

Book - 6-A, Dr. 12-A

INSTRUCTION NOTES

FILE
H11-100
360A

PROJ.32-N15

KEUFFEL & ESSER CO.

DRAWING MATERIALS

AND

SURVEYING INSTRUMENTS.

NEW YORK.

CHICAGO. ST. LOUIS. SAN FRANCISCO. MONTREAL.

TABLES FOR EXCAVATIONS AND EMBANKMENTS.

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 18 FEET WIDE. SIDE SLOPES 1 TO 1.

FOR SINGLE TRACK EXCAVATION.

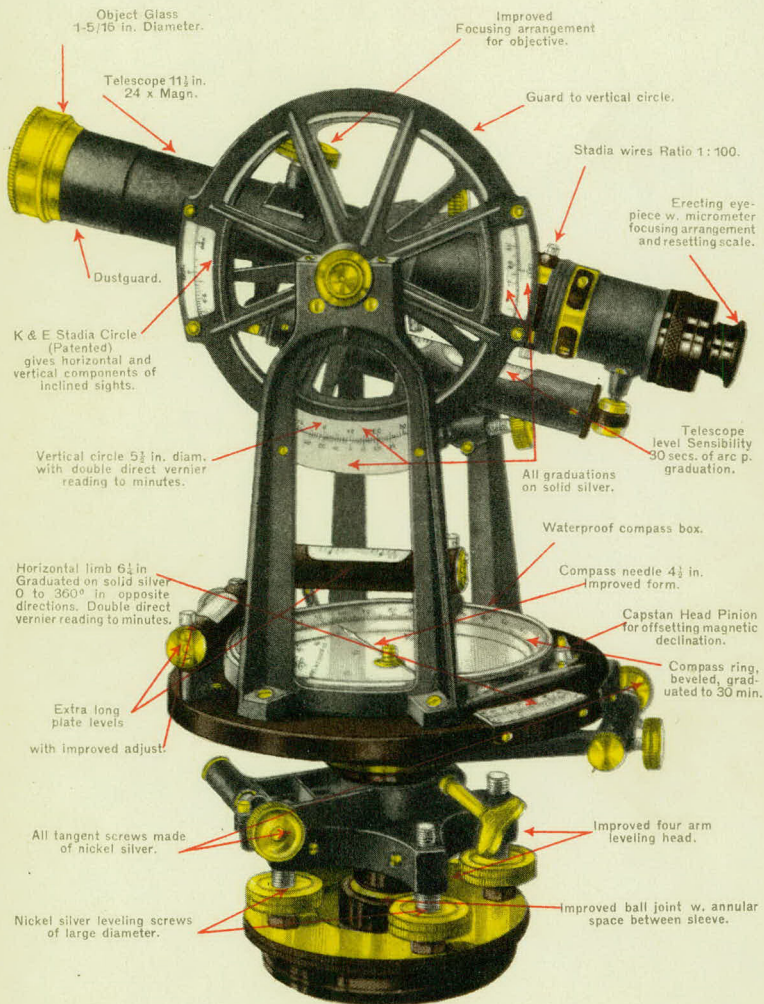
"Copyright, 1895, by Keuffel & Esser Co."

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

Calculated by Julien A. Hall, M. Am. Soc. C. E.

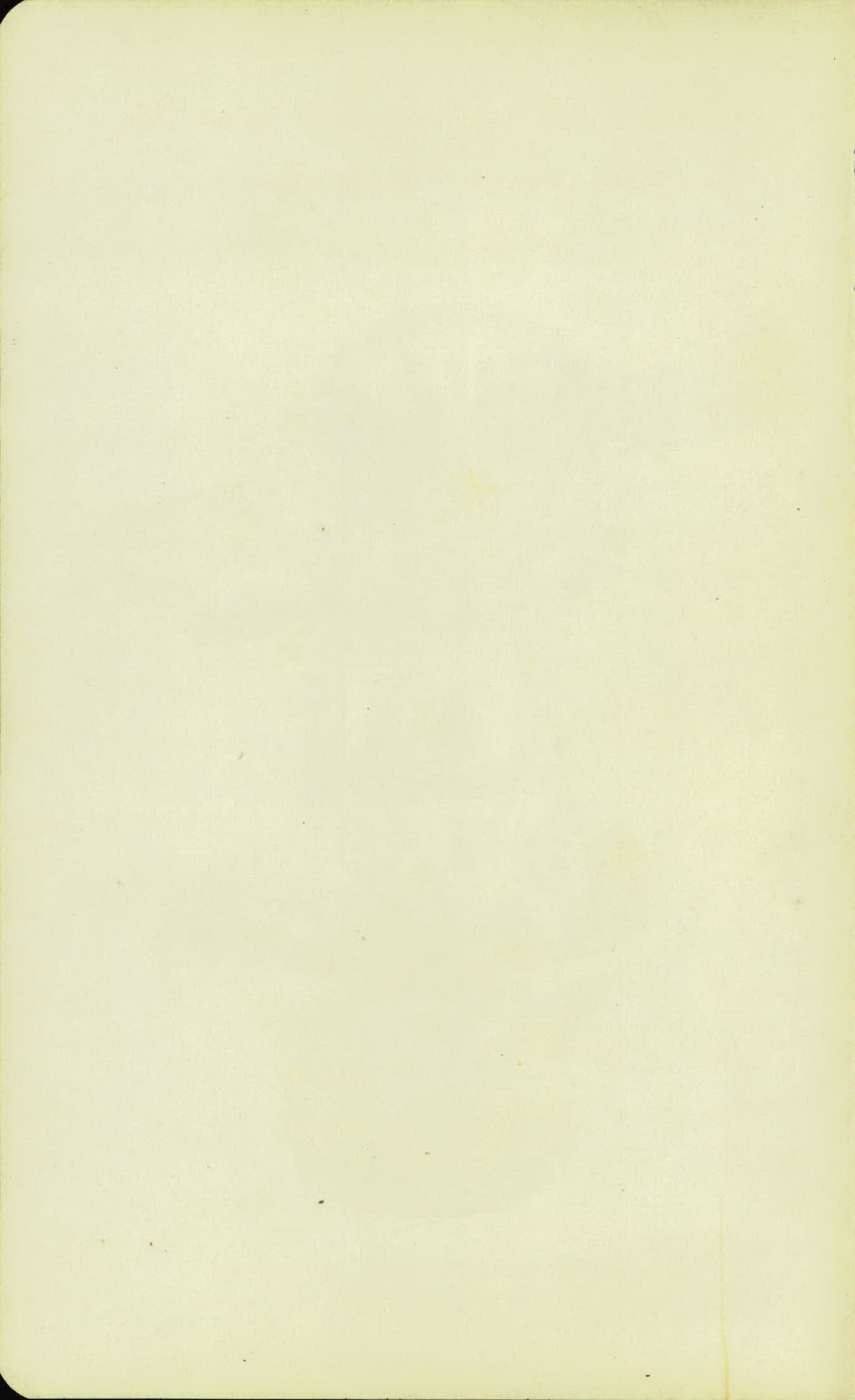
For Keith's Railroad Curve Tables see end of book.

EXTRA FINE ENGINEERS' TRANSIT No. 5060 S KEUFFEL & ESSER CO., N.Y.



ALSO MADE WITH

INTERNAL FOCUSING TELESCOPE
PRACTICALLY DUST AND MOISTURE PROOF.



PROJ # 32-N15

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$\Delta-Lt$ $\Delta-Rt$

12+88.23 P.T. $11^{\circ}22^{\frac{30}{}}$

+50

$10^{\circ}65'$

$10^{\circ}02^{\frac{30}{}}$

12

$9^{\circ}10'$

$8^{\circ}17^{\frac{30}{}}$

$\Delta-22^{\circ}45'$

+50

$7^{\circ}25'$

$6^{\circ}32^{\frac{30}{}}$

$D-7^{\circ}Lt$

11+28.0 P.I.

$22^{\circ}45'$

$T-164.77$

11

$5^{\circ}40'$

$4^{\circ}47^{\frac{30}{}}$

$L-325.00$

+50

$3^{\circ}55'$

$3^{\circ}02^{\frac{30}{}}$

$R-819.02$

10

$2^{\circ}10'$

$1^{\circ}17^{\frac{30}{}}$

9+63.23 P.C.

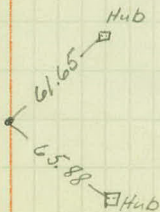
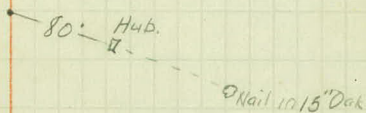
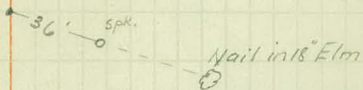
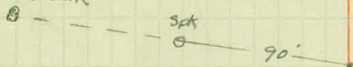
$0^{\circ}25'$

$0^{\circ}00'$

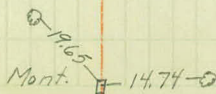
6+00.20 P.O.T.

0+00

Nail in 8" Oak



E. 4 Cor. Sec. 24



A-Lt.

A-Rt.

22+24.57	P.T.	18°41'	
22		16°50 ³⁰	Δ-37°22'
+50		13°05 ³⁰	D-15°L
21+05.0	P.I.	37°22'	T-129.54
21		9°20 ³⁰	L-249.11
+50		5°35 ³⁰	R-383.065
20		1°50 ³⁰	
19+75.46	P.C.	0°00'	
17+58.02	P.T.	19°37'	
+50		19°01'	
17		15°16'	Δ-39°14'
+50		11°31'	D-15°R
16+33.0	P.I.	39°14'	T-136.53
16		7°46'	L-261.55
+50		4°01'	R-383.065
15		0°16'	
14+96.47	P.C.	0°00'	

10.08 — 10" Oak

23.81

15" Oak

63.22 — 3 Nails in Cottage



95.15

12" Oak

Spk.

35'

79.19

B.M. Spk.

42+45.10 Mont. Δ -Lt Δ -Rt
 $\frac{1}{2}$ Highway Ave

32+90.67 P.T.

11°40'

+50

10°02'

32

8°02'

Δ -23°20'

+50

6°02'

D-8°Lt

31+47.0 P.I.

23°20'

T-148.0

31

4°02'

L-291.67

+50

2°02'

R-716.79

30

0°02'

29+99.0 P.C.

0°00'

27+19.02 P.T.

22°12'

27

20°47'

+50

18°54.5

17°02'

Δ -44°25'

15°07.5

26

13°17'

D-15°R

25+79.30 P.I.

11°24.5

T-156.39

+50

1°39.5

9°32'

L-296.11

25

3°54.5

5°47'

R-383.065

+50

2°02'

24+22.91 P.C.

0°00'

Top of Silo



Spk.

50'

12" Oak



56.95

6" Oak



43.52

55'

Hub

Nailing 6" Oak

O.P.R.

37.85

32.77

O.G.P.

18" Pop

99.31

0.

Spk.

E. Edge of Chimney } House Rf. Sta. 3+00

B.M. 4.74 992.38 ✓ 987.64

0+00 79.9 12.5 .

+50 81.5 10.9 .

1 83.2 9.2 .

+50 84.8 7.6 .

+70 85.5 6.9 .

B.M. 10.61 998.25 ✓ 4.74 987.64 ✓

2 86.5 11.8 .

+20 87.1 11.2 .

+38 87.7 10.6 .

+50 88.1 .

+77 88.9 9.4 .

3 89.4 ✓ 8.9 .

T.P. 9.98 1006.01 ✓ 2.22 996.03

+38 89.7 16.3 .

+50 89.8 .

1 1/2' - Cut 21' = 00 P.C. 2:11 11
24' = 00 C.

4

11-10-32

Spk in Stump 33' Lt. 1+80 - F. Line

$$\frac{14.2}{33} \quad \frac{12.5}{9} \quad \frac{12.4}{10.1} \quad \frac{11.7}{11} \quad \frac{11.2}{21} \quad \frac{10.4}{27.3} \quad \frac{9.6}{33}$$

$$\frac{14.2}{33} \quad \frac{10.5}{4} \quad \frac{10.5}{10.4} \quad \frac{10.4}{7} \quad \frac{9.0}{19} \quad \frac{6.9}{30.0} \quad \frac{6.4}{33}$$

$$\frac{12.0}{33} \quad \frac{8.5}{8} \quad \frac{7.7}{11.5} \quad \frac{7.5}{6} \quad \frac{7.8}{14} \quad \frac{7.2}{16} \quad \frac{4.7}{30.8} \quad \frac{4.3}{33}$$

$$\frac{9.3}{33} \quad \frac{8.3}{31} \quad \frac{7.1}{24.8} \quad \frac{8.4}{11} \quad \frac{6.3}{11.3} \quad \frac{2.1}{8} \quad \frac{1.2}{18} \quad \frac{2.1}{30} \quad \frac{1.8}{32.7} \quad \frac{1.4}{36}$$

$$\frac{7.8}{33} \quad \frac{5.7}{25.8} \quad \frac{5.5}{21} \quad \frac{3.8}{12} \quad \frac{2.1}{14.8} \quad \frac{1.0}{11} \quad \frac{0.7}{33} \quad \frac{0.5}{38}$$

$$\frac{14.7}{33} \quad \frac{11.6}{8} \quad \frac{11.3}{10.5} \quad \frac{10.7}{15} \quad \frac{9.0}{28.2} \quad \frac{8.8}{33}$$

$$\frac{16.8}{33} \quad \frac{15.1}{20.8} \quad \frac{12.2}{11.0} \quad \frac{10.6}{15} \quad \frac{9.4}{26.7} \quad \frac{9.0}{33}$$

$$\frac{15.6}{33} \quad \frac{13.2}{15} \quad \frac{11.6}{11.0} \quad \frac{9.7}{16} \quad \frac{8.9}{33}$$

$$\frac{8.1}{33} \quad \frac{7.2}{27.3} \quad \frac{6.0}{14} \quad \frac{5.1}{14.3} \quad \frac{5.0}{16} \quad \frac{6.0}{29.1} \quad \frac{6.0}{33}$$

$$\frac{5.7}{33} \quad \frac{5.3}{29.4} \quad \frac{3.6}{15} \quad \frac{2.7}{16.2} \quad \frac{2.2}{18} \quad \frac{2.7}{33.3} \quad \frac{2.7}{40}$$

$$\frac{12.7}{33} \quad \frac{12.5}{29.7} \quad \frac{10.1}{11} \quad \frac{9.1}{17.2} \quad \frac{7.8}{18} \quad \frac{7.3}{31.5} \quad \frac{7.1}{42}$$

✓
1006.01

3+65 89.8 16.2 .

4 89.5 16.5 .

+36 88.7 17.3 .

+50 88.3

+60 88.0 18.0 .

5 86.5 19.5 .

+50 83.7 22.3 .

6 80.3 25.7 .

+23 78.3 27.7 .

T.P. 1.30 995.82 ✓ 11.49 994.52 ✓

+50 75.9

+60 75.0 20.8 .

7 71.2 24.4 .

+15 69.8 26.0 .

11-16-32

16.2

$$\frac{11.7}{33} \quad \frac{4.2}{30.3} \quad \frac{11.4}{16} \quad \frac{10.7}{+5.5} \quad \frac{9.2}{16} \quad \frac{7.8}{36.6} \quad \frac{7.4}{40}$$

16.5

$$\frac{7.6}{50} \quad \frac{9.0}{37} \quad \frac{11.9}{33.9} \quad \frac{11.2}{17} \quad \frac{11.0}{+5.5} \quad \frac{10.2}{21} \quad \frac{9.9}{33.9} \quad \frac{9.7}{37}$$

17.3

$$\frac{6.4}{50} \quad \frac{7.8}{38.3} \quad \frac{9.1}{31} \quad \frac{9.8}{17} \quad \frac{10.6}{+6.7} \quad \frac{10.3}{17} \quad \frac{9.9}{35.1} \quad \frac{9.6}{37}$$

19.0

$$\frac{6.5}{50} \quad \frac{7.7}{36} \quad \frac{8.3}{21} \quad \frac{8.0}{+10.0} \quad \frac{7.3}{19} \quad \frac{7.3}{40}$$

19.5

$$\frac{6.2}{50} \quad \frac{6.5}{43.5} \quad \frac{6.3}{38} \quad \frac{4.9}{16} \quad \frac{3.9}{+15.6} \quad \frac{2.9}{22} \quad \frac{2.4}{45} \quad \frac{2.9}{48.9} \quad \frac{3.5}{55}$$

22.3

$$\frac{6.7}{60} \quad \frac{6.4}{47.9} \quad \frac{6.2}{39} \quad \frac{5.2}{25} \quad \frac{2.9}{+19.4} \quad \frac{1.8}{22} \quad \frac{2.0}{50} \quad \frac{3.1}{52.8} \quad \frac{3.5}{60}$$

25.7

$$\frac{4.9}{60} \quad \frac{4.4}{84.0} \quad \frac{4.2}{50} \quad \frac{3.2}{21} \quad \frac{3.1}{+22.6} \quad \frac{3.1}{22} \quad \frac{3.6}{50} \quad \frac{3.9}{56.7} \quad \frac{4.0}{60}$$

27.7

$$\frac{6.6}{60} \quad \frac{5.7}{50} \quad \frac{5.4}{22} \quad \frac{5.4}{+22.3} \quad \frac{5.9}{19} \quad \frac{6.4}{36} \quad \frac{6.8}{50} \quad \frac{7.1}{60}$$

20.8

$$\frac{2.7}{60} \quad \frac{2.8}{58.0} \quad \frac{3.3}{36} \quad \frac{4.1}{22} \quad \frac{4.4}{+16.4} \quad \frac{4.2}{23} \quad \frac{4.0}{40} \quad \frac{4.0}{49.2} \quad \frac{3.7}{60}$$

24.6

$$\frac{8.7}{60} \quad \frac{8.4}{48.3} \quad \frac{7.3}{37} \quad \frac{7.5}{24} \quad \frac{7.4}{+17.2} \quad \frac{8.2}{20} \quad \frac{8.3}{38} \quad \frac{8.7}{47.9} \quad \frac{9.5}{60}$$

26.0

$$\frac{9.8}{60} \quad \frac{10.1}{50} \quad \frac{9.7}{43} \quad \frac{9.2}{19} \quad \frac{9.5}{15} \quad \frac{9.7}{30} \quad \frac{11.4}{42} \quad \frac{12.0}{42} \quad \frac{14.5}{60}$$

995.82 ✓

7+26

T.P.

