessell Hoffmann

and Mary finished road

5 hours.

May 14 - 1943 Harrison's

Merry, Hoffmann final

X - set. 0700 to 12+87

S.P. 27516-01 5 Hours

0700 to 6+50 3 Hours S.P. 62516-01

Mon May 17- 1943

Harrison and Hoffman
Run line str 10 to 50
in A.M. 4 Hours Harrison
Hoffman Merry Final
X sec. str 6+50 to 16+00
4 Hours.

Tues. May 18. 1943. Clear warm

Harrison, Hoffman, Merry, Deyo
8 Hours Final X sec. str
16+00 to 37+00 Deyo's first
Day.

Wed. May 19. Clear warm

Harrison, Merry, Deyo, Hoffman
staked Ditch pt. str 100+00 R.
to 104+50 Blue Lips in Ditch
Wt. 98+37 to 101+75 3 Hours.
final X. Sec. Sta. 37+00 to
52+00.

Thurs May 20 - 1943 Harrison
Merry, Hoffman, Deys final
X-Section sta 52 to 69 400
Rain at 4:15 8 Hours

Fri May 21 - 1943 Harrison
Merry, Hoffman, Deys final
X-Section sta 69 to 80
4 Hours P.M. Harrison
Hoffman, Merry final 62511-01
X-Section Brown Pit
"19" Sta 16 to 20 4 Hours
011 S.P. 6216-02

Mon, May 24. Rain. Harrison
Photography final X-sec. on
sp. 62511-01, 8 Hours - Hoffman
Worked out on Van house
Crew. Merry and Deys reported
well since 2 Hours and went
Home.

Tues. May 25. Harrison, Nestor
Photography final X-sec. 8 Hours

Wed. May 26. Rain. Harrison
and Distad plotted final
X sections sta 6+00 to
sta 28+00 Checked
final X sec. sta 0+00
to sta 10+00 Merry and
Deryo reported more quads
2 Hours.

We

Thurs May 27 Harrison and
J. J. Ferichman plotting
final X sec. sta 30 to
53 Distad planimeter
sta 0+00 12 + 43.7 SP22846
0+00 to 5+00 6257/01

Fri May 28- Clear warm Harrison
Merry, Deryo Hoffmann final
X sec sta 79 to 102
8 Hours.

Tues June 1-1943 Clear Mild
Harrison, Hoffman, Deyo
finished final & sections
Sta 102 to 105 + 54 and
Run tack line for 50' Radius
Curves at 105 + 04 Connection
with S. Bound Lane Smelling
Ave. 4 Hours for Hoffman
and Deyo - Harrison in
office plotting final & Sec
52 to 60 Deyo and Hoffman
worked with Van Loon
M. P.M.

Wed. June 2 - Cloudy. Rainy P.M.
Harrison and Dinstead checking
final plotting Sta. 95 + 00
to 50 + 00 plotting final
& sec. 60 to 65 Merry
and Deyo working with
Van Loon.

Thurs. June 3. Clear warm
Harrison, Dinstead plotting
finals 67 to 75 - Olson working
on plotting in P.M. 4 Hours
Harrison and Dinstead 8 Hours

Fri June 4. Cloudy Cool
Harrison Drawing in
Paving sections of Sta
50 to 80. Disband camp
Johnson Plotting final
X- Sec. Sta 75 to 88

Mon June 7. Harrison and Kemp
over to St. Paul Park
after seed for Co. Rd C
4 Hours. 1 in P.M.
Harrison plotted in Paving
sec. 80 to 88 plot
final X- Sec. 88 to 95

Tues. June 8. Cloudy Cool
Harrison Plotting final
X- Sec. Sta 95 to 105 + 54.
8 Hours.

Wed June 9. 1943 Cloudy Cool
Harrison plotting in
Pavement, sec. sta
88+00 to 105
Fish and Kemp

Checking final plottings
start 8:40 to 1:05 8 Hours.

June 15 Harrison and Johnson
Planimeter Final X-See.
3 Hours.

June 16 Johnson Planimeters
final X-See. 31 to 56+00
8 Hours Harrison
assisting Hughes on
computing areas for
X-overs.

June 18 Harrison and Kemp
planimeter final X-See
Harrison from 65 to 90
Kemp went with Hughes
to St. Paul Park after
oats. 4 Hours. 62.16-02
4 Hours on 62.51-01
Harrison 8 Hours on 62.51-01

June 21 - 1943 Clear Hot
Harrison Computed fields
Sec. sta 8+12.6 to sta
25+00 scotty and
Kemp Planimeter fields
on S.P. 62.511-01

Tues. June 22. Clear Hot. Harrison
wrapped 4 Hours Computing
additional soil on S.P. 62.516-02
and 4 Hours
Checking fields on 62.511-01
scotty Planimetering 8 Hours

Wed. June 23. Clear & Hot. Harrison
Checking Entrances and
Roads leading to 62.516-02
for Block Left for Manure
~~scotty and~~ 3 Hours
5 7 Hours on fields 62.511-01
scotty Planimeter and
entering areas 8 Hours

Thurs June 24. Clear Hot. Harrison
scotty on finals in A.M.
4 Hours. First meal Harrison
to new Brooklyn to connect
Paris only 8 and 108
could not find B.H. on
100

clear Hot

Fri June 25 Harrison, First scotty
Johnson on finals until
12 o'clock 4 Hours. Harrison
Johnson Hopperman Panning
Blue Tops sta. 167 + 70
to 169 + 50 S.P. 6216-02
ditch Blue tops sta 40
to 45 ditch cat. slots
Lt. sta 41 to 44
4 Hours

Mon. June 28. Cloudy Cool. Harrison
on finals 5 Hours. With
Van on Blue Tops 3
Hours 6216-02

Tues June 29 Clear Cool
Harrison and Fish
Correcting Bench
marks on T.H. 100
and 8 4 Hours of
Hours on trials 62-5110

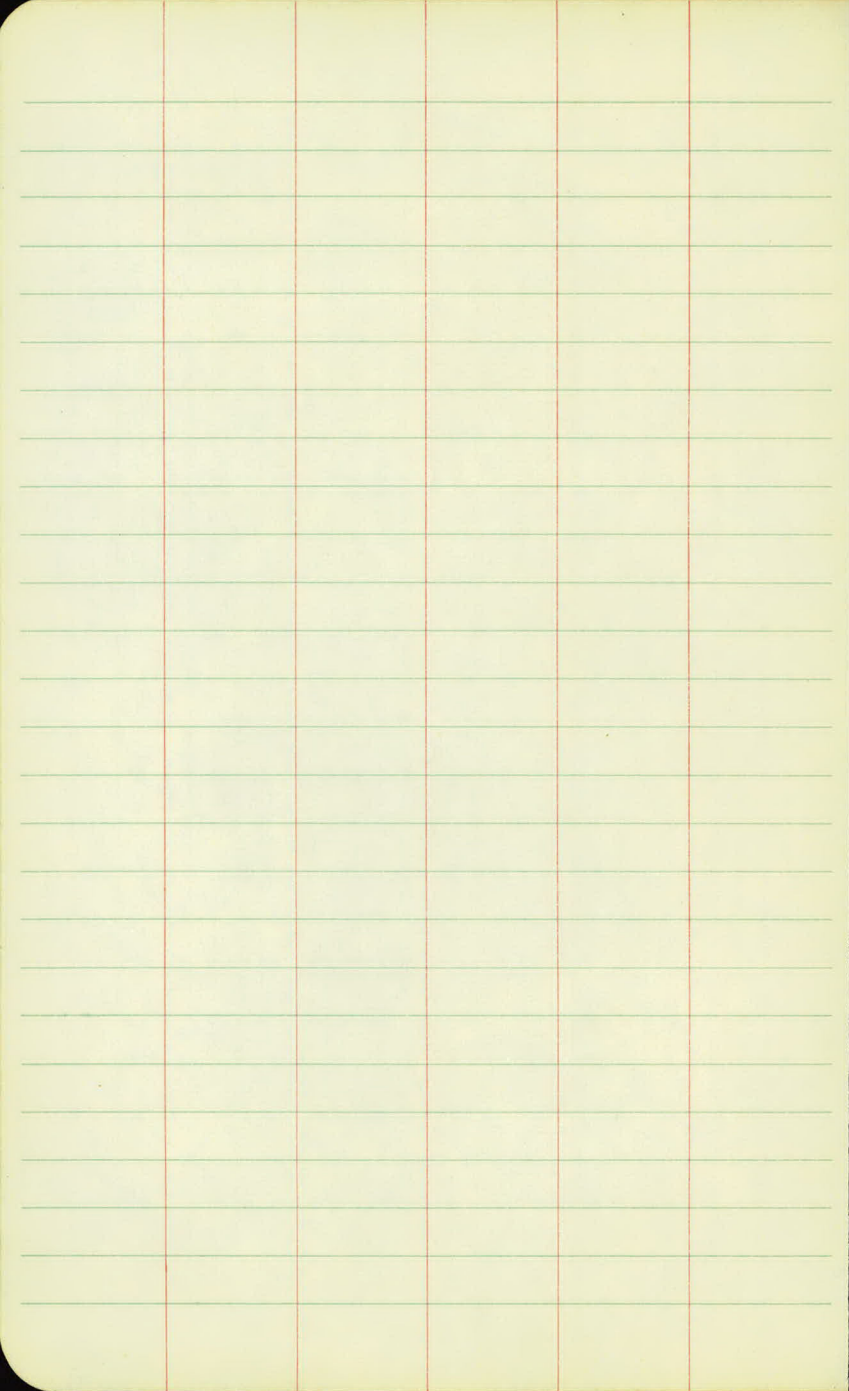
Wed June 30 Clear Cool
Harrison & Hours Preparing
final Estimate.