2.54

985.32 ✓

13.04

68.8

✓ 27.0 .

982.78

7+26

68.8.

16.5 .

+50

T.P.

0.26

973.19 ✓

12.39

66.5

✓ 18.8 .

972.93

7+50

66.5

6.7 .

+67

B.M.

7.65

969.86 ✓

10.98

64.9

8.3 .

962.21 ✓

+95

62.3

7.4 .

8

61.8

8.1 .

+34

58.6

11.3 .

+50

57.1

12.8 .

+70

55.2

14.7 .

9

-0.5

+0.5

52.4

17.5^{17.0} .

$$\begin{array}{r}
 0.15.7 \\
 \frac{19.6}{60} \quad \frac{10.6}{55} \quad \frac{11.3}{44} \quad \frac{11.6}{37} \quad \frac{12.0}{23} \quad \frac{12.3}{44.7} \\
 47.6
 \end{array}$$

$$\begin{array}{r}
 16.3 \\
 \frac{3.5}{13} \quad \frac{5.3}{29} \quad \frac{5.9}{39.9} \quad \frac{6.6}{50}
 \end{array}$$

$$\begin{array}{r}
 18.8 \\
 \frac{7.4}{50} \quad \frac{10.7}{40.1} \quad \frac{8.1}{16} \quad \frac{9.9}{72} \quad \frac{13.2}{12}
 \end{array}$$

Nail Stump 38' Lt 7+42

$$\begin{array}{r}
 6.7 \\
 \frac{2.5}{228} \quad \frac{4.2}{33}
 \end{array}$$

8.3

$$\begin{array}{r}
 \frac{2.6}{40} \quad \frac{3.4}{31.4} \quad \frac{6.3}{15} \quad \frac{7.8}{10.5} \quad \frac{10.1}{17} \quad \frac{10.3}{21} \quad \frac{10.9}{29} \quad \frac{10.5}{33}
 \end{array}$$

3 Nails in 8" Oak 80' Lt 7+90

$$\begin{array}{r}
 \frac{11.5}{45} \quad \frac{13.7}{33}
 \end{array}$$

$$\begin{array}{r}
 \frac{9.0}{20} \quad \frac{4.0}{34} \quad \checkmark
 \end{array}$$

8.1

$$\begin{array}{r}
 \frac{10.4}{15} \quad \frac{6.2}{26.9} \quad \frac{3.4}{33}
 \end{array}$$

11.3

$$\begin{array}{r}
 \frac{12.0}{-0.7} \quad \frac{5.4}{20} \quad \frac{1.1}{33} \quad \frac{1.9}{43.0} \quad \frac{4.0}{50}
 \end{array}$$

12.8

$$\begin{array}{r}
 \frac{11.0}{+1.8} \quad \frac{5.5}{20} \quad \frac{2.8}{33} \quad \frac{0.5}{42.5} \quad \frac{1.0}{50}
 \end{array}$$

14.7

$$\begin{array}{r}
 \frac{12.2}{+2.5} \quad \frac{9.2}{14} \quad \frac{6.6}{30} \quad \frac{3.2}{50}
 \end{array}$$

17.5

$$\begin{array}{r}
 \frac{13.5}{29.3} \quad \frac{11.7}{43}
 \end{array}$$

		969.86 ✓			
T.P.	0.48	958.74 ✓	11.60	958.26 ✓	
+95				42.3	+3.6 .
8				41.8	+3.1 .
+34				58.4	0.1 .
+50				57.1	1.4 .
+70				55.2	3.5 .
9		-0.5	+0.5	52.4	^{6.8} 6.3 .
T.P.	0.21	945.26 ✓	13.69	945.05	
+50	1.0	-0.9	+0.8	47.7	+1.5 +3.2 +2.4 .
T.P.	2.27	934.76 ✓	12.77	932.49	
10	2.0	-1.2	+1.0	43.0	+7.0 +9.2 +8.2 .
B.M.	0.37	923.90 ✓	11.23	923.53	+12.9 923.53
10+00	2.0	-1.2		43.0	+17.9 +19.1 .
+50	2.0	-1.2	+1.0	38.3	+13.2 +15.4 +14.4 .
+70	2.0	-1.2	+1.0	35.7	+10.6 +12.6 +11.8 .

$$\frac{4.7}{19} \quad \frac{5.4}{6} \quad \frac{4.8}{-}$$

+3.6

$$\frac{4.8}{33} \quad \frac{3.3/5.2}{29.6} \quad \frac{6.6}{12} \quad \frac{6.3}{7} \quad \frac{4.0}{-7.1}$$

+3.1

$$\frac{14.9}{50} \quad \frac{5.4/5.7}{43.0} \quad \frac{15.3}{38} \quad \frac{12.6}{33} \quad \frac{6.0}{15}$$

0.1

$$\frac{11.0}{33} \quad \frac{5.5/10.1}{30.0} \quad \frac{5.5}{17}$$

1.6

$$\frac{10.8}{35} \quad \frac{7.5}{25} \quad \frac{4.5}{14}$$

3.5

$$\frac{14.3}{33} \quad \frac{5.4/12.4}{24.2} \quad \frac{10.1}{15} \quad \frac{7.3}{-1.0} \quad \frac{5.4}{10}$$

6.3

$$\frac{15.2}{50} \quad \frac{13.5/14.0}{45.0} \quad \frac{11.9}{31} \quad \frac{8.9}{13} \quad \frac{7.4}{-9.8} \quad \frac{5.4}{16} \quad \frac{9.3/3.7}{24.8} \quad \frac{2.8}{35}$$

+2.4

$$\frac{12.4}{32} \quad \frac{10.6}{19} \quad \frac{8.2}{-10.4} \quad \frac{6.2}{18} \quad \frac{13.1/3.9}{39.2} \quad \frac{3.2}{50}$$

+8.2

Spk. in Birch Stump 70' L. 9480

$$\frac{7.6}{70} \quad \frac{24.7/6.8}{64.4}$$

+1.44

$$\frac{16.0}{80} \quad \frac{28.8/15.6}{70} \quad \frac{13.5}{35} \quad \frac{11.9}{19} \quad \frac{10.1}{-24.5} \quad \frac{8.6}{17} \quad \frac{6.2}{37} \quad \frac{19.7/4.3}{50} \quad \frac{2.5}{60}$$

+11.8

$$\frac{16.2}{80} \quad \frac{15.8}{70} \quad \frac{14.3}{50} \quad \frac{12.0}{20} \quad \frac{10.7}{-21.5} \quad \frac{8.8}{21} \quad \frac{6.2}{40} \quad \frac{4.6}{50} \quad \frac{3.6}{60}$$

-22.5

923.90 ✓

11 +00 2.0 -1.2 +1.0 33.6 ^{+8.5 +10.7}
+9.7.

+50 2.0 -1.2 +1.0 28.9 ^{+3.8 +4.0}
+5.0.

+76 24.6 +2.7.

12 2.0 -1.1 +1.0 24.6 ^{0.4 +1.7}
+0.7.

T.P. 6.79 917.75 ✓ 12.94 910.96 ✓

+50 2.0 -1.0 +1.0 21.0 ^{+2.2 +4.2}
+3.2.

+76 -0.8 +0.8 19.5 ^{+0.9 +2.5}
+1.7.

13 0.8 -0.7 +0.7 18.2 ^{0.3 +1.1}
+0.4.

+38 -0.5 +0.5 16.5 ^{1.8 0.8}
1.3.

T.P. 7.62 922.07 ✓ 3.30 914.45 ✓
⁺⁵⁰
+84 15.9
15.1 7.0.

14 +0.2 -0.2 14.8 ^{7.1 7.5}
7.3.

+50 +0.5 -0.5 14.2 ^{7.4 8.4}
7.9.

+9.7

$$\frac{15.6}{70} \quad \frac{2.3}{15.2} \quad \frac{10.8}{37} \quad \frac{9.9}{22} \quad \frac{8.3}{-18.0} \quad \frac{6.8}{14} \quad \frac{5.3}{30} \quad \frac{4.9}{42.8} \quad \frac{4.2}{50} \quad \frac{3.5}{50}$$

+5.0

$$\frac{15.3}{70} \quad \frac{13.6}{56} \quad \frac{12.5}{47.6} \quad \frac{8.2}{28} \quad \frac{6.2}{11} \quad \frac{5.4}{-10.4} \quad \frac{4.3}{20} \quad \frac{3.5}{32} \quad \frac{1.9}{50}$$

+2.7

$$\frac{15.5}{60} \quad \frac{14.6}{50} \quad \frac{9.3}{24} \quad \frac{7.5}{11} \quad \frac{5.8}{-8.5} \quad \frac{4.4}{17} \quad \frac{3.6}{30} \quad \frac{3.3}{35}$$

+10.7

$$\frac{15.7}{50} \quad \frac{14.8}{44.6} \quad \frac{13.2}{35} \quad \frac{11.3}{21} \quad \frac{10.7}{8} \quad \frac{9.2}{-9.9} \quad \frac{6.8}{13} \quad \frac{5.3}{27.0} \quad \frac{5.0}{33}$$

Nail in Willow 65' Lt. 12+05 +3.2

$$\frac{8.6}{50} \quad \frac{10.7}{36.4} \quad \frac{10.7}{27} \quad \frac{11.0}{23} \quad \frac{10.8}{16} \quad \frac{9.5}{4} \quad \frac{8.8}{-12.5} \quad \frac{8.2}{18} \quad \frac{8.8}{39} \quad \frac{9.0}{50}$$

+1.7

$$\frac{7.9}{44} \quad \frac{9.0}{38} \quad \frac{9.8}{33} \quad \frac{10.5}{16} \quad \frac{11.4}{-13.1} \quad \frac{11.4}{10} \quad \frac{10.9}{39.8} \quad \frac{10.9}{50}$$

+0.4

$$\frac{6.3}{38} \quad \frac{6.7}{25.6} \quad \frac{6.9}{21} \quad \frac{8.0}{9} \quad \frac{9.4}{-9.8} \quad \frac{10.2}{7} \quad \frac{11.0}{27} \quad \frac{10.9}{37} \quad \frac{11.3}{50}$$

1.3

$$\frac{0.7}{32} \quad \frac{3.0}{22.2} \quad \frac{4.9}{23} \quad \frac{5.4}{10} \quad \frac{6.3}{-5.0} \quad \frac{7.3}{19} \quad \frac{7.8}{27} \quad \frac{9.1}{40}$$

7.0

$$\frac{0.7}{40} \quad \frac{1.3}{32.6} \quad \frac{2.8}{14} \quad \frac{4.4}{+2.4} \quad \frac{6.6}{10} \quad \frac{7.0}{13} \quad \frac{10.1}{30}$$

7.3

$$\frac{0.1}{40} \quad \frac{0.7}{33} \quad \frac{2.1}{18} \quad \frac{3.7}{+3.6} \quad \frac{5.5}{14} \quad \frac{7.2}{24.5} \quad \frac{8.9}{33}$$

7.9

$$\frac{0.0}{38} \quad \frac{0.2}{33} \quad \frac{1.5}{18} \quad \frac{3.4}{+4.5} \quad \frac{5.7}{15} \quad \frac{7.7}{25.1} \quad \frac{10.1}{35}$$

922.07 ✓

15	1.5	+0.8	-0.9	14.0	7.3 8.1	9.0
+50	3.0	+1.0	-1.3	13.8	7.3 8.3	9.6
B.M.	0.42	916.37 ✓	6.11	915.96	916.95	
16	3.0	+1.0	-1.3	13.6	11.8 2.8	4.1
+50	3.0	+1.0	-1.3	13.6	11.8 2.8	4.1
17	3.0	+1.0	-1.3	13.9	11.5 2.5	3.8
+50	3.0 ^{2.5}	+1.0	-1.3	14.7	0.7 1.7	3.0
18	1.0	+0.7	-0.9	15.8	10.1 0.6	1.5
+50		+0.3	-0.3	17.2	11.1 10.8	10.5
19		-0.3	+0.3	19.0	12.3 12.6	12.9
+38		-0.5	+0.5	20.5	13.6 14.1	14.6
T.P.	13.21	927.16 ✓	2.42	913.95		
+50				20.7	6.5	4.8
+75	1.5	-0.9	+0.8	21.6	5.6	

11-17-32

8.1

$$\begin{array}{r} 2.7 \\ 33 \end{array} \quad \begin{array}{r} 42/3.1 \\ 30.3 \end{array} \quad \begin{array}{r} 4.6 \\ 20 \end{array} \quad \begin{array}{r} 4.4 \\ +1.5 \end{array} \quad \begin{array}{r} 8.7 \\ 15 \end{array} \quad \begin{array}{r} 10.3 \\ 23.6 \end{array} \quad \begin{array}{r} 11.6 \\ 33 \end{array}$$

8.3

$$\begin{array}{r} 7.0 \\ 33 \end{array} \quad \begin{array}{r} 26.6/7.8 \\ 23.3 \end{array} \quad \begin{array}{r} 9.2 \\ 10 \end{array} \quad \begin{array}{r} 10.5 \\ -2.2 \end{array} \quad \begin{array}{r} 12.3 \\ 17 \end{array} \quad \begin{array}{r} 12.7 \\ 22.2 \end{array} \quad \begin{array}{r} 13.6 \\ 33 \end{array}$$

2.8

Spk. in Bottom of 12" Oak 56' Lt. 15' + 6.5

$$\begin{array}{r} 4.5 \\ 33 \end{array} \quad \begin{array}{r} 4.5/5.2 \\ 19.8 \end{array} \quad \begin{array}{r} 5.6 \\ 16 \end{array} \quad \begin{array}{r} 7.3 \\ -4.5 \end{array} \quad \begin{array}{r} 8.2 \\ 12 \end{array} \quad \begin{array}{r} 8.6 \\ 25 \end{array} \quad \begin{array}{r} 8.8 \\ 33 \end{array}$$

2.8

$$\begin{array}{r} 5.9 \\ 33 \end{array} \quad \begin{array}{r} 4.9/6.7 \\ 22.8 \end{array} \quad \begin{array}{r} 7.5 \\ 18 \end{array} \quad \begin{array}{r} 8.2 \\ -5.4 \end{array} \quad \begin{array}{r} 9.1 \\ 26 \end{array} \quad \begin{array}{r} 9.5 \\ 33 \end{array}$$

2.5

$$\begin{array}{r} 8.1 \\ 33 \end{array} \quad \begin{array}{r} 8.4/8.4 \\ 26.8 \end{array} \quad \begin{array}{r} 9.3 \\ 16 \end{array} \quad \begin{array}{r} 9.4 \\ -6.9 \end{array} \quad \begin{array}{r} 9.7 \\ 27.8 \end{array} \quad \begin{array}{r} 9.9 \\ 33 \end{array}$$

1.7

$$\begin{array}{r} 9.9 \\ 38 \end{array} \quad \begin{array}{r} 9.9/9.9 \\ 31.4 \end{array} \quad \begin{array}{r} 9.8 \\ -8.1 \end{array} \quad \begin{array}{r} 9.9 \\ 29.8 \end{array} \quad \begin{array}{r} 9.9 \\ 33 \end{array}$$

0.6

$$\begin{array}{r} 10.6 \\ 38 \end{array} \quad \begin{array}{r} 10.4/10.3 \\ 33 \end{array} \quad \begin{array}{r} 9.9 \\ -9.3 \end{array} \quad \begin{array}{r} 9.2 \\ 29.4 \end{array} \quad \begin{array}{r} 9.2 \\ 38 \end{array}$$

+0.8

$$\begin{array}{r} 10.5 \\ 40 \end{array} \quad \begin{array}{r} 10.1/10.1 \\ 33 \end{array} \quad \begin{array}{r} 10.0 \\ 20 \end{array} \quad \begin{array}{r} 8.9 \\ -9.7 \end{array} \quad \begin{array}{r} 7.6 \\ 19 \end{array} \quad \begin{array}{r} 7.5 \\ 29 \end{array} \quad \begin{array}{r} 7.0 \\ 33 \end{array}$$

+2.6

$$\begin{array}{r} 8.6 \\ 40 \end{array} \quad \begin{array}{r} 8.3/8.3 \\ 33 \end{array} \quad \begin{array}{r} 8.0 \\ 24 \end{array} \quad \begin{array}{r} 7.2 \\ 14 \end{array} \quad \begin{array}{r} 6.7 \\ -9.3 \end{array} \quad \begin{array}{r} 5.4 \\ 15 \end{array} \quad \begin{array}{r} 4.3 \\ 27.4 \end{array} \quad \begin{array}{r} 3.6 \\ 33 \end{array}$$

+4.1

$$\begin{array}{r} 5.2 \\ 35 \end{array} \quad \begin{array}{r} 4.6/4.6 \\ 29.4 \end{array} \quad \begin{array}{r} 4.5 \\ 25 \end{array} \quad \begin{array}{r} 4.0 \\ 12 \end{array} \quad \begin{array}{r} 3.0 \\ -7.1 \end{array} \quad \begin{array}{r} 1.4 \\ 19 \end{array} \quad \begin{array}{r} 0.5 \\ 23.2 \end{array} \quad \begin{array}{r} +0.7 \\ 35 \end{array}$$

5.6

$$\begin{array}{r} 2.9 \\ 33 \end{array} \quad \begin{array}{r} 7.0/7.0 \\ 24.7 \end{array} \quad \begin{array}{r} 6.6 \\ 23 \end{array} \quad \begin{array}{r} 6.1 \\ 16 \end{array} \quad \begin{array}{r} 4.5 \\ +1.1 \end{array} \quad \begin{array}{r} 3.5 \\ 15 \end{array} \quad \begin{array}{r} 3.0 \\ 26.7 \end{array} \quad \begin{array}{r} 2.9 \\ 33 \end{array}$$

		927.16 ✓			
T.P.	12.31	937.31 ✓	2.16	925.00 ✓	16.4 14.2
20	2.5	-1.2	+1.0	22.1	15.2.
+34				22.6	14.7.
+50	3.0	-1.3	+1.0	22.9	15.7 13.4 14.4.
+80				23.3	14.0.
T.P.	9.78	943.46 ✓	3.63	933.68 ✓	
20+80				23.3	20.2.
21	3.0	-1.3	+1.0	23.4	21.4 20.1.
+50	3.0	-1.3	+1.0	23.4	21.4 20.1.
22	2.5	-1.1	+0.9	22.9	21.7 20.6.
+50	0.4	-0.7	+0.6	22.2	22.0 21.3.
+88		-0.4	+0.4	22.0	21.9 21.5.
T.P.	1.21	931.86 ✓	12.81	930.65 ✓	
21+00			+1.0	23.4	7.5 8.5.