Thurs July 1 - Harrison Preparing
final Estimate

Fri July 2 - Harrison on
sick leave.

Tues July 6. Clear - Rain P.M.
Perup, Austin, Harrison
taking contours on T.H. 36
Sta 33 to 40 8 Hours

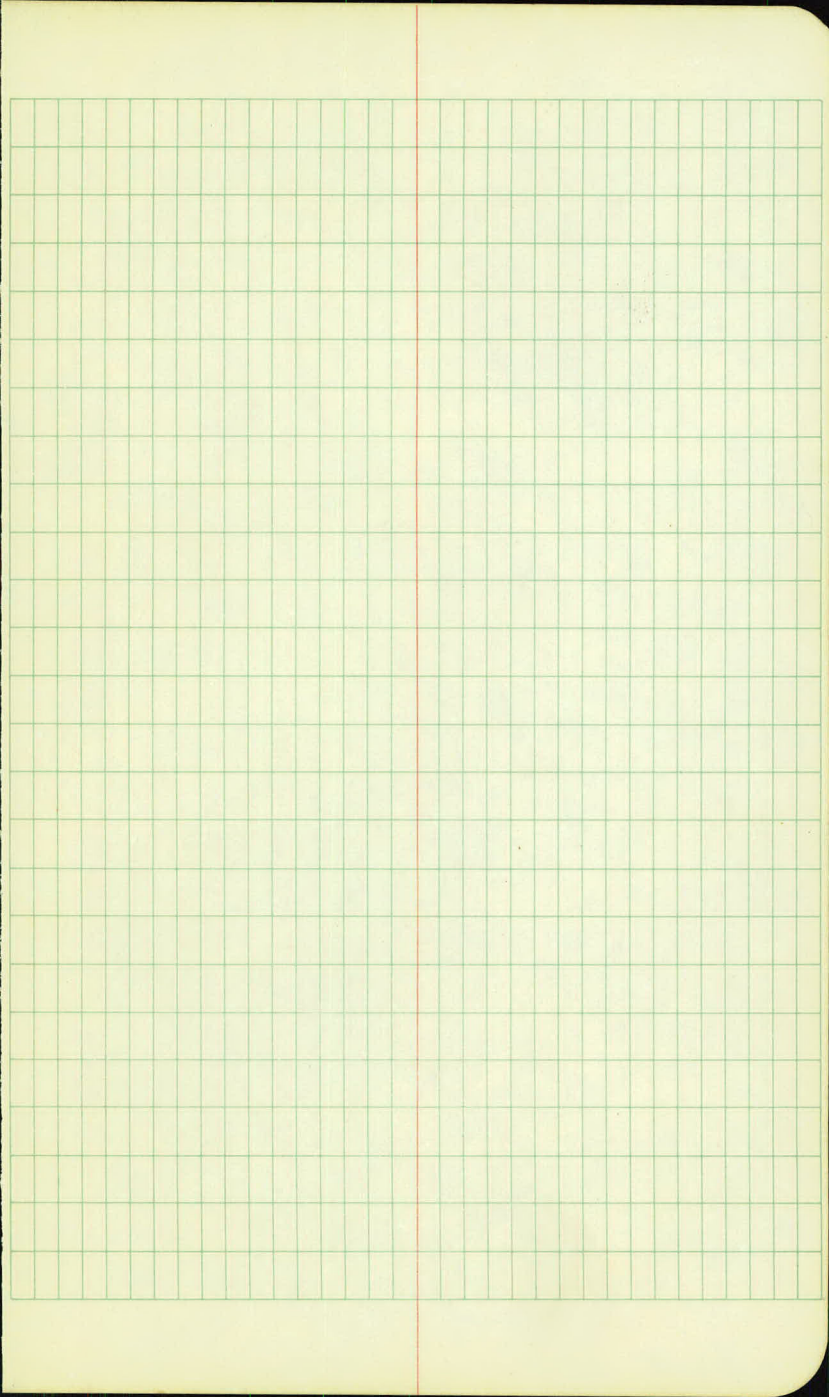
wed. July 7, 1943 Clear Hat
Byarrison, Kemp, Austin
top of contour north of
Sta. 0.33 to 45 T.H. # 36.



Track # 7155

July 27	23020	23020	SP 62-511-0 1
" 31	23020	23056	" "
Aug- 3	23056	23648	" "
" 4	23068	23070	" "
" 5	23076	23096	" "
" 6	23096	23107	" "
" 7	23107	23113	
" 8	23113	23119	
" 10	23119	23130	
" 11	23130	23136	62-16-02
" 12	23136	23140	" " "
" 13	23140	23147	" " "
" 14	23147	23159	" " "
" 15	23159	23169	62-511-02 3 62-16-02 7
" 17	23169	23180	62-16-02
" 18	23180	23198	62-511-01 5 62-16-02 13
" 19	23198	23212	62-511-01 3 62-16-02 11
" 20	23212	23227	62-16-02 10 62-511-01 5
" 21	23227	23234	" " "
" 22	23234	23250	62-16-02
" 24	23250	23257	62-511-01
" 25	23257	23264	" " "
" 26	23264	23282	62-511-01 10 62-16-02 8
" 27	23282	23289	" " "

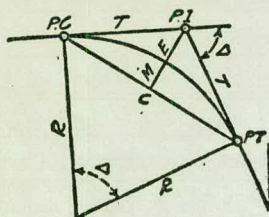
aug	27		23289	62-16-0
aug	28	23289	23298	4 4 4
aug	29	23298	23312	27-516-0
	31	23312		



Sta	V	2- 2/	3	Trees
"	V	57+50 - 94+50	5	"
"	V	60+50 - 62+50	17	"
"	V	55+50 - 56+50	2	"
"	V	52+00 <i>by road</i>	1	"
"	V	43+00 44+00	1	"
"	V	36+50 40+00	5	
"	V	114+00 105+00	1	Stn

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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CURVE FORMULAS

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

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

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

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

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

EXPLANATION AND USE OF TABLES

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

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

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

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

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

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

TABLE II.—INCHES IN DECIMALS OF A FOOT.