15.2

$$\frac{13.8}{50} \quad \frac{4.8}{6} / \frac{11.6}{33.7} \quad \frac{9.8}{15} \quad \frac{9.0}{16} \quad \frac{8.8}{16} \quad \frac{4.9}{6} / \frac{9.3}{31.4} \quad \frac{9.9}{38}$$

14.7

$$\frac{6.0}{40} \quad \frac{5.5}{33} \quad \frac{4.6}{17} \quad \frac{4.6}{10.1} \quad \frac{5.6}{15} \quad \frac{6.4}{25} \quad \frac{9.0}{40}$$

14.4

$$\frac{3.8}{50} \quad \frac{11.1}{6} / \frac{3.8}{45.9} \quad \frac{3.7}{30} \quad \frac{2.9}{27} \quad \frac{3.1}{13} \quad \frac{3.8}{10.6} \quad \frac{5.0}{12} \quad \frac{4.7}{23} \quad \frac{3}{6} / \frac{8.1}{32} \quad \frac{9.9}{40}$$

14.0

$$\frac{0.0}{20} \quad \frac{0.8}{16} \quad \frac{3.3}{14} \quad \frac{6.7}{25} \quad \frac{10.3}{35} \quad \frac{13.4}{35}$$

20.2

$$\frac{4.6}{60} \quad \frac{4.6}{50} \quad \frac{5.2}{33}$$

20.1

$$\frac{2.6}{60} \quad \frac{4.8}{6} / \frac{2.6}{55.2} \quad \frac{3.4}{39} \quad \frac{5.9}{24} \quad \frac{8.4}{13} \quad \frac{12.0}{78.1}$$

20.1

$$\frac{0.7}{60} \quad \frac{20.0}{6} / \frac{1.4}{57} \quad \frac{7.4}{36} \quad \frac{13.5}{18}$$

20.4

$$\frac{1.8}{60} \quad \frac{17.2}{6} / \frac{4.5}{52.3} \quad \frac{9.8}{37} \quad \frac{12.6}{29}$$

21.3

$$\frac{3.7}{60} \quad \frac{12.3}{6} / \frac{9.7}{42.9} \quad \frac{12.8}{34}$$

21.5

$$\frac{9.5}{50} \quad \frac{13.1}{42}$$

21.5

$$\frac{4.9}{15} \quad \frac{6.5}{20} \quad \frac{8.3}{22.8} \quad \frac{11.1}{28} \quad \frac{15.3}{33}$$

931.86 ✓

21+50

+1.0

23.4

8.5^{7.5}

22.

-1.1

+0.9

22.9

9.0.

+50

+0.6

22.2

9.7.

+88

+0.4

22.0

9.9.

23

-0.2

+0.2

21.9

10.2
10.0.

+50

+0.3

-0.3

22.5

9.1
9.4.

24

0.4

+0.6

-0.6

24.0

7.3
7.9.

+50

2.5

+0.9

-1.0

26.3

4.7 6.6
5.6.

T.P.

0.33

919.29 ✓

12.90

918.96 ✓

21+50

+1.0

23.4

+5.1
+4.1.

B.M.

4.75

914.54 ✓

914.52

22

+0.9

22.9

+4.5
+3.6.

+50

+0.6

22.2

+3.5
+2.9.

8.5

$$\frac{5.7}{4} \quad \frac{2.5}{11.0} \quad \frac{11.8}{9}$$

9.0

$$\frac{5.0}{18} \quad \frac{11.3}{-2.3}$$

9.7

$$\frac{9.1}{12} \quad \frac{13.5}{-3.8}$$

9.9

$$\frac{5.3}{33} \quad \frac{10.2}{20}$$

10.0

$$\frac{5.6}{33} \quad \frac{6.4/8.6}{26.4} \quad \frac{11.7}{19}$$

9.4

$$\frac{0.8}{38} \quad \frac{5.7/3.4}{32.6} \quad \frac{7.5}{25} \quad \frac{12.0}{17}$$

7.9

$$\frac{+6.3}{52} \quad \frac{DC. 17.4}{50} \quad \frac{+5.5}{50} \quad \frac{3.8/10.9}{20.2} \quad \frac{11.0}{20}$$

5.6

$$\frac{+11.4}{55} \quad \frac{DC. 11.8}{50} \quad \frac{1.3}{27.8} \quad \frac{12.1}{19} \quad \frac{15.1}{13} \quad \frac{15.7}{3} \quad \frac{11.2}{-5.7} \quad \frac{11.3}{21} \quad \frac{11.2}{21} \quad \frac{8/10.4}{23.1} \quad \frac{7.0}{33} \quad \frac{2/2.2}{42.9} \quad \frac{0.6}{48}$$

+4.1

$$\frac{8.0}{22} \quad \frac{8.8}{33} \quad \frac{6.5/9.9}{43} \quad \frac{10.2}{55}$$

Spk. in Oak 50' Rt. 23+55 +3.6

$$\frac{2.5}{6} \quad \frac{7.5}{14} \quad \frac{7.8}{30} \quad \frac{9/8.5}{39} \quad \frac{8.8}{50}$$

+2.9

$$\frac{6.6}{9} \quad \frac{7.0}{24} \quad \frac{10/7.1}{34.2} \quad \frac{7.7}{43}$$

919.29 ✓

22+88 22.0 +2.7

23 -0.2 +0.2 21.9 +2.6, ^{+2.8}

+50 +0.3 -0.3 22.5 +3.2, ^{+2.9}

24 0.4 +0.6 -0.6 24.0 +4.7, ^{+4.1}

T.P. 8.13 927.09 ✓ 0.33 918.96 ✓

24+69 3.0 +1.0 -1.3 27.4 +0.3, ^{+1.3}

25 3.0 +1.0 -1.3 29.5 +2.4, ^{+3.4}

+50 3.0 +1.0 -1.3 33.6 +6.5, ^{+7.5}

T.P. 13.04 937.67 ✓ 2.46 924.63 ✓

24+69 3.0 -1.3 27.4 10.3, ^{11.4}

25 3.0 -1.3 29.5 8.2, ^{9.5}

+50 3.0 -1.3 33.6 4.1.

26 3.0 +1.0 -1.3 37.9 +0.2, ^{+1.2}

+2.7

$$\frac{6.4}{3} \quad \frac{5.8}{27} \quad \frac{6.4}{43}$$

+2.6

$$\frac{5.8}{5} \quad \frac{5.8}{-8.4} \quad \frac{6.0}{19} \quad \frac{6.3}{31.2} \quad \frac{6.4}{43}$$

+3.2

$$\frac{4.7}{8} \quad \frac{4.4}{-7.3} \quad \frac{4.7}{16} \quad \frac{5.3}{29.4} \quad \frac{5.3}{43}$$

+4.7

$$\frac{3.7}{10} \quad \frac{3.5}{-8.2} \quad \frac{2.4}{5} \quad \frac{3.0}{21} \quad \frac{3.4}{28} \quad \frac{1.7}{33} \quad \frac{1.1}{35}$$

+0.3

$$\frac{0.0}{52} \quad \frac{0.79}{50} \quad \frac{1.4}{32.2} \quad \frac{8.3}{24} \quad \frac{11.0}{17} \quad \frac{9.0}{9} \quad \frac{5.5}{5} \quad \frac{4.3}{5} \quad \frac{4.2}{-4.5} \quad \frac{4.6}{14}$$

+2.4

$$\frac{5.5}{58} \quad \frac{7.8}{47.5} \quad \frac{7.9}{45} \quad \frac{9.3}{39.4} \quad \frac{10.1}{38} \quad \frac{8.1}{24} \quad \frac{3.2}{15} \quad \frac{1.0}{9} \quad \frac{0.8}{-3.2} \quad \frac{0.8}{13}$$

+6.5

$$\frac{5.8}{55} \quad \frac{6.0}{48.9} \quad \frac{6.4}{46} \quad \frac{7.5}{43} \quad \frac{8.2}{42} \quad \frac{8.6}{28} \quad \frac{4.3}{24}$$

10.3

$$\frac{12.4}{21} \quad \frac{4.5}{33.8} \quad \frac{5.1}{39}$$

8.2

$$\frac{2.5}{20} \quad \frac{4.5}{22} \quad \frac{1.3}{29}$$

4.1

$$\frac{9.8}{13} \quad \frac{4.8}{7} \quad \frac{4.5}{-0.4} \quad \frac{4.2}{15} \quad \frac{0.2}{23}$$

+0.2

$$\frac{11.2}{43} \quad \frac{11.8}{28.6} \quad \frac{4.7}{22}$$

937.67 ✓

26+25 3.0 +1.0 -1.3 40.0 ^{+3.3} +2.3,

T.P. 13.65 950.96 ✓ 0.34 937.31 ✓

25+00 3.0 +1.0 -1.3 29.5 ^{22.8} 21.5,

+50 3.0 +1.0 -1.3 33.6 17.4.

26+00 3.0 +1.0 -1.3 37.9 13.1.

+25 3.0 +1.0 -1.3 40.0 ^{11.0.} (12.0)

+50 3.0 +1.0 -1.3 41.9 ^{8.1} 9.1.

T.P. 13.14 962.75 ✓ 1.35 949.61 ✓

25+50 3.0 +1.0 -1.3 33.6 ^{30.5} 29.2.

26 3.0 +1.0 -1.3 37.9 ^{26.2} 24.9.

+25 3.0 +1.0 -1.3 40.0 ^{24.1} 22.8.

+50 3.0 +1.0 -1.3 41.9 ^{22.2} 20.9.

27 2.5 +0.9 -1.1 45.5 ^{16.4} ^{18.4} 17.3.

11-18-32

$$\begin{array}{r} 8.8 \\ 48 \end{array} \quad \begin{array}{r} 11.9 \\ 43 \end{array} \quad \begin{array}{r} 11.0 \\ 38 \end{array} \quad \begin{array}{r} 10.0/6.7 \\ 33 \end{array} \quad \begin{array}{r} 1.9 \\ 25 \end{array}$$

+2.3

21.5

$$\begin{array}{r} 9.8 \\ 42 \end{array} \quad \begin{array}{r} 6.1 \\ 52.1 \end{array} \quad \begin{array}{r} 3.1 \\ 60 \end{array} \quad \begin{array}{r} 1.4 \\ 65 \end{array}$$

17.4

$$\begin{array}{r} 6.6 \\ 33 \end{array} \quad \begin{array}{r} 2.2 \\ 35 \end{array} \quad \begin{array}{r} 0.1 \\ 37 \end{array}$$

13.1

$$\begin{array}{r} 12.4 \\ 13 \end{array} \quad \begin{array}{r} 11.5 \\ 11.6 \end{array} \quad \begin{array}{r} 12.1 \\ 13 \end{array}$$

11.0

$$\begin{array}{r} 12.6 \\ 19 \end{array} \quad \begin{array}{r} 9.7 \\ 14 \end{array} \quad \begin{array}{r} 9.0 \\ 13.0 \end{array} \quad \begin{array}{r} 9.4 \\ 13 \end{array}$$

9.1

$$\begin{array}{r} 9.8 \\ 33 \end{array} \quad \begin{array}{r} 8.8 \\ 23 \end{array} \quad \begin{array}{r} 8.8 \\ 19 \end{array} \quad \begin{array}{r} 7.3 \\ 13 \end{array} \quad \begin{array}{r} 6.9 \\ 12.1 \end{array} \quad \begin{array}{r} 7.1 \\ 10 \end{array}$$

29.2

$$\begin{array}{r} 7.5 \\ 53 \end{array} \quad \begin{array}{r} 4.3 \\ 65 \end{array} \quad \begin{array}{r} 1.5 \\ 75 \end{array}$$

24.9

$$\begin{array}{r} 12.9 \\ 25 \end{array} \quad \begin{array}{r} 8.5 \\ 41 \end{array} \quad \begin{array}{r} 3.0 \\ 41.8 \end{array} \quad \begin{array}{r} 1.3 \\ 70 \end{array}$$

22.8

$$\begin{array}{r} 13.3 \\ 24 \end{array} \quad \begin{array}{r} 10.0 \\ 38 \end{array} \quad \begin{array}{r} 6.5 \\ 51.4 \end{array} \quad \begin{array}{r} 3.6 \\ 65 \end{array}$$

20.9

$$\begin{array}{r} 14.8 \\ 18 \end{array} \quad \begin{array}{r} 13.7 \\ 29 \end{array} \quad \begin{array}{r} 10.5 \\ 36 \end{array} \quad \begin{array}{r} 7.5 \\ 49.1 \end{array} \quad \begin{array}{r} 4.0 \\ 65 \end{array}$$

17.3

$$\begin{array}{r} 11.9 \\ 33 \end{array} \quad \begin{array}{r} 12.1 \\ 30.5 \end{array} \quad \begin{array}{r} 12.0 \\ 13 \end{array} \quad \begin{array}{r} 13.6 \\ 10 \end{array} \quad \begin{array}{r} 13.0 \\ 14.3 \end{array} \quad \begin{array}{r} 13.8 \\ 8 \end{array} \quad \begin{array}{r} 11.8 \\ 13 \end{array} \quad \begin{array}{r} 10.9 \\ 26 \end{array} \quad \begin{array}{r} 8.6 \\ 11.2 \end{array} \quad \begin{array}{r} 6.0 \\ 65 \end{array}$$

962.75 ✓

27+25

47.2

15.6.

+50

0.5

+0.6

-0.6

48.7

13.5

14.7

12.5

13.7

13.1

14.1

28

+0.3

-0.3

51.6

10.9

11.5

11.2.

T.P.

5.34

958.25 ✓

9.84

952.91 ✓

+50

54.1

4.2.

29

-0.2

+0.2

54.2

2.3

1.9

2.1.

+50

-0.5

+0.5

58.0

0.8

+0.2

0.3.

30

1.0

-0.9

+0.8

59.6

+0.4

+2.1

+1.3.

T.P.

13.67

968.74 ✓

3.18

955.07 ✓

+70

2.1

-1.2

+1.0

61.7

8.2

6.0

7.0.

31

2.1

-1.2

+1.0

61.7

8.1

6.0

7.0.

T.P.

10.07

977.34 ✓

1.47

967.27 ✓

+50

2.1

-1.2

+1.0

61.8

16.7

14.5

15.5.

B.M.

8.04

977.33 ✓

8.04

969.30

969.29

+75

2.1

-1.2

+1.0

61.7

16.8

14.6

15.6.

15.6

$$\frac{7.9}{35} \quad \frac{9.0}{14} \quad \frac{10.7}{10} \quad \frac{10.7}{7} \quad \frac{11.1}{7} \quad \frac{9.9}{11} \quad \frac{10.6}{30} \quad \frac{9.7}{50}$$

14.1

$$\frac{5.8}{42} \quad \frac{6.4}{33.0} \quad \frac{6.7}{32.7} \quad \frac{8.2}{16} \quad \frac{9.8}{13} \quad \frac{9.7}{13.4} \quad \frac{9.8}{4} \quad \frac{11.5}{27.8} \quad \frac{11.7}{33}$$

11.2

$$\frac{7.2}{33} \quad \frac{7.4}{29.1} \quad \frac{7.7}{26} \quad \frac{10.0}{23} \quad \frac{9.7}{11} \quad \frac{10.2}{11.0} \quad \frac{12.7}{22.2} \quad \frac{13.7}{33}$$

4.2

$$\frac{5.0}{33} \quad \frac{5.2}{32} \quad \frac{6.8}{30} \quad \frac{6.4}{17.8} \quad \frac{7.2}{11} \quad \frac{8.1}{7} \quad \frac{8.9}{-4.7} \quad \frac{11.1}{12} \quad \frac{11.6}{27.8} \quad \frac{12.1}{37}$$

2.1

$$\frac{7.1}{40} \quad \frac{8.0}{35} \quad \frac{6.9}{31} \quad \frac{6.8}{22} \quad \frac{7.5}{15} \quad \frac{9.7}{10} \quad \frac{10.8}{-8.7} \quad \frac{12.1}{33} \quad \frac{12.2}{40}$$

0.3

$$\frac{5.7}{32} \quad \frac{5.6}{22.6} \quad \frac{5.9}{17} \quad \frac{6.6}{15} \quad \frac{7.8}{-7.5} \quad \frac{9.5}{19} \quad \frac{9.8}{33} \quad \frac{9.3}{45}$$

+1.3

$$\frac{3.1}{33} \quad \frac{3.2}{20.2} \quad \frac{3.4}{16} \quad \frac{3.1}{-4.4} \quad \frac{2.6}{22.4} \quad \frac{1.8}{33}$$

7.0

$$\frac{7.6}{35} \quad \frac{7.2}{26.9} \quad \frac{7.7}{10} \quad \frac{7.6}{-0.6} \quad \frac{7.7}{10} \quad \frac{6.2}{23.7} \quad \frac{5.8}{35}$$

7.0

$$\frac{4.9}{40} \quad \frac{4.3}{31.8} \quad \frac{3.1}{11} \quad \frac{3.3}{7} \quad \frac{2.3}{5} \quad \frac{2.1}{14.4} \quad \frac{2.3}{9} \quad \frac{1.3}{31.1} \quad \frac{1.1}{33}$$

15.5

$$\textcircled{50} \quad \frac{9.4}{40} \quad \frac{7.9}{39.3} \quad \frac{5.6}{22} \quad \frac{6.4}{20} \quad \frac{5.7}{10} \quad \frac{5.9}{19.6} \quad \frac{5.9}{2} \quad \frac{4.0}{3} \quad \frac{4.3}{29} \quad \frac{5.3}{30} \quad \frac{6.2}{36.5} \quad \frac{7.2}{43}$$

SW. Cor.