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

TABLE III.—RADII, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
20	17188.8	.073	.291	0.10	20'	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.837	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					
1					8				
10	5729.65	.218	.873	0.30	20	716.78	1.746	6.976	2.40
20	4911.15	.255	1.018	0.35	30	688.16	1.819	7.266	2.50
30	4297.28	.291	1.164	0.40	40	674.69	1.855	7.411	2.55
40	3819.83	.327	1.309	0.45					
50	3437.87	.364	1.454	0.50	9				
	3125.36	.400	1.600	0.55	20	637.28	1.965	7.846	2.70
2					30	614.56	2.037	8.136	2.80
10	2864.93	.436	1.745	0.60	40	603.80	2.074	8.281	2.85
20	2644.58	.473	1.891	0.65					
30	2455.70	.509	2.036	0.70	10	593.42	2.110	8.426	2.90
40	2292.01	.545	2.181	0.75	30	573.69	2.183	8.716	3.00
50	2148.79	.582	2.327	0.80	40	546.44	2.292	9.150	3.15
	2022.41	.618	2.472	0.85	11	521.67	2.402	9.585	3.30
3					30	499.06	2.511	10.02	3.45
10	1910.08	.655	2.618	0.90	12	478.34	2.620	10.45	3.60
20	1809.57	.691	2.763	0.95	30	459.28	2.730	10.89	3.75
30	1719.12	.727	2.908	1.00	13	441.68	2.839	11.32	3.90
40	1637.28	.764	3.054	1.05	30	425.40	2.949	11.75	4.05
50	1562.88	.800	3.199	1.10	14	410.28	3.058	12.18	4.20
	1494.95	.836	3.345	1.15	30	396.20	3.168	12.62	4.35
4					15				
10	1432.69	.873	3.490	1.20	30	383.07	3.277	13.05	4.50
20	1375.40	.909	3.635	1.25					
30	1322.53	.945	3.718	1.30	16	370.78	3.387	13.49	4.65
40	1273.57	.982	3.926	1.35	30	359.27	3.496	13.92	4.80
50	1228.11	1.018	4.071	1.40					
	1185.78	1.055	4.217	1.45	17	348.45	3.606	14.35	4.95
5					30	338.27	3.716	14.78	5.10
10	1146.28	1.091	4.362	1.50	18	319.62	3.935	15.64	5.40
20	1109.33	1.127	4.507	1.55	19	302.94	4.155	16.51	5.70
30	1074.68	1.164	4.653	1.60	20	287.94	4.374	17.37	6.00
40	1042.14	1.200	4.798	1.65	21	274.37	4.594	18.22	6.30
50	1011.51	1.237	4.943	1.70	22	262.04	4.814	19.08	6.60
	982.64	1.273	5.088	1.75	23	250.79	5.035	19.94	6.90
6					24	240.49	5.255	20.79	7.20
10	955.37	1.309	5.234	1.80	25	231.01	5.476	21.64	7.50
20	929.57	1.346	5.379	1.85	26	222.27	5.697	22.50	7.80
30	905.13	1.382	5.524	1.90	27	214.18	5.918	23.35	8.10
40	881.95	1.418	5.669	1.95	28	206.68	6.139	24.19	8.40
	859.92	1.455	5.814	2.00	29	199.70	6.360	25.04	8.70
					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	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

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

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.4	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

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

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

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

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92	5933.2	2518.5	102	7075.5	3374.9	112	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93	6037.8	2594.0	103	7203.2	3474.4	113	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4768.9
94	6144.3	2671.6	104	7333.6	3576.8	114	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95	6252.8	2751.3	105	7467.0	3682.3	115	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96	6363.4	2833.2	106	7603.5	3791.0	116	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97	6476.2	2917.3	107	7743.2	3902.9	117	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98	6591.2	3003.8	108	7886.2	4018.2	118	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99	6708.6	3092.7	109	8032.7	4137.1	119	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	6808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100	6828.3	3184.1	110	8182.8	4259.7	120	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

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

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.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	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

FOR EXTERNALS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.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	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.33

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	196.96	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.80	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.43
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

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

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.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	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

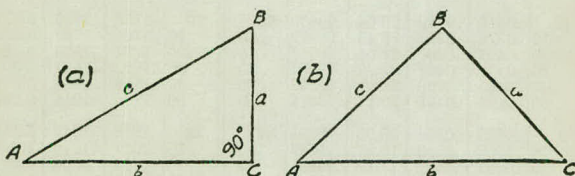
SLOPE REDUCTIONS.

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

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



FORMULA FOR SOLVING TRIANGLES.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	$\sin. A = \frac{a}{c}, \cos. B = \frac{a}{c}, b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan. A = \frac{a}{b}, \cot. B = \frac{a}{b}, c = \sqrt{a^2 + b^2}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot. A, c = \frac{a}{\sin. A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan. A, c = \frac{b}{\cos. A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin. A, b = c \cos. A$
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	$A - B$	$\tan. \frac{1}{2}(A - B) = \frac{(a - b) \tan. \frac{1}{2}(A + B)}{a + b}$
c, b, c	A	$\left\{ \begin{aligned} \text{If } s = \frac{1}{2}(a + b + c), \sin. \frac{1}{2} A &= \sqrt{\frac{(s - b)(s - c)}{bc}} \\ \cos. \frac{1}{2} A &= \sqrt{\frac{s(s - a)}{bc}}, \tan. \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{s(s - a)}} \\ \sin. A &= \frac{2\sqrt{(s - a)(s - b)(s - c)} s}{bc} \end{aligned} \right.$
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	∞	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	5.576	.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	.98163	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
	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	.91708	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.	
or						or					
32	.5299	.6249	1.600	.84805	58	30	.6225	.7954	1.257	.78261	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30	39	.6293	.8098	1.235	.77715	51
40	.5398	.6412	1.560	.84182	20	10	.6316	.8146	1.228	.77531	50
50	.5422	.6453	1.550	.84025	10	20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30	40	.6428	.8391	1.192	.76604	50
40	.5544	.6661	1.501	.83228	20	10	.6450	.8441	1.185	.76417	50
50	.5568	.6703	1.492	.83066	10	20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30	41	.6561	.8693	1.150	.75471	49
40	.5688	.6916	1.446	.82248	20	10	.6583	.8744	1.144	.75280	50
50	.5712	.6959	1.437	.82082	10	20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30	42	.6691	.9004	1.111	.74314	48
40	.5831	.7177	1.393	.81242	20	10	.6713	.9057	1.104	.74120	50
50	.5854	.7221	1.385	.81072	10	20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30	43	.6820	.9325	1.072	.73135	47
40	.5972	.7445	1.343	.80212	20	10	.6841	.9380	1.066	.72937	50
50	.5995	.7490	1.335	.80038	10	20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30	44	.6947	.9657	1.036	.71934	46
40	.6111	.7720	1.295	.79158	20	10	.6967	.9713	1.030	.71732	50
50	.6134	.7766	1.288	.78980	10	20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
											or
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

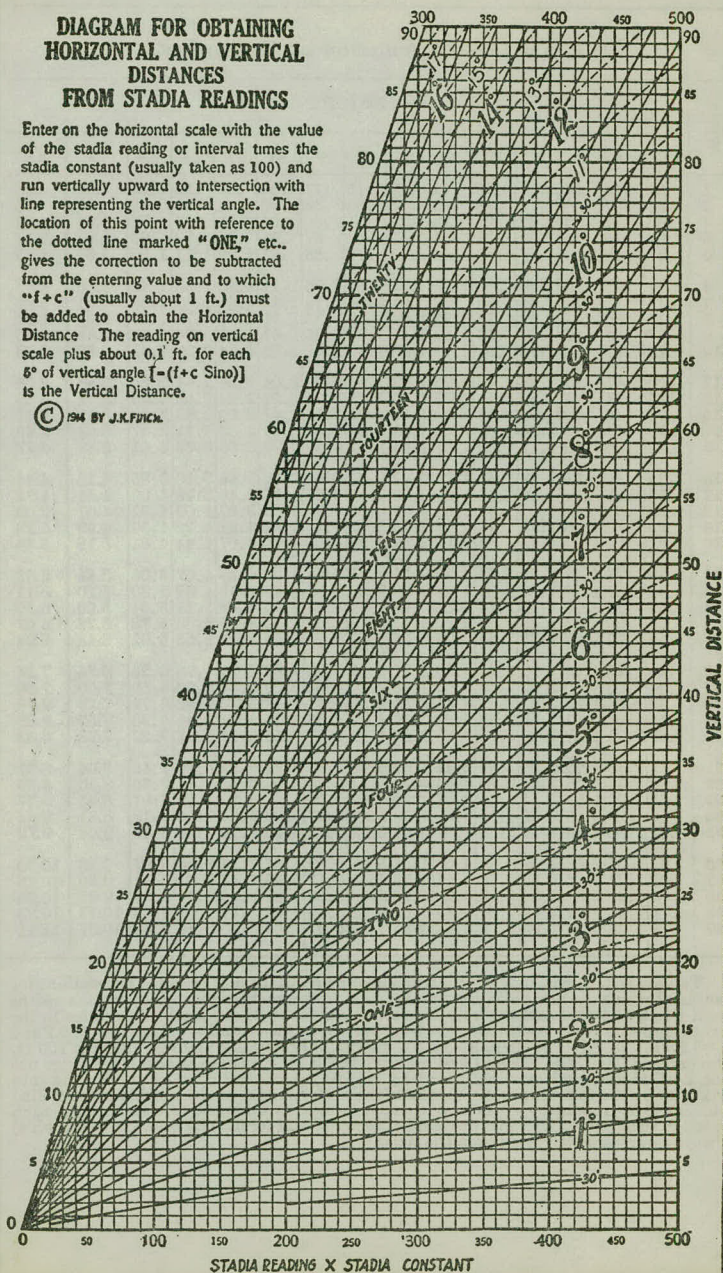
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96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