Water Table Fr. House 85' R+32+30

$$\frac{8.0}{50} \quad \frac{6.8}{41.1} \quad \frac{4.0}{17} \quad \frac{5.3}{15} \quad \frac{4.8}{5} \quad \frac{4.8}{10.8} \quad \frac{5.2}{6} \quad \frac{4.1}{8} \quad \frac{4.4}{18} \quad \frac{6.2}{36.6} \quad \frac{7.4}{43}$$

977.33 ✓

32	2.1	-1.2	+1.0	61.4	17.1 15.9	14.9
----	-----	------	------	------	--------------	------

+34	2.1	-1.2	+1.0	60.8	17.7 16.5	15.5
-----	-----	------	------	------	--------------	------

+50	2.0	-1.2	+1.0	60.4	18.1 16.9	15.9
-----	-----	------	------	------	--------------	------

+68	1.9	-1.1	+0.9	59.9	18.5 17.4	16.5
-----	-----	------	------	------	--------------	------

33	0.7	-0.8	+0.7	58.9	19.2 18.4	17.7
----	-----	------	------	------	--------------	------

+35		-0.5	+0.5	57.4	20.4 19.9	19.4
-----	--	------	------	------	--------------	------

T.P.	2.14	965.93 ✓	13.56	963.77 ✓		
------	------	----------	-------	----------	--	--

33 + 35				57.4	8.5	
---------	--	--	--	------	-----	--

+87		-0.2	+0.2	54.8	11.3 11.1	10.9
-----	--	------	------	------	--------------	------

34				54.0	11.9	
----	--	--	--	------	------	--

T.P.	0.19	953.79 ✓	12.33	953.60 ✓		
------	------	----------	-------	----------	--	--

34				54.0	+0.2	
----	--	--	--	------	------	--

+50				51.0	2.8	
-----	--	--	--	------	-----	--

11-21-32

15.9

$$\frac{8.0}{50} \quad \frac{9.8}{6} / \frac{7.3}{40.6} \quad \frac{5.3}{12} \quad \frac{5.9}{10} \quad \frac{5.8}{+10.1} \quad \frac{6.3}{13} \quad \frac{4.6}{30} \quad \frac{8.8}{6} / \frac{7.1}{35.7} \quad \frac{7.7}{43}$$

16.5

$$\frac{7.6}{46} \quad \frac{6.1}{33} \quad \frac{6.1}{21} \quad \frac{7.5}{11} \quad \frac{7.5}{+9.0} \quad \frac{7.6}{12} \quad \frac{8.0}{23} \quad \frac{6.4}{33} \quad \frac{6.9}{46}$$

16.9

$$\frac{7.2}{50} \quad \frac{11.1}{6} / \frac{6.4}{43.7} \quad \frac{5.6}{32} \quad \frac{6.2}{25} \quad \frac{4.6}{20} \quad \frac{4.6}{14} \quad \frac{9.0}{9} \quad \frac{8.6}{+8.3} \quad \frac{9.0}{18} \quad \frac{9.6}{19} \quad \frac{9.6}{25} \quad \frac{4.5}{31} \quad \frac{11.5}{6} / \frac{4.4}{41.3} \quad \frac{4.7}{50}$$

17.4

$$\frac{5.0}{50} \quad \frac{13.8}{6} / \frac{4.7}{46.6} \quad \frac{2.1}{25} \quad \frac{6.5}{24} \quad \frac{10.7}{18} \quad \frac{10.6}{10} \quad \frac{10.2}{+7.2} \quad \frac{10.7}{16} \quad \frac{12.4}{20} \quad \frac{12.5}{22} \quad \frac{3.5}{38} \quad \frac{13.3}{6} / \frac{3.5}{43} \quad \frac{4.0}{50}$$

18.4

$$\frac{1.3}{60} \quad \frac{18.0}{6} / \frac{0.2}{50} \quad \frac{+0.7}{43} \quad \frac{13.6}{21} \quad \frac{13.3}{+5.1} \quad \frac{14.0}{15} \quad \frac{15.8}{19} \quad \frac{11.9}{6} / \frac{5.8}{26.9} \quad \frac{15.6}{35} \quad \frac{13.5}{43}$$

19.9

$$\frac{2.2}{60} \quad \frac{17.9}{6} / \frac{2.5}{50} \quad \frac{2.9}{39} \quad \frac{6.7}{38} \quad \frac{10.3}{34} \quad \frac{8.8}{6} / \frac{10.6}{37.2} \quad \frac{12.3}{50}$$

8.5

$$\frac{4.8}{23} \quad \frac{6.5}{11} \quad \frac{5.6}{+2.8} \quad \frac{6.1}{13} \quad \frac{7.8}{17} \quad \frac{7.7}{21}$$

11.1

$$\frac{0.0}{50} \quad \frac{8.3}{6} / \frac{3.0}{36.5} \quad \frac{7.4}{17} \quad \frac{10.8}{14} \quad \frac{11.1}{0.0} \quad \frac{11.4}{13} \quad \frac{11.1}{6} / \frac{13.0}{17.2} \quad \frac{13.5}{23} \quad \frac{15.6}{33}$$

12.9

$$\frac{3.8}{50} \quad \frac{6.9}{33} \quad \frac{9.2}{6} / \frac{9.0}{25.4} \quad \frac{9.9}{18} \quad \frac{12.7}{15} \quad \frac{12.6}{-0.7} \quad \frac{12.9}{12}$$

x 0.7

$$\frac{6.8}{26} \quad \frac{18.2}{6} / \frac{8.0}{29.4} \quad \frac{7.8}{32} \quad \frac{7.3}{35}$$

2.8

$$\frac{4.6}{33} \quad \frac{7.5}{24} \quad \frac{4.7}{1} / \frac{7.5}{22.4} \quad \frac{7.1}{14} \quad \frac{6.1}{12} \quad \frac{6.4}{-3.6} \quad \frac{7.0}{10} \quad \frac{12.8}{18} \quad \frac{11.5}{6} / \frac{7.3}{42} \quad \frac{18.0}{50}$$

953.79 ✓

943.62 ✓

11.46

942.33 ✓

T.P.

1.29

35

48.0

+4.4.

+50

45.0

+1.4.

36

42.0

1.6.

T.P.

2.86

940.85 ✓

5.63

937.99 ✓

+50

39.3

1.6.

37

37.2

3.7.

+50

35.8

5.1.

38

34.9

6.0.

+50

34.7

6.2.

39

35.1

5.8.

T.P.

9.72

944.43 ✓

6.14

934.71 ✓

+50

35.8

8.6.

40

34.5

7.9.

$$\begin{array}{cccccccccccc} & & & & & +4.4 & & & & & & & \\ \frac{0.1}{35} & \frac{0.1}{25} & \frac{2.4}{21} & \frac{2.0}{14} & \frac{0.8}{12} & \frac{0.9}{-5.3} & \frac{1.4}{7} & \frac{6.6}{15} & \frac{8.6}{21} & \frac{11.8}{43} & \frac{12.2}{53} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +1.4 & & & & & & \\ \frac{1.9}{33} & \frac{2.1}{31.4} & \frac{3.2}{22.2} & \frac{4.9}{19} & \frac{5.0}{15} & \frac{4.2}{12} & \frac{4.6}{-6.0} & \frac{5.3}{6} & \frac{6.8}{11} & \frac{10.0}{29} & \frac{11.0}{37.8} & \frac{11.8}{43} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +1.6 & & & & & & \\ \frac{1.0}{40} & \frac{1.8}{34.6} & \frac{2.7}{28} & \frac{3.1}{23} & \frac{5.7}{21.2} & \frac{7.0}{12} & \frac{6.9}{-5.3} & \frac{7.2}{8} & \frac{8.7}{11} & \frac{11.5}{32.8} & \frac{12.4}{43} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +1.6 & & & & & & \\ \frac{0.5}{38} & \frac{0.9}{34.9} & \frac{2.4}{24} & \frac{5.4}{20.6} & \frac{5.6}{20} & \frac{6.0}{12} & \frac{6.1}{-4.5} & \frac{6.1}{8} & \frac{8.0}{11} & \frac{10.0}{29.8} & \frac{11.1}{40} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +3.7 & & & & & & \\ \frac{0.8}{33} & \frac{6.4}{27} & \frac{6.5}{18.6} & \frac{6.9}{15} & \frac{7.3}{11} & \frac{7.2}{-3.5} & \frac{7.4}{9} & \frac{9.3}{11} & \frac{10.5}{27.2} & \frac{11.1}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +5.1 & & & & & & \\ \frac{8.1}{33} & \frac{8.1}{19} & \frac{8.2}{15} & \frac{7.8}{13} & \frac{7.8}{-2.7} & \frac{8.0}{8} & \frac{9.7}{11} & \frac{10.3}{23.4} & \frac{10.7}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +6.0 & & & & & & \\ \frac{7.0}{33} & \frac{7.6}{21.6} & \frac{7.7}{20} & \frac{7.5}{12} & \frac{7.6}{-1.6} & \frac{7.9}{8} & \frac{9.1}{10} & \frac{9.7}{20.4} & \frac{10.6}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +6.2 & & & & & & \\ \frac{6.2}{33} & \frac{6.9}{23} & \frac{7.3}{12} & \frac{7.2}{-1.0} & \frac{7.6}{8} & \frac{9.7}{11} & \frac{10.7}{16} & \frac{11.2}{23} & \frac{11.6}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +5.8 & & & & & & \\ \frac{2.9}{33} & \frac{3.5}{27.5} & \frac{4.1}{20} & \frac{6.4}{16} & \frac{6.5}{12} & \frac{6.5}{-0.7} & \frac{6.8}{8} & \frac{7.4}{10} & \frac{8.7}{15.8} & \frac{10.9}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +8.6 & & & & & & \\ \frac{1.9}{40} & \frac{2.2}{33} & \frac{3.4}{22} & \frac{8.6}{16} & \frac{8.9}{-0.3} & \frac{9.3}{8} & \frac{9.8}{9} & \frac{9.7}{13} & \frac{10.6}{17} & \frac{13.3}{33} \end{array}$$

$$\begin{array}{cccccccccccc} & & & & & +7.9 & & & & & & \\ \frac{1.4}{40} & \frac{2.3}{32.4} & \frac{2.8}{24} & \frac{4.0}{21} & \frac{7.9}{17} & \frac{8.5}{12} & \frac{8.5}{-0.6} & \frac{8.9}{8} & \frac{10.0}{10} & \frac{12.0}{17} & \frac{13.6}{26.4} & \frac{14.5}{33} \end{array}$$

944.43 ✓

40+50

37.2

7.2 .

41

37.9

4.5 .

+50

38.6

5.8 .

42

39.3

5.1 .

+31

39.6

4.8 .

+35

+45

B.M.

5.63

938.80 ✓

938.87

7.2

$$\frac{4.9}{33} \quad \frac{6.2}{25.8} \quad \frac{7.2}{18} \quad \frac{8.1}{11} \quad \frac{8.4}{-1.2} \quad \frac{9.0}{8} \quad \frac{10.4}{10} \quad \frac{12.5}{14} \quad \frac{13}{1} \quad \frac{13.5}{25.6} \quad \frac{14.4}{33}$$

6.5

$$\frac{6.0}{33} \quad \frac{7.3}{22.8} \quad \frac{8.3}{13} \quad \frac{8.5}{-2.0} \quad \frac{9.1}{8} \quad \frac{10.1}{11} \quad \frac{10.9}{14} \quad \frac{11.9}{23.8} \quad \frac{12.7}{33}$$

5.8

$$\frac{5.9}{33} \quad \frac{7.1}{22.1} \quad \frac{7.6}{12} \quad \frac{7.8}{-2.0} \quad \frac{8.3}{8} \quad \frac{9.5}{13} \quad \frac{10.0}{21.4} \quad \frac{10.6}{33}$$

5.1

$$\frac{5.8}{33} \quad \frac{5.9}{22.8} \quad \frac{6.4}{18} \quad \frac{6.5}{15} \quad \frac{6.2}{12} \quad \frac{6.3}{-1.2} \quad \frac{6.6}{9} \quad \frac{7.4}{15} \quad \frac{7.6}{2} \quad \frac{8.2}{18} \quad \frac{8.2}{33}$$

4.8

$$\frac{4.0}{50} \quad \frac{4.8}{28} \quad \frac{4.6}{15} \quad \frac{4.6}{+0.2} \quad \frac{4.9}{7} \quad \frac{6.0}{10} \quad \frac{6.5}{14} \quad \frac{8.2}{18} \quad \frac{8.2}{23} \quad \frac{9.2}{33}$$

4.3

$$\frac{0.8}{50} \quad \frac{1.5}{38} \quad \frac{3.7}{21} \quad \frac{4.2}{8} \quad \frac{4.5}{8} \quad \frac{4.6}{14} \quad \frac{4.5}{24} \quad \frac{5.8}{38}$$

3.7

$$\frac{0.7}{50} \quad \frac{1.8}{31} \quad \frac{3.4}{11} \quad \frac{3.7}{19} \quad \frac{3.9}{19} \quad \frac{5.5}{33}$$

Spk. in P.P. N.E. Cor. Hightwood Rd.

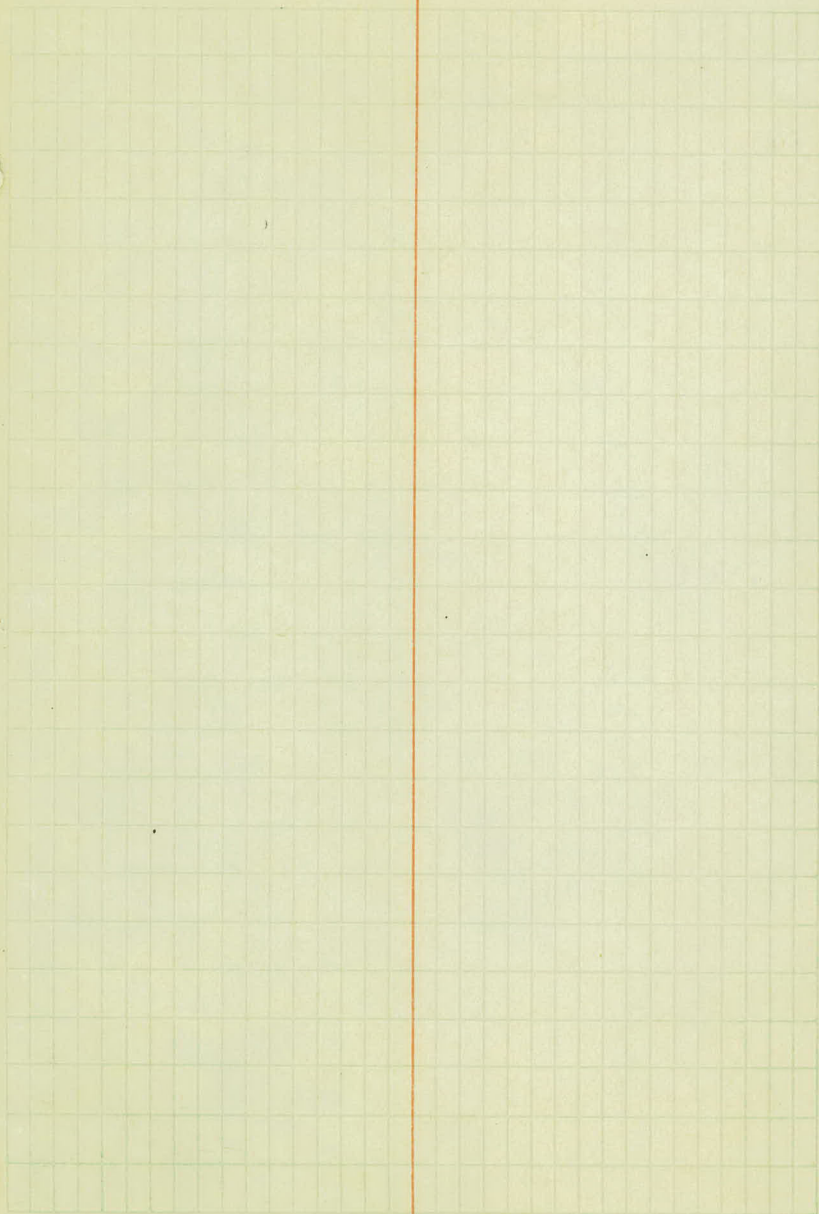
16+50

17+00

6.7

D.C. 41D.C. 3.4D.C. 1.9D.C. 1.7

B.M.	0.74	970.03		969.29	
31+00		-1.2	+1.0	61.7	9.53 7.33
+50		-1.2	+1.0	61.8	8.33 7.23
32		-1.2	+1.0	61.4	8.23 7.63 ✓
+50		-1.2	+1.0	60.4	8.63 8.63 ✓
33		-0.8	+0.7	58.9	10.83 9.63
T.P.	0.100	959.59	10.44	959.59	11.93 10.45
+50		-0.3	+0.3	56.7	11.13
34				54.0	3.19 2.59 ✓
+50				51.0	2.89
35				48.0	5.59 ✓
T.P.	0.51	948.50	11.60	947.99	8.59 ✓
+50				45.0	11.59 ✓
36				42.0	3.5 ✓
+50				39.3	6.5 ✓
37				37.2	9.2 ✓
+50				35.8	11.3 ✓
T.P.	4.26	940.07	12.67	935.81	12.7 ✓
38				34.9	3.5 ✓
+50				34.7	5.17 ✓
39				35.1	5.37 ✓
+50				35.8	4.97 ✓
40				36.5	4.27 ✓
+50				37.2	3.57 ✓
41				37.9	2.87 ✓
					2.17 ✓



940.07

41+50

38.6

1.47✓

42

39.3

0.77✓

T.P.

5.25

944.54

0.78

939.29

B.M.

5.72

938.82

B.M.

1.07

970.36

969.29

31+00

2.1

-1.2

+1.0

61.7

7.66✓

+50

2.1

-1.0

+0.9

60.9

8.66✓

30

1.0

-0.9

+0.8

59.6

10.46✓

+50

0.56

959.04

+0.5

58.0

11.66✓

29

T.P.

-0.2

+0.2

56.2

9.46✓

+50

54.1

11.66✓

28

+0.3

-0.3

51.6

12.36✓

+50

0.5

+0.6

-0.6

48.7

10.46✓

27

2.5

+0.9

-1.1

45.5

11.66✓

B.M.

12.33

926.85

914.52

24

0.4

+0.6

-0.6

24.0

2.85✓

T.P.

12.38

936.98

2.25

924.60

9.78✓

+50

2.5

+0.9

-1.0

24.3

10.68✓

25

3.0

+1.0

-1.3

29.5

6.48✓

+50

3.0

+1.0

-1.3

33.6

7.48✓

T.P.

13.46

948.06

2.38

934.60

9.78✓

26

3.0

+1.0

-1.3

37.9

4.68✓

+50

3.0

+1.0

-1.3

41.9

3.78✓

27

2.5

+0.9

-1.1

45.5

9.16✓

T.P.