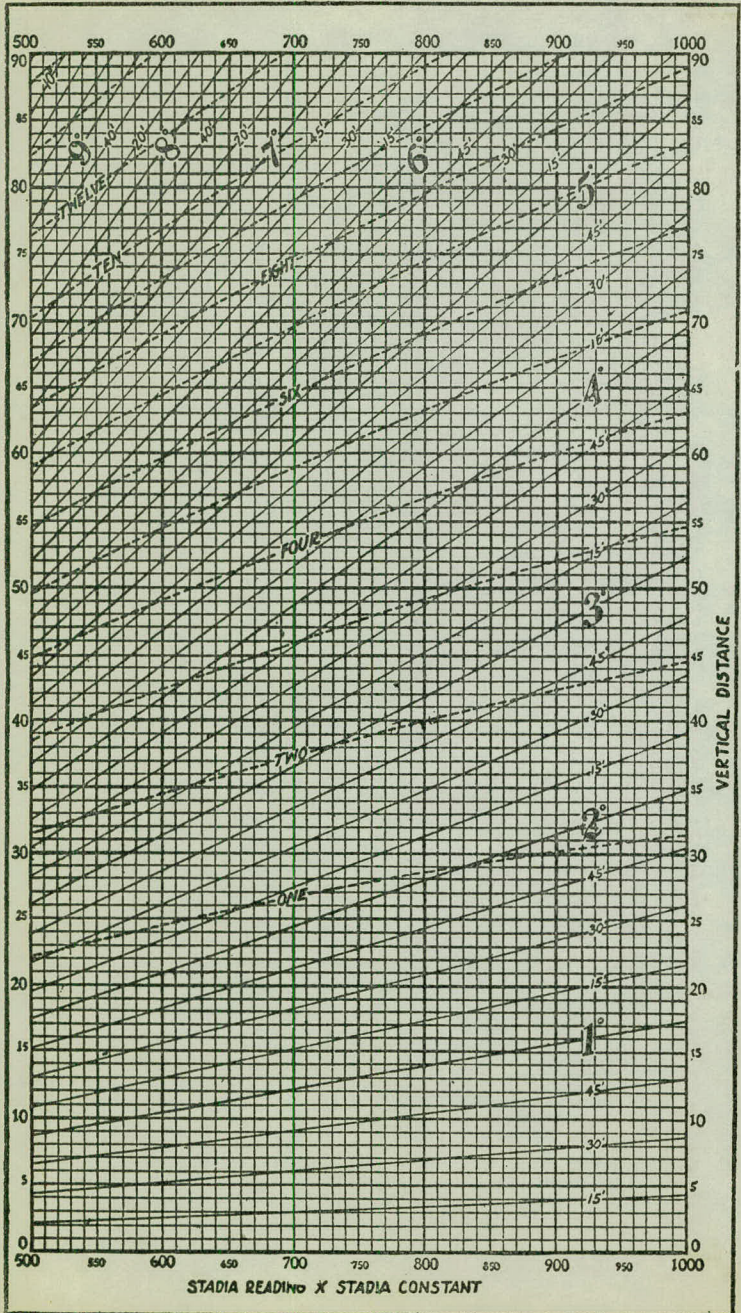
Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if $w=16.2$ and $h=5.3$, cu. yds. $=1.48+.028+.039=1.597$ cu. yds. or practically 160 cu. yds. per 100 ft. If we exceeds 40 ft., use one half and multiply result by 2, if both w and h are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) $=h$, and $\frac{1}{2}$ the roadbed $=w$, add the triangles formed by taking the distance out to each break in turn ($=w$'s) by the difference between the cuts (or fills) on each side of it ($=h$'s) always subtracting the outer from the inner.