7.60

954.01

1.65

946.41

11.46✓

+50

0.5

+0.6

-0.6

48.7

10.16✓

5.16✓

2.56✓

4.71✓

5.31✓

$$\begin{array}{r}
 914.52 \\
 11.45 \\
 \hline
 925.97 = 14.6.
 \end{array}$$

$$\begin{array}{r}
 948.06 \\
 1165 \\
 \hline
 \end{array}$$

$$946.41$$

$$\begin{array}{r}
 946.41 \\
 7.60 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 954.01 \\
 48.70 \\
 \hline
 \end{array}$$

$$5.31$$

$$54.01$$

$$51.20$$

$$2.11 - 2.71 = 2.71$$

B.M.	4.20	918.72		914.52	
0+00				13.5	5.2
+25				13.0	5.7
+50				12.5	6.2
+75				11.1	7.6
+90				10.3	8.4
T.P.	3.78	916.00	6.50	912.22	
1+15				10.15	5.85
+45				10.0	6.0

Sp. Ditch

Rt. Sta. 24 + 32

$$\begin{array}{r} 5.2 \\ 00 \\ \hline \end{array} \quad \begin{array}{r} 4.9 \\ 10.8 \\ \hline \end{array} \quad \begin{array}{r} 5.2 \\ 1.8 \\ \hline \end{array}$$

$$\begin{array}{r} 4.1 \\ 4.1 \\ \hline \end{array} \quad \begin{array}{r} 5.2 \\ 1.0 \\ \hline \end{array} \quad \begin{array}{r} 5.6 \\ 1.9 \\ \hline \end{array}$$

$$\begin{array}{r} 6.0 \\ 3.4 \\ \hline \end{array} \quad \begin{array}{r} 7.0 \\ 10.6 \\ \hline \end{array} \quad \begin{array}{r} 7.2 \\ 1.6 \\ \hline \end{array}$$

$$\begin{array}{r} 7.5 \\ 2.4 \\ \hline \end{array} \quad \begin{array}{r} 8.0 \\ 10.4 \\ \hline \end{array} \quad \begin{array}{r} 5.1 \\ 1.5 \\ \hline \end{array}$$

$$\begin{array}{r} 3.2 \\ 5.1 \\ \hline \end{array} \quad \begin{array}{r} 3.9 \\ 12.0 \\ \hline \end{array} \quad \begin{array}{r} 4.1 \\ 2.7 \\ \hline \end{array}$$

$$\begin{array}{r} 6.0 \\ 00 \\ \hline \end{array}$$

B.M.	11.45	925.97		914.52	
21	3.0	-1.3	+1.0	23.4	2.57
+50	3.0	-1.3	+1.0	23.4	2.57
22	2.5	-1.1	+0.9	22.9	3.07
+50	0.4	-0.7	+0.6	22.2	3.77
23		-0.2	+0.2	21.9	4.07
+50		+0.3	-0.3	22.5	3.47
24	0.4	+0.6	-0.6	24.0	1.97
+50	2.5	936.03 +0.9	-1.0	26.3	9.73
25	3.0	+1.0	-1.3	29.5	6.53
+50	3.0	+1.0	-1.3	33.6	2.43
26	3.0	947.46 +1.0	-1.3	37.9	9.56
+50	3.0	+1.0	-1.3	41.9	5.56
27	2.5	+0.9	-1.1	45.5	1.96
+50	0.5	957.74 +0.6	-0.6	48.7	9.06
28		+0.3	-0.3	51.6	6.46
+50		0	0	54.1	3.66 ✓
29		-0.2	+0.2	56.2	1.56
+50		964.18 -0.5	+0.5	58.0	6.18
30	1.0	-0.9	+0.8	59.6	4.58
+50	2.1	-1.0	+0.9	60.9	3.28
31	2.1	-1.2	+1.0	61.7	2.48
+50	2.1	-1.2	+1.0	61.8	2.38
32		-1.2	+1.0	61.4	2.78
+50		-1.2	+1.0	60.4	3.78

3.87 ✓ 1.57 ✓

3.87 ✓ 1.57 ✓

4.17 ✓ 2.17 ✓

4.47 ✓ 3.17 ✓

4.27 ✓ 3.87 ✓

3.17 ✓ 3.77 ✓

1.37 ✓ 2.57 ✓

8.83 ✓ 10.73 ✓

5.53 ✓ 7.83 ✓

1.43 ✓ 3.73 ✓

8.56 ✓ 10.86 ✓

4.56 ✓ 6.86 ✓

1.06 ✓ 3.06 ✓

8.46 ✓ 9.66 ✓

5.86 ✓ 6.46 ✓

1.74 ✓ 1.34 ✓

6.68 ✓ 5.68 ✓

5.48 ✓ 3.78 ✓

4.28 ✓ 2.38 ✓

3.68 ✓ 1.48 ✓

3.58 ✓ 1.38 ✓

3.98 ✓ 1.78 ✓

4.98 ✓ 2.78 ✓

925.97

2.58

923.39

12.64

936.03

1.45

934.58 T.P.

12.88

947.46

1.05

946.41

11.35

957.76

1.36

956.40

7.78

964.18

964.18

33 0.7 -0.8 +0.7 58.9 5.28

+50 -0.3 +0.3 54.7 7.48

34 0 0 54.0 10.18 ✓

+50

B.M. 11.54 924.06 914.52

18 1.0 +0.7 -0.9 15.8

8.56 ✓ 9.16 ✓

+50 +0.3 -0.3 17.2

8.86

19 -0.3 +0.3 19.0

7.36 ✓ 6.76 ✓

+38 -0.5 +0.5 20.5

7.06

6.06 ✓ 5.06 ✓

+75 1.5 -0.9 +0.8 21.6

5.56

5.36 ✓ 3.66 ✓

20 2.5 -1.2 +1.0 22.1

4.46

5.16 ✓ 2.96 ✓

+50 3.0 -1.3 +1.0 22.9

3.96

4.46 ✓ 2.16 ✓

21 3.0 -1.3 +1.0 23.4

3.16

3.96 ✓ 1.66 ✓

+50

2.66

22

+50

23

+50

24

6.08 ✓ 4.58 -

7.78 ✓ 7.18 ✓

6.8

4.5

6.7

2.9

22.1

1.5

3.94

4.4

24.4 1.06 ✓ 4.9

2.6

7.5

18.9 - 7.16 ✓

19.1 - 6.96 ✓

19.2 - 6.86 ✓

19.3 - 6.76 ✓

19.4 - 6.66 ✓

19.5 - 6.56 ✓

19.7 - 6.36 ✓

20.8

20.9 18.9 19.0 4.0

21.6 19.6 19.1 5.0

22.1 20.1 19.2 5.8

22.1 20.1 19.3 5.6

21.8 19.8 19.4 4.8

21.5 19.5 19.5 4.0

21.7 19.7

22.8

24.4

T.P.	11.41	984.34		972.93	
6				80.3	4.04
+60				75.0	9.34
T.P.	3.21	976.14	11.41	972.93	
7				71.2	4.94
+50				66.5	9.64
T.P.	5.18	978.11		972.93	
6					
+60				75.0	3.11
7				71.2	6.91 ✓
+50				66.5	11.61 ✓
T.P.	0.42	966.91	11.42	966.49	
8				61.8	5.11 ✓
+50				57.1	9.81 ✓
T.P.	0.0	954.29	12.62	954.29	
9		-0.5	+0.5	52.4	2.39 1.39 1.89
+50	1.0	-0.9	+0.8	47.7	2.49 5.79 6.59
T.P.	0.18	941.65	12.82	941.47	
10	2.0	-1.2	+1.0	43.0	+0.15 +1.35
+50	2.0	-1.2	+1.0	38.3	4.55 3.35
11	2.0	-1.2	+1.0	33.6	9.25 8.05
T.P.	0.18	928.50	13.33	928.32	
+50	2.0	-1.2	+1.0	28.9	0.8 +0.4
12	2.0	-1.1	+1.0	24.6	5.0 3.9
+50	2.0	-1.0	+1.0	21.0	8.5 7.5

~~F.1.7~~

972.93

11.41

984.34

~~F.1.3~~

972.93

3.21

976.14

~~F.2.7~~~~F.3.2 F.2.8~~

C0.3

14.3

C0.6

972.93

5.18

978.11

11.62

966.49

.42

966.91

12.62

954.29

12.82

941.47

.18

941.45

13.33

928.32

.18

928.50

F.1.1

12.41

7.6

5.8

F.1.6

51.9

46.8

F.2.0 F.2.4

5.4

F.2.3 F.4.7

F.1.5

F.2.4

F.1.4

F.2.3

F.1.7

F.1.3

B.M	3.59	919.54		915.95	
13+50				15.9	3.64 ✓
14		+0.2	-0.2	14.8	4.54 ✓ 4.94 ✓
+50		+0.5	-0.5	14.2	4.74 ✓ 5.84 ✓
15	1.5	+0.8	-0.9	14.0	5.34 ✓ 4.74 ✓ 6.44 ✓
+50	3.0	+1.0	-1.3	13.8	5.54 ✓ 4.74 ✓ 7.04 ✓
16	3.0	+1.0	-1.3	13.6	5.74 ✓ 4.94 ✓ 7.24 ✓
+50	3.0	+1.0	-1.3	13.6	5.94 ✓ 4.44 ✓ 7.24 ✓
17	3.0	+1.0	-1.3	13.9	5.94 ✓ 4.64 ✓ 6.94 ✓
+50	2.5	+1.0	-1.3	14.7	5.64 ✓ 3.84 ✓ 6.14 ✓
18	1.0	+0.7	-0.9	15.8	4.84 ✓ 3.04 ✓ 4.64 ✓
+50		+0.3	-0.3	17.2	3.74 ✓ 2.04 ✓ 2.64 ✓

T.P.	13.74	988.64		974.90	
4+50				88.3	0.34 ✓
5				86.5	2.14 ✓
+50				83.7	4.94 ✓
6				80.3	8.34 ✓
+50				75.9	12.74 ✓
7		973.30		71.2	2.1 ✓
+50				66.5	6.8 ✓
8		962.60		61.8	11.5 ✓
+50				57.1	5.5 ✓
9		-0.5	+0.5	52.4	10.7 ✓ 9.7 ✓ 10.2 ✓

13+31

915.95

0.59

919.54

20100 .24

1.80

197

972.93

974.90

13.74

988.64

88.3

74.9

13.4

972.93

.37

973.30

C1.0

B.M.	1.83	964.04		962.21	
9+00		-0.5 952.62	+0.5	52.4	12.14 ✓ 11.14
+50	1.0	-0.9	+0.8	47.7	11.64 4.92
10	2.0	-1.2 942.92	+1.0	43.0	9.62
+50	2.0	-1.2	+1.0	38.3	4.62
11	2.0	-1.2 933.93	+1.0	33.6	9.32
+50	2.0	-1.2	+1.0	28.9	5.03
12	2.0	-1.1 924.72	+1.0	24.6	9.33
+50	2.0	-1.0	+1.0	21.0	3.72
13	0.8	-0.7	+0.7	18.2	6.52
+50				15.9	8.82 ✓
14		+0.2	-0.2	14.8	9.92
+50		+0.5	-0.5	14.2	10.52

$$\begin{array}{r} 962.21 \\ .47 \\ \hline \end{array}$$

$$962.68$$

$$51.90$$

$$10.78$$

$$5.82 \checkmark \quad 4.12 \checkmark$$

$$10.82 \checkmark \quad 8.62 \checkmark$$

$$5.82 \checkmark \quad 3.62 \checkmark$$

$$10.52 \checkmark \quad 8.32 \checkmark$$

$$6.23 \checkmark \quad 4.03 \checkmark$$

$$10.43 \checkmark \quad 8.33 \checkmark$$

$$4.72 \checkmark \quad 2.72 \checkmark$$

$$7.22 \checkmark \quad 5.82 \checkmark$$

$$9.72 \quad 10.12$$

$$10.02$$

$$924.72$$

$$915.95$$

$$8.77$$

$$5.58 \quad 962.21$$

$$1.83 +$$

$$964.04$$

$$12.23 -$$

$$951.81$$

$$.81 +$$

$$952.62$$

$$10.82 -$$

$$941.60$$

$$1.32 +$$

$$942.92$$

$$10.52 -$$

$$932.40$$

$$1.53 +$$

$$933.93$$

$$10.43 -$$

$$923.50$$

$$1.22 +$$

$$924.72$$

$$8.98 -$$

$$915.74$$

B.M.	4.13	991.77	987.64	
0 +00			79.9	11.87 ✓
+50			81.5	10.27 ✓
1			83.2	8.57 ✓
+50			84.8	6.97 ✓
2			86.5	5.27 ✓
+50			88.1	3.67 ✓
3			89.4	2.37 ✓
+50		992.50	89.8	2.7 ✓
4			89.5	3.0 ✓
+50			88.3	4.2 ✓
5			86.5	6.0 ✓
+50			83.7	8.8 ✓
6			80.3	12.2 ✓
+50		980.60	75.9	4.7 ✓
7			71.2	9.4 ✓
+50		967.80	66.5	1.3 ✓
8			61.8	6.0 ✓
+50			57.1	10.7 ✓
9		959.42 +0.5	52.4	7.0 2

+0.5

$$0+00 = 80.5$$

$$= 79.5$$

79.9

3.1

983.0 H.I.

987.64

4.86

78.5

(4.5)

992.50

12.19

80.4

980.31

78.4

.29

79.2

3.8

980.60

79.5

3.5 ✓

13.20

79.8

3.2 ✓

967.40

80.1

2.9 ✓

.40

80.5

2.5

967.80

1.6

1.3

1.9

3.2

2.6

(7.2)

(6.6)

5.0 ✓

(6.0)

4.4 ✓

3.7 ✓

3.1

967.80

10.69

957.11

4.2 —

2.31

3.2 —

959.42

6.8

(5.0)

7.52 ✓ 6.52 ✓

983.00

0-125

0-100

0-75

0-50

0-25

6-5-33

$$\frac{5.7}{33} \quad \frac{5.1}{14} \quad \frac{5.2}{11} \quad 4.3 \quad \frac{4.5}{6} \quad \frac{5.1}{13} \quad \frac{5.4}{19} \quad \frac{5.3}{33}$$

$$\frac{5.6}{33} \quad \frac{5.3}{14} \quad \frac{4.7}{6} \quad 4.6 \quad \frac{4.7}{11} \quad \frac{4.9}{21} \quad \frac{5.4}{25} \quad \frac{4.9}{33}$$

$$\frac{5.4}{33} \quad \frac{5.0}{15} \quad 4.7 \quad \frac{4.7}{5} \quad \frac{4.5}{8} \quad \frac{4.8}{14} \quad \frac{4.3}{33}$$

$$\frac{4.9}{33} \quad \frac{4.5}{24} \quad \frac{4.8}{19} \quad 4.3 \quad \frac{3.8}{6} \quad \frac{2.8}{15} \quad \frac{2.2}{33}$$

$$\frac{4.9}{33} \quad 3.3 \quad \frac{2.1}{13} \quad \frac{1.0}{33}$$

B.M.	1.61	963.82		962.21	
7+50				66.5	
8				41.8	2.02
+50				57.1	4.72
9		-0.5	+0.5	52.4	11.42
+50		953.03			
		-0.9	+0.8	47.7	5.33
+75		-1.0	+0.9	45.3	7.73
10		-1.2	+1.0	43.0	10.03
+25		✓	✓	40.4	12.43
+50		941.86	✓	38.3	3.56
+75		✓	✓	35.9	5.96
11		935.80	✓	33.6	2.20
+25		✓	✓	31.2	4.6
+50		✓	✓	28.9	6.9
+75		✓	✓	26.7	9.1
12		-1.2	+1.0	24.6	11.2
+25		924.97			
		-1.1	+1.0	22.7	2.27
+50		-1.0	+0.9	21.0	3.97
+75		-0.8	+0.8	19.5	5.47
13		-0.7	+0.7	18.2	6.77
+25		-0.4	+0.4	17.0	7.97
+50		-0.2	+0.2	16.1	8.87

$$\begin{array}{r} 12 \overline{) 196} \quad 12 \overline{) 204} \\ \underline{12} \quad \underline{12} \\ 76 \quad 84 \end{array}$$

$$4 \overline{) 9.40} \\ \underline{2.35}$$

$$11.92 \checkmark \quad 10.92 \checkmark$$

$$6.23 \checkmark \quad 4.53 \checkmark$$

$$8.73 \checkmark \quad 4.83 \checkmark$$

$$11.23 \checkmark \quad 9.03 \checkmark$$

$$13.63 \checkmark \quad 11.43 \checkmark$$

$$4.76 \checkmark \quad 2.86 \checkmark$$

$$7.16 \checkmark \quad 4.96 \checkmark$$

$$3.4 \checkmark \quad 1.2 \checkmark$$

$$5.8 \checkmark \quad 3.6 \checkmark$$

$$8.1 \checkmark \quad 5.9 \checkmark$$

$$10.3 \checkmark \quad 8.1 \checkmark$$

$$12.4 \checkmark \quad 10.2 \checkmark$$

$$3.37 \checkmark \quad 1.27 \checkmark$$

$$4.97 \checkmark \quad 3.07 \checkmark$$

$$4.27 \checkmark \quad 4.67 \checkmark$$

$$7.47 \checkmark \quad 6.07 \checkmark$$

$$8.37$$

$$8.67 \checkmark$$

204R

204R

516L

924

962.21

1061

963.82

10.93

952.89

.44

953.03

11.42

941.41

.25

941.86

7.16

934.70

1.10

935.80

12.39

923.41

1.52

924.97

BM.		917.37		915.95	
15+25					
+50	3.0	+1.0	-1.3	13.8	3.57
+75				13.7	3.67
16				13.6	3.77
+25				13.6	3.77
+50				13.4	3.77
+75				13.7	3.67
17				13.9	3.47
+25	3.0	+1.0	-1.3	14.2	3.17
+50	2.5	+1.0	-1.3	14.7	2.67
18		+0.7	-0.9	15.8	1.57
+50		+0.3	-0.3	17.2	
19		-0.3	+0.3	19.0	
+50		-0.6	+0.5	21.0	
+75		-0.9	+0.8	21.6	

2.57 4.87 ✓

2.67 4.97 ✓

2.77 ✓ 5.07 ✓

2.77 ✓ 5.07 ✓

2.77 ✓ 5.07 ✓

2.67 ✓ 4.97 ✓

2.47 ✓ 4.77 ✓

2.17 ✓ 4.47 ✓

1.67 ✓ 3.97 ✓

0.87 ✓ 2.47 ✓

$$\begin{array}{r}
 31 \\
 12 \overline{) 372} \\
 \underline{24} \\
 12
 \end{array}$$