DIAGRAM FOR OBTAINING HORIZONTAL AND VERTICAL DISTANCES FROM STADIA READINGS

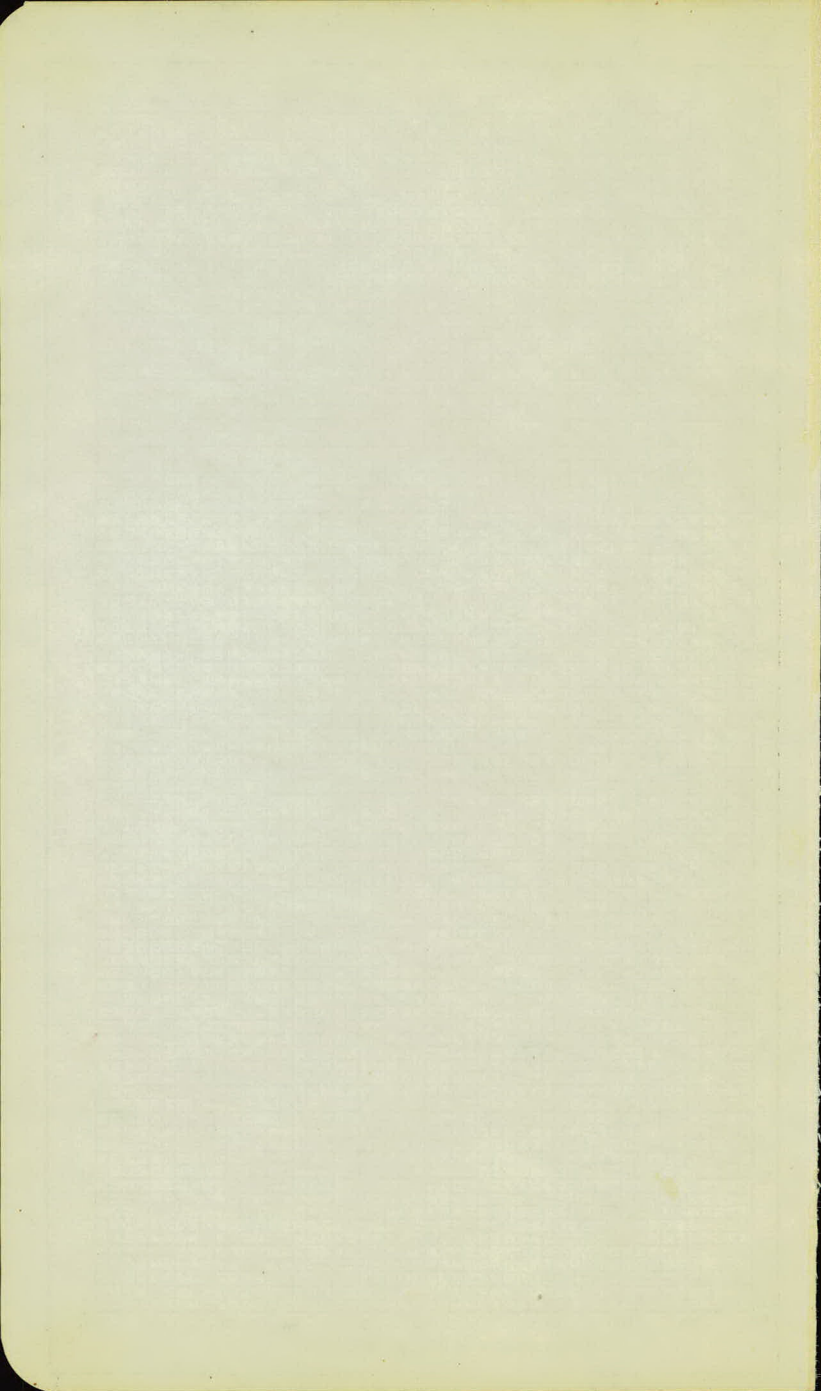
Enter on the horizontal scale with the value of the stadia reading or interval times the stadia constant (usually taken as 100) and run vertically upward to intersection with line representing the vertical angle. The location of this point with reference to the dotted line marked "ONE," etc., gives the 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 [$=(f+c \text{ Sino})$] is the Vertical Distance.

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STADIA READING X STADIA CONSTANT



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.