372 L

384 R

 756

915.95

1.42

 917.37

B.M.	10.48	925.00		914.52	
21			+1.0	23.4	1.6
+50			+1.0	23.4	1.6
22			+0.9	22.9	2.1
+50			+0.6	22.2	2.8
23			+0.2	21.9	3.1
+25				22.2	2.8 ✓
+50		934.06	+0.3	22.5	11.56
24			+0.6	24.0	10.06
+50			+0.9	26.3	7.76
25		+1.0		29.5	4.56
+50		944.00	+1.0	30.6	10.4
26		+1.0		37.9	6.1
+50		+1.0		41.9	2.1
27		+0.9		45.5	
		955.41			
28 +50		962.05		54.1	1.31 ✓
29		-0.2	+0.2	56.2	5.85
+50		-0.5	+0.5	58.0	4.05
30		-0.9	+0.8	59.6	2.45
+					

0.6 ✓

0.6 ✓

1.2 ✓

2.2 ✓

2.9 ✓

216' R

$$\begin{array}{r}
 26 \\
 12 \\
 \hline
 52 \\
 26 \\
 \hline
 31218 \\
 12 \overline{) 216} \\
 \underline{12} \\
 96 \\
 \underline{96} \\
 00
 \end{array}$$

(3)

$$\begin{array}{r}
 48 \\
 144 \\
 \hline
 192
 \end{array}$$

11.26 ✓

9.46 ✓ 10.66 ✓

6.86 ✓ 8.76 ✓

3.56 ✓

9.4 ✓

5.1 ✓

1.1 ✓

48' R

312' L

944.52

10.48

925.00

.19

924.81

9.25

934.06

1.59

932.47

11.53

944.00

1.10

942.90

12.51

955.41

1.30

954.11

7.94

962.05

2.54

959.51 T.R.-RT

6.05 ✓ 5.65 ✓

4.55 ✓ 3.55 ✓

3.35 ✓ 1.65 ✓

192' R

156' L

924

960.20

33+50

+0.3

54.7

3.6

34

54.0

6.35✓

+50

51.0

9.35✓

35

48.0

12.35✓

+50

45.0

3.55✓

36

42.0

6.55✓

+50

39.3

9.25✓

37

37.2

11.35✓

+50

35.8

12.75✓

38

34.9

13.65✓

+50

34.7

7.04✓

39

35.1

6.64✓

+50

35.8

5.94✓

40

36.5

5.24✓

+50

37.2

4.54✓

41

37.9

3.84✓

+50

38.6

3.14✓

42

39.3

2.44✓

948.55

941.74

3.3 ✓

372° L

144° R

574° R

1092

924

756

924

3696

4080

394

$$\begin{array}{r} 18 \\ \times 4 \\ \hline 108 \end{array}$$

959.51

.79

960.30

12.30

948.00

.55

948.55

13.65

934.90

6.84

941.74

2.93

938.81

48

12) 580

48

100

86

4

48

12) 576

48

90

B.M. 0.62 988.26 ✓ 987.64 ✓

0-125

0-100

0-75

0-50

0-25

0+00

+50

1

T.P. 5.71 993.35 ✓ 0.62 987.64 ✓

+50

+70

2

+20

6-22-33

$$\frac{10.7}{13} \quad 9.7 \quad \frac{9.7}{12} \quad \frac{10.7}{15}$$

$$\frac{10.5}{13} \quad 9.4 \quad \frac{8.8}{13} \quad \frac{10.2}{15}$$

$$\frac{10.2}{14} \quad 9.4 \quad \frac{8.7}{13} \quad \frac{9.8}{15}$$

$$\frac{9.9}{13} \quad 9.1 \quad \frac{8.3}{12} \quad \frac{10.3}{16} \quad \frac{10.3}{20} \quad \frac{7.6}{24}$$

$$\frac{9.1}{13} \quad 8.6 \quad \frac{8.2}{10} \quad \frac{10.2}{14} \quad \frac{10.2}{18} \quad \frac{6.8}{26}$$

$$\frac{10.2}{18} \quad \frac{8.4}{13} \quad (8.2) \quad \frac{7.7}{13} \quad \frac{9.6}{17} \quad \frac{9.6}{21} \quad \frac{6.2}{28}$$

$$\frac{9.3}{18} \quad \frac{6.7}{13} \quad (6.8) \quad \frac{6.7}{13} \quad \frac{8.7}{17} \quad \frac{8.7}{21} \quad \frac{2.8}{30}$$

$$\frac{7.0}{25} \quad \frac{7.3}{22} \quad \frac{7.3}{18} \quad \frac{5.0}{13} \quad (5.1) \quad \frac{5.0}{13} \quad \frac{7.1}{17} \quad \frac{7.1}{21} \quad \frac{0.7}{31}$$

$$\frac{8.5}{25} \quad \frac{10.6}{21} \quad \frac{10.6}{17} \quad \frac{8.6}{13} \quad (8.6) \quad \frac{8.4}{13} \quad \frac{10.6}{17} \quad \frac{10.6}{21} \quad \frac{2.8}{33}$$

$$\frac{7.6}{25} \quad \frac{9.8}{24} \quad \frac{9.8}{17} \quad \frac{2.7}{13} \quad (7.9) \quad \frac{7.7}{13} \quad \frac{9.8}{17} \quad \frac{9.8}{21} \quad \frac{1.7}{33}$$

$$\frac{9.0}{25} \quad \frac{9.3}{22} \quad \frac{9.2}{17} \quad \frac{6.8}{13} \quad (6.9) \quad \frac{6.8}{13} \quad \frac{8.9}{17} \quad \frac{8.9}{21} \quad \frac{4.0}{24}$$

$$\frac{10.5}{22} \quad \frac{6.4}{13} \quad (6.3) \quad \frac{6.2}{13} \quad \frac{8.2}{17} \quad \frac{8.2}{21} \quad \frac{4.5}{28}$$

993.35 ✓

2+38

+77

T.P.

11.08

1000.29 ✓

4.14

989.21 ✓

3

+38

+65

4

+34

+60

T.P.

5.62

1004.64 ✓

1.27

999.02 ✓

5

+50

6

+23

$$\begin{array}{ccccccc} & & 5.7 & & & & \\ \frac{9.0}{21} & \frac{5.6}{13} & 5.5 & \frac{5.7}{13} & \frac{7.7}{17} & \frac{7.7}{21} & \frac{4.1}{28} \end{array}$$

$$\begin{array}{ccccccc} & & 2.8 & & & & \\ \frac{2.6}{27} & \frac{6.7}{21} & \frac{6.7}{17} & \frac{4.7}{13} & \frac{4.7}{13} & \frac{6.7}{17} & \frac{6.7}{21} & \frac{1.1}{29} \end{array}$$

$$\begin{array}{ccccccc} & & 10.9 & & & & \\ \frac{7.4}{29} & \frac{13.2}{21} & \frac{13.2}{17} & \frac{11.0}{13} & \frac{11.1}{13} & \frac{13.0}{17} & \frac{13.0}{21} & \frac{4.8}{33} \end{array}$$

$$\begin{array}{ccccccc} & & 10.6 & & & & \\ \frac{6.8}{30} & \frac{12.6}{21} & \frac{12.6}{17} & \frac{10.6}{13} & \frac{10.6}{13} & \frac{12.3}{17} & \frac{12.3}{21} & \frac{1.8}{38} \end{array}$$

$$\begin{array}{ccccccc} & & 10.5 & & & & \\ \frac{6.2}{30} & \frac{12.6}{21} & \frac{12.6}{17} & \frac{10.7}{13} & \frac{10.6}{13} & \frac{12.6}{17} & \frac{12.6}{21} & \frac{2.2}{37} \end{array}$$

$$\begin{array}{ccccccc} & & 10.8 & & & & \\ \frac{4.2}{34} & \frac{12.7}{21} & \frac{12.7}{17} & \frac{10.8}{13} & \frac{10.8}{13} & \frac{13.0}{17} & \frac{13.0}{21} & \frac{4.2}{34} \end{array}$$

$$\begin{array}{ccccccc} & & 11.6 & & & & \\ \frac{2.2}{38} & \frac{13.6}{21} & \frac{13.6}{17} & \frac{11.6}{13} & \frac{11.6}{13} & \frac{13.6}{17} & \frac{13.6}{21} & \frac{4.2}{35} \end{array}$$

$$\begin{array}{ccccccc} & & 12.3 & & & & \\ \frac{1.9}{41} & \frac{14.3}{21} & \frac{14.3}{17} & \frac{12.3}{13} & \frac{12.4}{13} & \frac{14.4}{17} & \frac{14.4}{21} & \frac{1.8}{41} \end{array}$$

$$\begin{array}{ccc} 5.2 & 18.1 & 1.5 \\ \frac{44}{44} & & \frac{49}{49} \end{array}$$

$$\begin{array}{ccc} 5.1 & 20.9 & 1.8 \\ \frac{48}{48} & & \frac{53}{53} \end{array}$$

$$\begin{array}{ccc} 3.0 & 24.3 & 2.5 \\ \frac{56}{56} & & \frac{57}{57} \end{array}$$

$$\begin{array}{ccc} 4.2 & 26.3 & 6.0 \\ \frac{54}{54} & & \frac{54}{54} \end{array}$$

1004.64

6+60

T.P.

0.51

991.50 ✓

13.65

990.99 ✓

7

+15

+26

5+00

+50

6

T.P.

0.46

979.06 ✓

12.90

978.60 ✓

+23

+60

7

+15

+26

$$\frac{11.7}{51} \quad 29.6 \quad \frac{12.8}{49}$$

$$\frac{4.1}{48} \quad 20.3 \quad \frac{4.5}{48}$$

$$\frac{5.9}{48} \quad 21.1 \quad \frac{7.5}{45}$$

$$\frac{7.0}{48} \quad 22.1 \quad \frac{12.2}{40}$$

$$\frac{7.1}{21} \quad \frac{7.1}{17} \quad \frac{5.0}{13} \quad 5.0 \quad \frac{5.0}{13} \quad \frac{7.1}{17} \quad \frac{7.1}{21}$$

$$\frac{9.7}{21} \quad \frac{9.7}{17} \quad \frac{7.7}{13} \quad 1.8 \quad \frac{7.7}{13} \quad \frac{9.7}{17} \quad \frac{9.7}{21}$$

$$\frac{13.2}{21} \quad \frac{13.2}{17} \quad \frac{11.2}{13} \quad 11.2 \quad \frac{11.2}{13} \quad \frac{13.1}{17} \quad \frac{13.1}{21}$$

$$\frac{2.6}{20} \quad \frac{2.6}{17} \quad \frac{0.7}{13} \quad 0.8 \quad \frac{0.7}{13} \quad \frac{2.6}{17} \quad \frac{2.6}{21}$$

$$\frac{6.1}{21} \quad \frac{6.1}{17} \quad \frac{4.1}{13} \quad 4.1 \quad \frac{4.1}{13} \quad \frac{6.1}{17} \quad \frac{6.1}{21}$$

$$\frac{9.8}{21} \quad \frac{9.8}{17} \quad \frac{7.8}{13} \quad 1.9 \quad \frac{7.8}{13} \quad \frac{10.1}{17} \quad \frac{10.1}{21}$$

$$\frac{11.3}{21} \quad \frac{11.3}{17} \quad \frac{9.0}{13} \quad 9.3 \quad \frac{9.2}{13} \quad \frac{11.3}{17} \quad \frac{11.3}{21}$$

$$\frac{12.4}{21} \quad \frac{12.4}{17} \quad \frac{10.2}{13} \quad 10.3 \quad \frac{10.3}{13} \quad \frac{12.4}{17} \quad \frac{12.4}{21}$$

979.06 ✓

7+50

T.P.

6.24

971.67 ✓

13.63

965.43 ✓

+67

B.M.

9.43

971.64 ✓

9.43

962.21

+95

8

+34

+50

+70

T.P.

0.28

959.25 ✓

12.67

958.97 ✓

7+95

8

+34

+50

+70

$$\frac{2.0}{40} \quad \frac{14.5}{21} \quad \frac{14.5}{17} \quad \frac{12.5}{13} \quad \frac{12.0}{12.4} \quad \frac{12.5}{13} \quad \frac{14.5}{17} \quad \frac{14.5}{21} \quad \frac{10.0}{28}$$

$$\frac{2.0}{31} \quad \frac{9.1}{21} \quad \frac{9.1}{17} \quad \frac{6.8}{13} \quad \frac{6.6}{6.6} \quad \frac{6.6}{13} \quad \frac{9.0}{17} \quad \frac{9.0}{21}$$

$$\frac{9.3}{13} \quad \frac{9.3}{9.3} \quad \frac{9.3}{13} \quad \frac{11.3}{17} \quad \frac{11.3}{21} \quad \frac{9.0}{25}$$

$$\frac{9.8}{13} \quad \frac{9.8}{9.8} \quad \frac{9.8}{13} \quad \frac{11.7}{17} \quad \frac{11.7}{21} \quad \frac{8.0}{27}$$

$$\frac{13.0}{13} \quad \frac{13.0}{12.9} \quad \frac{12.9}{13} \quad \frac{14.9}{17} \quad \frac{14.9}{21} \quad \frac{0.0}{43}$$

$$\frac{14.5}{43} \quad \frac{2.2}{43}$$

$$\frac{16.1}{37} \quad \frac{2.0}{37}$$

$$\frac{4.2}{27} \quad +3.0$$

$$\frac{5.6}{30} \quad +2.5$$

$$\frac{16.3}{43} \quad 0.7$$

$$\frac{10.5}{30} \quad \frac{2.0}{13} \quad \frac{2.2}{2.0} \quad \frac{2.0}{13} \quad \frac{4.0}{17} \quad \frac{4.0}{21}$$

$$\frac{6.7}{20} \quad \frac{4.0}{13} \quad \frac{4.1}{2.9} \quad \frac{3.8}{13} \quad \frac{5.5}{17} \quad \frac{5.5}{21}$$

959.25 ✓

9

T.P.

0.77

949.30 ✓

10.72

948.53 ✓

+50

10

+50

T.P.

2.21

939.13 ✓

12.38

936.92 ✓

9+50

10

+50

+70

11

+50

T.P.

3.81

931.66 ✓

11.28

927.85 ✓

10+50

+70

$$\frac{13.0}{25} \quad \frac{7.1}{13} \quad 6.9 \quad \frac{6.4}{13} \quad \frac{8.6}{17} \quad \frac{8.6}{27} \quad \frac{3.2}{29}$$

$$\frac{9.5}{30} \quad \frac{2.3}{14} \quad \frac{1.6}{1.1} \quad \frac{0.7}{13} \quad \frac{6.2}{24} \quad \frac{7.4}{29} \quad \frac{8.0}{29} \quad \frac{8.0}{33} \quad \frac{6.6}{33}$$

$$\frac{12.0}{27} \quad \frac{7.2}{15} \quad 6.3 \quad \frac{5.1}{13}$$

$$\frac{11.6}{15} \quad \frac{11.0}{10.6} \quad \frac{9.8}{13}$$

$$\times \frac{7.8}{78} \quad \times 8.6$$

$$\frac{13.0}{50} \quad \frac{7.8}{29} \quad \times 3.9 \quad \frac{6.6}{36} \quad \frac{7.7}{41} \quad \frac{8.7}{42} \quad \frac{8.7}{45} \quad \frac{7.8}{46}$$

$$\frac{12.8}{43} \quad \frac{8.0}{30} \quad 0.8 \quad \frac{6.6}{27} \quad \frac{13.5}{39}$$

$$\frac{11.5}{35} \quad \frac{8.5}{27} \quad \frac{3.5}{15} \quad 3.4 \quad \frac{11.6}{13} \quad \frac{7.2}{28} \quad \frac{12.5}{35}$$

$$\frac{11.2}{26} \quad \frac{6.6}{15} \quad 5.5 \quad \frac{4.4}{13} \quad \frac{11.0}{25}$$

$$\frac{11.3}{15} \quad 10.2 \quad \frac{8.8}{13}$$

$$\times 6.6 \quad \frac{7.6}{42} \quad \frac{11.0}{50} \quad \frac{12.0}{51} \quad \frac{12.0}{54} \quad \frac{11.0}{55}$$

$$\times 4.0 \quad \frac{9.5}{42} \quad \frac{13.0}{49} \quad \frac{12.5}{52}$$

✓
931.66

11

+50

+76

12

T.P.

0.51

922.15

10.02

921.64

10+00

+50

+70

11

+50

+76

12

+50

$$\begin{array}{r} \times 1.9 \\ \hline 12.1 \\ 43 \end{array}$$

$$\begin{array}{r} 2.8 \\ \hline 11.3 \\ 32 \end{array}$$

$$\begin{array}{r} 11.5 \\ 28 \end{array} \quad \begin{array}{r} 5.8 \\ 15 \end{array} \quad \begin{array}{r} 5.1 \\ 4.5 \end{array} \quad \begin{array}{r} 3.5 \\ 13 \end{array} \quad \begin{array}{r} 11.5 \\ 28 \end{array}$$

$$\begin{array}{r} 12.7 \\ 28 \end{array} \quad \begin{array}{r} 8.0 \\ 15 \end{array} \quad \begin{array}{r} 1.1 \\ 6.4 \end{array} \quad \begin{array}{r} 5.7 \\ 13 \end{array} \quad \begin{array}{r} 13.1 \\ 27 \end{array}$$

$$\begin{array}{r} 4.9 \\ 64 \end{array} \quad \times 20.8$$

$$\begin{array}{r} 13.7 \\ 70 \end{array} \quad \times 16.1$$

$$\begin{array}{r} 13.7 \\ 70 \end{array} \quad \times 13.5$$

$$\begin{array}{r} 13.4 \\ 62 \end{array} \quad \begin{array}{r} 0.0 \\ 37 \end{array} \quad \times 11.4$$

$$\begin{array}{r} 11.0 \\ 48 \end{array} \quad \begin{array}{r} 2.0 \\ 32 \end{array} \quad \times 6.7$$

$$\begin{array}{r} 11.6 \\ 46 \end{array} \quad \times 4.4$$

$$\begin{array}{r} 13.5 \\ 45 \end{array} \quad \times 2.4$$

$$\begin{array}{r} 12.7 \\ 35 \end{array} \quad \begin{array}{r} 2.0 \\ 15 \end{array} \quad \begin{array}{r} 1.2 \\ 0.5 \end{array} \quad \begin{array}{r} 0.0 \\ 13 \end{array} \quad \begin{array}{r} 13.3 \\ 39 \end{array}$$

922.15[✓]

12 + 76

13

+ 38

+ 84

14

+ 50

15

+ 50

B.M.

2.85

918.80[✓]

6.17

915.98[✓]

915.95

16

+ 50

17

+ 50

$$\frac{14.2}{3.3} \quad \frac{3.2}{14} \quad 2.7 \quad \frac{1.4}{14} \quad \frac{15.3}{40}$$

$$\frac{11.0}{26} \quad \frac{4.5}{13} \quad 4.0 \quad \frac{3.0}{13} \quad \frac{15.3}{40}$$

$$\frac{7.4}{22} \quad \frac{8.0}{21} \quad \frac{8.0}{17} \quad \frac{6.0}{13} \quad 5.7 \quad \frac{5.4}{13} \quad \frac{12.1}{27}$$

$$\frac{1.3}{32} \quad \frac{8.5}{21} \quad \frac{8.5}{17} \quad \frac{6.9}{13} \quad 1.1 \quad \frac{7.3}{13}$$

$$\frac{0.8}{30} \quad \frac{9.0}{21} \quad \frac{9.0}{17} \quad \frac{7.0}{13} \quad 1.5 \quad \frac{7.4}{13} \quad \frac{9.5}{17} \quad \frac{9.5}{21} \quad \frac{7.3}{25}$$

$$\frac{0.5}{30} \quad \frac{9.1}{21} \quad \frac{9.1}{17} \quad \frac{7.8}{10} \quad 8.1 \quad \frac{8.4}{13} \quad \frac{10.3}{17} \quad \frac{10.3}{21} \quad \frac{7.8}{25}$$

$$\frac{3.2}{30} \quad \frac{9.6}{21} \quad \frac{9.6}{17} \quad \frac{7.6}{13} \quad 8.2 \quad \frac{8.9}{14} \quad \frac{11.0}{18} \quad \frac{11.0}{22} \quad \frac{10.3}{24}$$

$$\frac{7.8}{23} \quad \frac{9.6}{21} \quad \frac{9.6}{17} \quad \frac{7.7}{14} \quad 8.3 \quad \frac{9.0}{15} \quad \frac{12.7}{22}$$

$$\frac{7.7}{20} \quad \frac{4.4}{10} \quad 5.2 \quad \frac{6.5}{15} \quad \frac{11.0}{25}$$

$$\frac{8.3}{34} \quad \frac{12.0}{30} \quad \frac{12.0}{28} \quad \frac{9.0}{25} \quad \frac{9.0}{23} \quad \frac{4.4}{13} \quad 5.2 \quad \frac{6.5}{15} \quad \frac{11.0}{25}$$

$$\frac{10.4}{34} \quad \frac{12.0}{32} \quad \frac{12.0}{30} \quad \frac{10.7}{28} \quad \frac{10.7}{27} \quad \frac{4.2}{14} \quad 4.9 \quad \frac{5.8}{15} \quad \frac{11.7}{29}$$

$$\frac{11.7}{32} \quad \frac{3.8}{14} \quad 4.1 \quad \frac{5.0}{14} \quad \frac{11.7}{28}$$

918.80

18

+50

T.P.

3.79

922.02

0.57

918.23 ✓

19

+38

T.P.

9.06

930.51 ✓

0.57

921.45 ✓

+75

20

+34

+50

+80

21

+50

22

$$\begin{array}{r} 12.3 \\ 32 \end{array} \quad \begin{array}{r} 2.8 \\ 15 \end{array} \quad \begin{array}{r} 3.0 \\ 3.2 \end{array} \quad \begin{array}{r} 3.9 \\ 13 \end{array} \quad \begin{array}{r} 11.7 \\ 30 \end{array}$$

$$\begin{array}{r} 12.3 \\ 34 \end{array} \quad \begin{array}{r} 1.5 \\ 14 \end{array} \quad \begin{array}{r} 1.6 \\ 1.5 \end{array} \quad \begin{array}{r} 1.7 \\ 13 \end{array} \quad \begin{array}{r} 9.7 \\ 29 \end{array}$$

$$\begin{array}{r} 14.0 \\ 33 \end{array} \quad \begin{array}{r} 3.5 \\ 13 \end{array} \quad \begin{array}{r} 3.0 \\ 3.1 \end{array} \quad \begin{array}{r} 3.1 \\ 14 \end{array} \quad \begin{array}{r} 9.8 \\ 26 \end{array}$$

$$\begin{array}{r} 10.4 \\ 29 \end{array} \quad \begin{array}{r} 2.3 \\ 14 \end{array} \quad \begin{array}{r} 1.5 \\ 1.7 \end{array} \quad \begin{array}{r} 1.1 \\ 13 \end{array} \quad \begin{array}{r} 6.0 \\ 23 \end{array}$$

$$\begin{array}{r} 10.3 \\ 25 \end{array} \quad \begin{array}{r} 11.6 \\ 21 \end{array} \quad \begin{array}{r} 11.6 \\ 17 \end{array} \quad \begin{array}{r} 9.5 \\ 14 \end{array} \quad \begin{array}{r} 8.9 \\ 9.1 \end{array} \quad \begin{array}{r} 8.4 \\ 13 \end{array} \quad \begin{array}{r} 10.2 \\ 17 \end{array} \quad \begin{array}{r} 10.2 \\ 21 \end{array} \quad \begin{array}{r} 6.4 \\ 27 \end{array}$$

$$\begin{array}{r} 4.7 \\ 34 \end{array} \quad \begin{array}{r} 11.7 \\ 24 \end{array} \quad \begin{array}{r} 11.7 \\ 20 \end{array} \quad \begin{array}{r} 9.7 \\ 16 \end{array} \quad \begin{array}{r} 8.4 \\ 8.3 \end{array} \quad \begin{array}{r} 7.5 \\ 10 \end{array} \quad \begin{array}{r} 9.5 \\ 17 \end{array} \quad \begin{array}{r} 9.5 \\ 21 \end{array} \quad \begin{array}{r} 2.5 \\ 32 \end{array}$$

$$\times \quad \begin{array}{r} 10.3 \\ 42 \end{array} \quad \begin{array}{r} 11.3 \\ 24 \end{array} \quad \begin{array}{r} 11.3 \\ 20 \end{array} \quad \begin{array}{r} 9.1 \\ 16 \end{array} \quad \begin{array}{r} 1.9 \\ 7.6 \end{array} \quad \begin{array}{r} 6.9 \\ 13 \end{array} \quad \begin{array}{r} 9.0 \\ 17 \end{array} \quad \begin{array}{r} 9.0 \\ 21 \end{array} \quad \begin{array}{r} 1.0 \\ 32 \end{array}$$

$$\begin{array}{r} 11.2 \\ 25 \end{array} \quad \begin{array}{r} 11.2 \\ 20 \end{array} \quad \begin{array}{r} 8.8 \\ 15 \end{array} \quad \begin{array}{r} 1.6 \\ 7.4 \end{array} \quad \begin{array}{r} 6.7 \\ 13 \end{array} \quad \begin{array}{r} 8.7 \\ 17 \end{array} \quad \begin{array}{r} 8.7 \\ 21 \end{array} \quad \begin{array}{r} 1.4 \\ 34 \end{array}$$

$$\begin{array}{r} 10.8 \\ 24 \end{array} \quad \begin{array}{r} 10.8 \\ 20 \end{array} \quad \begin{array}{r} 8.7 \\ 16 \end{array} \quad \begin{array}{r} 1.2 \\ 7.0 \end{array} \quad \begin{array}{r} 6.6 \\ 13 \end{array} \quad \begin{array}{r} 8.8 \\ 17 \end{array} \quad \begin{array}{r} 8.8 \\ 21 \end{array} \quad \begin{array}{r} 4.0 \\ 27 \end{array}$$

$$\begin{array}{r} 10.7 \\ 25 \end{array} \quad \begin{array}{r} 10.7 \\ 21 \end{array} \quad \begin{array}{r} 8.5 \\ 16 \end{array} \quad \begin{array}{r} 2.1 \\ 6.9 \end{array} \quad \begin{array}{r} 6.2 \\ 13 \end{array} \quad \begin{array}{r} 8.2 \\ 17 \end{array} \quad \begin{array}{r} 8.2 \\ 21 \end{array} \quad \begin{array}{r} 7.1 \\ 23 \end{array} \quad \times$$

$$\begin{array}{r} 10.2 \\ 25 \end{array} \quad \begin{array}{r} 10.2 \\ 21 \end{array} \quad \begin{array}{r} 8.3 \\ 16 \end{array} \quad \begin{array}{r} 1.1 \\ 7.1 \end{array} \quad \begin{array}{r} 6.4 \\ 13 \end{array} \quad \begin{array}{r} 11.5 \\ 24 \end{array}$$

$$\begin{array}{r} 10.8 \\ 25 \end{array} \quad \begin{array}{r} 10.8 \\ 20 \end{array} \quad \begin{array}{r} 8.8 \\ 16 \end{array} \quad \begin{array}{r} 1.6 \\ 7.6 \end{array} \quad \begin{array}{r} 7.0 \\ 13 \end{array} \quad \begin{array}{r} 12.0 \\ 24 \end{array}$$

930.51 ✓

22+50

+88

23

+50

T.P.

0.41

930.10 ✓

T.P.

2.20

920.35 ✓

12.36

918.15 ✓

21+50

22

+50

+88

23

+50

T.P.

13.53

943.63 ✓

930.10 ✓

20+50

+80

$$\frac{10.8}{23} \quad \frac{10.8}{19} \quad \frac{8.8}{13} \quad 8.3 \quad \frac{8.0}{13} \quad \frac{13.0}{24}$$

$$\times \quad \frac{4.4}{31} \quad \frac{10.9}{22} \quad \frac{10.9}{18} \quad \frac{8.8}{13} \quad 8.6 \quad \frac{8.2}{13} \quad \frac{13.5}{24}$$

$$\times \quad \frac{6.6}{28} \quad \frac{10.8}{22} \quad \frac{10.8}{17} \quad \frac{8.7}{13} \quad 8.6 \quad \frac{8.4}{13} \quad \frac{13.5}{23}$$

$$\times \quad \frac{2.2}{33} \quad \frac{10.5}{23} \quad \frac{10.5}{19} \quad \frac{7.7}{13} \quad 8.0 \quad \frac{8.6}{13}$$

$$+3.0 \quad \frac{10.8}{43}$$

$$+2.5 \quad \frac{9.4}{39}$$

$$+1.8 \quad \frac{8.2}{34}$$

$$+1.6 \quad \frac{7.5}{33}$$

$$+1.5 \quad \frac{7.2}{31}$$

$$+2.1 \quad \frac{6.4}{29} \quad \times$$

$$\frac{10.1}{46} \quad 20.1$$

$$\frac{4.2}{52} \quad 20.3$$

✓

943.63

21

+50

22

+50

24+00

+50

T.P.	2.08	932.18 ✓	13.53	930.10 ✓
------	------	----------	-------	----------

24+00

+50

+69

25

T.P.	9.15	930.41 ✓	10.92	921.26 ✓
------	------	----------	-------	----------

25

+50

$$\frac{2.8}{58}$$

20.2

$$\frac{1.5}{57}$$

20.2

$$\frac{4.5}{52}$$

20.7

$$\frac{9.8}{43}$$

21.4

$$\frac{6.8}{50}$$

19.6

$$\times \frac{12.6}{50}$$

17.3

$$\frac{12.4}{25}$$

$$\frac{12.4}{22}$$

$$\frac{7.6}{13}$$

8.2

$$\frac{8.8}{14}$$

$$\frac{15.5}{28}$$

$$\frac{15.8}{31}$$

$$\frac{14.6}{33}$$

x

$$\frac{13.2}{33}$$

$$\frac{13.2}{36}$$

$$\frac{5.4}{13}$$

5.9

$$\frac{7.0}{15}$$

$$\frac{10.0}{23}$$

$$\frac{10.5}{30}$$

$$\frac{2.6}{43}$$

x

$$\times \frac{6.2}{50}$$

$$\frac{14.8}{38}$$

$$\frac{14.8}{34}$$

$$\frac{4.1}{13}$$

4.6

$$\frac{5.8}{15}$$

$$\frac{8.7}{22}$$

$$\frac{8.7}{28}$$

$$\frac{6.6}{24}$$

$$\frac{2.0}{13}$$

2.7

$$\frac{4.0}{16}$$

$$\frac{6.2}{20}$$

$$\frac{6.2}{25}$$

$$\times \frac{10.9}{49}$$

$$\frac{12.3}{47}$$

$$\frac{13.3}{42}$$

$$\frac{12.8}{41}$$

0.9

$$\times \frac{7.5}{50}$$

$$\frac{11.8}{46}$$

$$\frac{11.8}{43}$$

$$\frac{3.6}{29}$$

x 3.2

930.41

24

T.P.

11.63

941.73

0.31

930.10

24+69

25+50

26

+25

T.P.

12.35

953.80

0.28

941.45

25+00

26+50

27

+25

+50

T.P.

11.77

961.05

4.52

949.28

25+50

26

$$\times \frac{1.3}{25} \times 1.5$$

$$14.3 \quad \frac{5.2}{80} \times$$

$$\frac{7.5}{14} \frac{8.1}{8.3} \quad \frac{9.4}{16} \frac{11.4}{21} \frac{11.4}{2.4}$$

$$\frac{3.0}{13} \frac{3.6}{4.0} \quad \frac{5.2}{16} \frac{7.3}{20} \frac{7.3}{23}$$

$$\times \frac{10.6}{33} \frac{0.6}{14} \frac{1.7}{1.9} \quad \frac{3.0}{16} \frac{5.3}{20} \frac{5.3}{23}$$

$$24.3 \quad \frac{8.7}{52} \times$$

$$\times \frac{11.2}{24} \frac{13.4}{21} \frac{13.4}{17} \frac{11.0}{13} \frac{11.9}{11.9} \frac{13.3}{16} \frac{15.5}{21} \frac{15.5}{24}$$

$$\times \frac{3.1}{31} \frac{9.5}{20} \frac{9.5}{17} \frac{7.5}{13} \frac{4.3}{8.3} \quad \frac{9.6}{16} \frac{11.4}{20} \frac{11.4}{23} \frac{70.3}{41} \times$$

$$\frac{7.8}{20} \frac{7.8}{17} \frac{6.1}{13} \frac{6.6}{6.9} \quad \frac{7.7}{14} \frac{9.8}{19} \frac{9.8}{23} \frac{1.8}{34} \times$$

$$\frac{6.4}{21} \frac{6.4}{17} \frac{4.6}{14} \frac{5.1}{5.1} \quad \frac{5.9}{13} \frac{7.8}{17} \frac{7.8}{21} \frac{2.5}{29} \times$$

$$27.5 \quad \frac{2.4}{65} \times$$

$$23.2 \quad \frac{2.6}{62} \times$$

941.05

26+25

+50

27+25

+50

28

+50

29

+50

30

T.P.

11.47

972.37

0.15

960.90

+70

31

+50

$$21.1 \quad \frac{5.2}{51} \quad \leftarrow$$

$$19.2 \quad \frac{6.2}{49} \quad \leftarrow$$

$$\times \frac{6.3}{33} \quad 13.9$$

$$\times \frac{5.0}{33} \quad 12.4$$

$$\frac{5.9}{29} \quad \frac{11.3}{21} \quad \frac{11.3}{17} \quad \frac{9.3}{13} \quad \frac{9.5}{9.7} \quad \frac{9.8}{13} \quad \frac{11.8}{17} \quad \frac{11.8}{21} \quad \frac{11.0}{22}$$

$$\frac{9.7}{19} \quad \frac{7.0}{13} \quad \frac{7.0}{20} \quad \frac{7.2}{13} \quad \frac{14.2}{27}$$

$$\frac{10.0}{23} \quad \frac{5.2}{13} \quad \frac{4.7}{13} \quad \frac{14.8}{32}$$

$$\frac{8.2}{23} \quad \frac{3.7}{13} \quad \frac{3.3}{3.3} \quad \frac{2.9}{14} \quad \frac{11.8}{32}$$

$$\frac{6.0}{22} \quad \frac{2.3}{14} \quad \frac{1.0}{1.6} \quad \frac{1.0}{13} \quad \frac{5.3}{23}$$

$$\frac{12.1}{27} \quad \frac{14.0}{22} \quad \frac{14.0}{19} \quad \frac{12.2}{15} \quad \frac{10.7}{11.0} \quad \frac{10.5}{13} \quad \frac{12.1}{16} \quad \frac{12.1}{20} \quad \frac{9.4}{26}$$

$$\frac{7.9}{32} \quad \frac{13.5}{22} \quad \frac{13.5}{18} \quad \frac{11.8}{15} \quad \frac{10.7}{10.6} \quad \frac{9.8}{13} \quad \frac{12.1}{17} \quad \frac{12.1}{21} \quad \frac{4.9}{32}$$

$$\frac{3.2}{40} \quad \frac{13.0}{29} \quad \frac{13.0}{20} \quad \frac{11.2}{16} \quad \frac{10.6}{10.2} \quad \frac{9.7}{13} \quad \frac{11.4}{16} \quad \frac{11.4}{19} \quad \frac{1.3}{36}$$

972.37[✓]

31+75

B.M.

32

2.08

969.29[✓]

969.29

+34

+50

T.P.

2.25

978.07[✓]

1.55

970.82[✓]

+68

8

33

+35

+87

T.P.

0.33

967.28

11.12

966.95[✓]

32+68

33

+35

+87

T.P.

0.38

954.72[✓]

12.94

954.34[✓]

$$\frac{1.9}{41} \quad \frac{13.2}{24} \quad \frac{13.2}{20} \quad \frac{14.5}{16} \quad 10.7 \quad \frac{9.9}{13} \quad \frac{11.3}{16} \quad \frac{11.3}{19} \quad \frac{1.2}{27}$$

$$\frac{2.4}{41} \quad \frac{13.4}{24} \quad \frac{13.4}{21} \quad \frac{11.7}{16} \quad 11.0 \quad \frac{10.2}{13} \quad \frac{12.0}{14} \quad \frac{12.0}{19} \quad \frac{2.2}{36}$$

$$\frac{2.4}{43} \quad \frac{14.1}{23} \quad \frac{14.1}{20} \quad \frac{12.5}{16} \quad 11.6 \quad \frac{10.6}{13} \quad \frac{12.2}{17} \quad \frac{12.2}{21} \quad \frac{1.7}{38}$$

$$\frac{1.7}{44} \quad \frac{14.5}{23} \quad \frac{14.5}{19} \quad \frac{12.6}{15} \quad 12.0 \quad \frac{10.9}{13} \quad \frac{12.7}{17} \quad \frac{12.7}{21} \quad \frac{10.9}{41}$$

$$\frac{5.1}{47} \quad 18.2 \frac{4.3}{43}$$

$$\frac{1.2}{50} \quad 14.2$$

$$\frac{3.2}{50} \quad 20.7 \quad \frac{14.3}{27}$$

$$\frac{14.0}{27} \quad 23.3$$

$$\frac{9.8}{21} \quad \frac{9.8}{17} \quad \frac{7.8}{13} \quad 7.4 \quad \frac{6.4}{13} \quad \frac{8.2}{17} \quad \frac{8.2}{21}$$

$$\frac{10.6}{20} \quad \frac{10.6}{16} \quad \frac{9.0}{13} \quad 8.4 \quad \frac{7.7}{13} \quad \frac{9.9}{17} \quad \frac{9.9}{21} \quad \frac{7.1}{27}$$

$$\frac{12.3}{20} \quad \frac{12.3}{17} \quad \frac{10.3}{13} \quad 9.9 \quad \frac{9.6}{13} \quad \frac{11.7}{17} \quad \frac{11.7}{20}$$

$$\frac{14.2}{20} \quad \frac{14.2}{17} \quad \frac{12.5}{13} \quad 12.5 \quad \frac{12.4}{13} \quad \frac{14.1}{17}$$

954.72

34

+50

35

T.P.

1.60

946.77

9.55

945.17

34+50

35

+50

T.P.

1.50

945.45

2.82

943.95

36

+50

T.P.

2.78

940.54

7.69

937.76

37

+50

38

+50

$$\begin{array}{r} +2.2 \\ 28 \end{array} \quad \begin{array}{r} 2.6 \\ 21 \end{array} \quad \begin{array}{r} 2.6 \\ 17 \end{array} \quad \begin{array}{r} 0.6 \\ 13 \end{array} \quad \begin{array}{r} 0.7 \\ 0.6 \end{array} \quad \begin{array}{r} 0.5 \\ 13 \end{array} \quad \begin{array}{r} 9.0 \\ 29 \end{array} \quad \times$$

$$\times \quad \begin{array}{r} 8.5 \\ 23 \end{array} \quad \begin{array}{r} 3.8 \\ 13 \end{array} \quad \begin{array}{r} 3.7 \\ 3.4 \end{array} \quad \begin{array}{r} 3.8 \\ 13 \end{array}$$

$$\times \quad \begin{array}{r} 12.7 \\ 25 \end{array} \quad \begin{array}{r} 6.8 \\ 13 \end{array} \quad \begin{array}{r} 6.7 \\ 6.5 \end{array} \quad \begin{array}{r} 6.8 \\ 13 \end{array}$$

$$+4.2 \quad \begin{array}{r} 9.4 \\ 38 \end{array} \quad \times$$

$$+1.2 \quad \begin{array}{r} 14.0 \\ 43 \end{array} \quad \times$$

$$\times \quad \begin{array}{r} 5.1 \\ 33 \end{array} \quad \begin{array}{r} 7.3 \\ 28 \end{array} \quad \begin{array}{r} 7.3 \\ 25 \end{array} \quad \begin{array}{r} 1.8 \\ 13 \end{array} \quad \begin{array}{r} 1.8 \\ 1.8 \end{array} \quad \begin{array}{r} 2.1 \\ 13 \end{array} \quad \begin{array}{r} 13.2 \\ 28 \end{array}$$

$$\begin{array}{r} 3.2 \\ 37 \end{array} \quad \begin{array}{r} 9.1 \\ 28 \end{array} \quad \begin{array}{r} 9.1 \\ 24 \end{array} \quad \begin{array}{r} 3.4 \\ 13 \end{array} \quad \begin{array}{r} 3.5 \\ 3.2 \end{array} \quad \begin{array}{r} 3.6 \\ 13 \end{array} \quad \begin{array}{r} 13.2 \\ 33 \end{array}$$

$$\begin{array}{r} 4.8 \\ 38 \end{array} \quad \begin{array}{r} 10.9 \\ 29 \end{array} \quad \begin{array}{r} 10.9 \\ 22 \end{array} \quad \begin{array}{r} 6.1 \\ 13 \end{array} \quad \begin{array}{r} 6.2 \\ 6.0 \end{array} \quad \begin{array}{r} 6.1 \\ 13 \end{array} \quad \begin{array}{r} 14.2 \\ 29 \end{array}$$

$$\begin{array}{r} 6.2 \\ 30 \end{array} \quad \begin{array}{r} 7.2 \\ 27 \end{array} \quad \begin{array}{r} 7.2 \\ 20 \end{array} \quad \begin{array}{r} 3.4 \\ 13 \end{array} \quad \begin{array}{r} 3.3 \\ 2.8 \end{array} \quad \begin{array}{r} 3.1 \\ 13 \end{array} \quad \begin{array}{r} 10.3 \\ 27 \end{array}$$

$$\begin{array}{r} 8.1 \\ 25 \end{array} \quad \begin{array}{r} 8.4 \\ 24 \end{array} \quad \begin{array}{r} 8.4 \\ 19 \end{array} \quad \begin{array}{r} 4.8 \\ 13 \end{array} \quad \begin{array}{r} 4.7 \\ 4.5 \end{array} \quad \begin{array}{r} 4.6 \\ 13 \end{array} \quad \begin{array}{r} 9.8 \\ 23 \end{array}$$

$$\begin{array}{r} 7.1 \\ 25 \end{array} \quad \begin{array}{r} 8.1 \\ 24 \end{array} \quad \begin{array}{r} 8.1 \\ 19 \end{array} \quad \begin{array}{r} 5.5 \\ 13 \end{array} \quad \begin{array}{r} 5.6 \\ 5.2 \end{array} \quad \begin{array}{r} 5.5 \\ 13 \end{array} \quad \begin{array}{r} 9.3 \\ 20 \end{array}$$

$$\begin{array}{r} 6.7 \\ 23 \end{array} \quad \begin{array}{r} 8.0 \\ 21 \end{array} \quad \begin{array}{r} 8.0 \\ 18 \end{array} \quad \begin{array}{r} 5.6 \\ 13 \end{array} \quad \begin{array}{r} 5.4 \\ 5.6 \end{array} \quad \begin{array}{r} 5.8 \\ 13 \end{array} \quad \begin{array}{r} 10.7 \\ 22 \end{array}$$

940.54

39

+50

40

+50

41

+50

42

T.P.

4.69

944.95

0.28

940.26

+31

+35

+45

B.M.

6.10

938.85

$$\frac{2.8}{2.9} \quad \frac{2.3}{2.3} \quad \frac{2.3}{17} \quad \frac{5.3}{13} \quad \frac{5.4}{5.3} \quad \frac{5.3}{13} \quad \frac{8.3}{19}$$

$$\frac{+1.7}{3.3} \quad \frac{6.0}{2.3} \quad \frac{6.0}{17} \quad \frac{4.5}{13} \quad \frac{4.7}{4.7} \quad \frac{4.7}{13} \quad \frac{4.7}{18}$$

$$\frac{+1.6}{3.3} \quad \frac{5.5}{2.3} \quad \frac{5.5}{17} \quad \frac{4.0}{13} \quad \frac{4.0}{4.1} \quad \frac{4.1}{13} \quad \frac{9.6}{2.6}$$

$$\frac{1.7}{2.8} \quad \frac{5.2}{2.3} \quad \frac{5.2}{18} \quad \frac{3.3}{13} \quad \frac{3.3}{3.4} \quad \frac{3.5}{13} \quad \frac{9.7}{2.6}$$

$$\frac{3.1}{2.4} \quad \frac{4.7}{2.1} \quad \frac{4.7}{18} \quad \frac{2.5}{13} \quad \frac{2.6}{2.7} \quad \frac{2.9}{13} \quad \frac{8.0}{2.4}$$

$$\frac{3.2}{2.2} \quad \frac{4.1}{2.1} \quad \frac{4.1}{17} \quad \frac{2.0}{13} \quad \frac{1.9}{2.0} \quad \frac{2.1}{13} \quad \frac{6.0}{2.2}$$

$$\frac{2.2}{2.3} \quad \frac{3.0}{2.2} \quad \frac{3.0}{18} \quad \frac{1.1}{13} \quad \frac{1.2}{1.2} \quad \frac{1.3}{13} \quad \frac{4.0}{18}$$

$$\frac{4.5}{4.6} \quad \frac{5.0}{3.3} \quad \frac{3.4}{2.4} \quad \frac{5.4}{4.6} \quad \frac{5.1}{1.4} \quad \frac{6.0}{17} \quad \frac{8.8}{18}$$

$$\frac{2.0}{4.5} \quad \frac{2.4}{3.6} \quad \frac{4.1}{13} \quad \frac{4.1}{4.5} \quad \frac{4.9}{1.4} \quad \frac{5.7}{18} \quad \frac{9.2}{19}$$

$$\frac{1.8}{4.0} \quad \frac{3.8}{13} \quad \frac{4.3}{4.3} \quad \frac{4.3}{13}$$

0-85 R		22' X 10' X 0.5' Fill	4 ✓
2+63 R	18" X 22' C.M.	20' X 12' X 1' Fill	9 ✓
3+36 L		20' X 8' X 1' Fill	6 ✓
11+33 R		78' X 34' X 6' Fill	589 ✓
13+38 L		25' X 8' X 1' Fill	7 ✓
13+90 R		24' X 8' X 1' Fill	7 ✓
15+65 L	12" X 24' C.M.	22' X 25' X 1' Fill	20 ✓
19+62 R	12" X 26' C.M.	21' X 10' X 1' Fill	8 ✓
19+72 L	12" X 22' C.M.	40' X 15' X 1.5' Fill	33 ✓
23+50 R		60' X 30' X 4' Fill	267 ✓
28+00 R		20' X 15' X 1' Fill	11 ✓
31+75 L		40' X 10' X 1' Fill	15 ✓
31+75 R		24' X 10' X 1' Fill	9 ✓

over

22' X 20' X 0.8' Cut 13 ✓

25' X 25' X 1.5' Cut 35 ✓

30' X 14' X 0.5' Cut 8 ✓

5' X 5' X 0.5' Cut 1 ✓

22' X 8' X 1' Cut 7 ✓

40' X 5' X 0.3' Cut 2 ✓

60' X 20' X 5' Cut 222 ✓

50' X 20' X 4' Cut 148 ✓

436 ✓

35+50 R

85' X 25' X 6' Fill 472^v

41+92 R

15' X 18' X 1' Fill 10^v

14671

KEITH'S RAILROAD CURVE TABLES.

80

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HOW TO USE KEITH'S TABLES.

EXAMPLE.

Wanted a Curve with an Ext. of about 12 ft. Angle
of Intersection or I. P.= $23^{\circ} 20'$ to the R. at Station
542+72.

Ext. in Tab. IV opposite $23^{\circ} 20' = 120.87$

$120.87 \div 12 = 10.07$. Say a 10° Curve.

Tan. in Tab. IV opp. $23^{\circ} 20' = 1183.1$

$1183.1 \div 10 = 118.31$.

Tab. V. correction for A. $23^{\circ} 20'$ for a 10° Cur.=0.16

$118.31 + 0.16 = 118.47 =$ corrected Tangent.

(If corrected Ext. is required find in same way)

Ang. $23^{\circ} 20' = 23.33^{\circ} \div 10 = 2.3333 =$ L. C.

$2^{\circ} 19\frac{1}{2}' =$ def. for sta.	542	I. P.=sta.	542+72
$4^{\circ} 49\frac{1}{2}' =$ " " "	+50	Tan.=	118.47
$7^{\circ} 19\frac{1}{2}' =$ " " "	543	B. C.=sta.	541+53.53
$9^{\circ} 49\frac{1}{2}' =$ " " "	+50	L. C.=	2.33.33
$11^{\circ} 40' =$ " " "	543+	E. C.=sta.	543+86.86
	86.86		

$100 - 53.53 = 46.47 \times 3' (\text{def. for 1 ft. of } 10^{\circ} \text{ Cur.}) = 139.41' =$
 $2^{\circ} 19\frac{1}{2}' =$ def. for sta. 542.

Def. for 50 ft.= $2^{\circ} 30'$ for a 10° Curve.

Def. for 36.86 ft.= $1^{\circ} 50\frac{1}{2}'$ for a 10° Curve

(These tables are published in Field Books of
KEUFFEL & ESSER Co., New York, N. Y.)

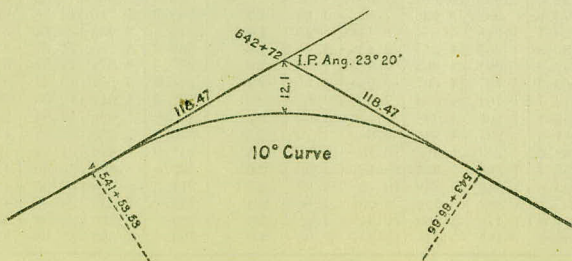


TABLE I. — Minutes in Decimals of a Degree.

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	$\frac{1}{8}$	3-16	$\frac{1}{4}$	5-16	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.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. Def.	Chd. Def.	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Def.	Chd. Def.	Def. for 1 Foot
0° 10'	34377.	.036	.145	.291	0.05'	7°	819.0	1.528	6.105	12.21	2.10'
20	17189.	.078	.291	.582	0.10	20'	781.8	1.600	6.395	12.79	2.20
30	11459.	.109	.436	.873	0.15	30	764.5	1.637	6.540	13.08	2.25
40	8594.4	.145	.582	1.164	0.20	40	747.9	1.673	6.685	13.37	2.30
50	6875.5	.182	.727	1.454	0.25	8	716.8	1.746	6.976	13.95	2.40
1	5729.6	.218	.873	1.745	0.30	20	688.2	1.819	7.266	14.53	2.50
10	4911.2	.255	1.018	2.036	0.35	30	674.7	1.855	7.411	14.82	2.55
20	4297.3	.291	1.164	2.327	0.40	40	661.7	1.892	7.556	15.11	2.60
30	3819.8	.327	1.309	2.618	0.45	9	637.3	1.965	7.846	15.69	2.70
40	3437.9	.364	1.454	2.909	0.50	20	614.6	2.037	8.136	16.27	2.80
50	3125.4	.400	1.600	3.200	0.55	30	603.8	2.074	8.281	16.56	2.85
2	2864.9	.436	1.745	3.490	0.60	40	593.4	2.110	8.426	16.85	2.90
10	2644.6	.473	1.891	3.781	0.65	10	573.7	2.183	8.716	17.43	3.00
20	2455.7	.509	2.036	4.072	0.70	30	546.4	2.292	9.150	18.30	3.15
30	2292.0	.545	2.181	4.363	0.75	11	521.7	2.402	9.585	19.16	3.30
40	2148.8	.582	2.327	4.654	0.80	30	499.1	2.511	10.02	20.04	3.45
50	2022.4	.618	2.472	4.945	0.85	12	478.3	2.620	10.45	20.91	3.60
3	1910.1	.655	2.618	5.235	0.90	30	459.3	2.730	10.89	21.77	3.75
10	1809.6	.691	2.763	5.526	0.95	13	441.7	2.839	11.32	22.64	3.90
20	1719.1	.727	2.908	5.817	1.00	30	425.4	2.949	11.75	23.51	4.05
30	1637.3	.764	3.054	6.108	1.05	14	410.3	3.058	12.18	24.37	4.20
40	1562.9	.800	3.199	6.398	1.10	30	396.2	3.168	12.62	25.24	4.35
50	1495.0	.836	3.345	6.689	1.15	15	383.1	3.277	13.05	26.11	4.50
4	1432.7	.873	3.490	6.980	1.20	30	370.8	3.387	13.49	26.97	4.65
10	1375.4	.909	3.635	7.271	1.25	16	359.3	3.496	13.92	27.84	4.80
20	1322.5	.945	3.781	7.561	1.30	30	348.5	3.606	14.35	28.70	4.95
30	1273.6	.982	3.926	7.852	1.35	17	338.3	3.716	14.78	29.56	5.10
40	1228.1	1.018	4.071	8.143	1.40	18	319.6	3.935	15.64	31.29	5.40
50	1185.8	1.055	4.217	8.433	1.45	19	302.9	4.155	16.51	33.01	5.70
5	1146.3	1.091	4.362	8.724	1.50	20	287.9	4.374	17.37	34.73	6.00
10	1109.3	1.127	4.507	9.014	1.55	21	274.4	4.594	18.22	36.44	6.30
20	1074.7	1.164	4.653	9.305	1.60	22	262.0	4.814	19.08	38.16	6.60
30	1042.1	1.200	4.798	9.596	1.65	23	250.8	5.035	19.94	39.87	6.90
40	1011.5	1.237	4.943	9.886	1.70	24	240.5	5.255	20.79	41.58	7.20
50	982.6	1.273	5.088	10.18	1.75	25	231.0	5.476	21.64	43.28	7.50
6	955.4	1.309	5.234	10.47	1.80	26	222.3	5.697	22.50	44.99	7.80
10	929.6	1.346	5.379	10.76	1.85	27	214.2	5.918	23.35	46.69	8.10
20	905.1	1.382	5.524	11.05	1.90	28	206.7	6.138	24.19	48.38	8.40
30	881.9	1.418	5.669	11.34	1.95	29	199.7	6.360	25.04	50.07	8.70
40	859.9	1.455	5.814	11.63	2.00	30	193.2	6.583	25.88	51.76	9.00

TABLE IV. — Tangents and Externals to a 1° Curve.

Angle	Tangent	External	Angle	Tangent	External	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	99.18
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.

Angle	Tangent	External	Angle	Tangent	External	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	483.4	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 External to a 1° Curve.

Angle	Tangent	External	Angle	Tangent	External	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	2225.5
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.

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

Table V. Corrections for use with table IV,

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		For Tangents Add													
ANGLE	CURVE	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°		.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°		.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°		.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°		.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°		.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°		.11	.22	.34	.47	.58	.69	.70	.81	.92	1.04	1.29	1.42	1.54	1.66
40°		.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°		.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°		.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°		.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°		.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°		.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°		.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°		.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°		.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°		.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°		.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°		.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.49	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

For Externals Add

ANGLE	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	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
80°		.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°		.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°		.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°		.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°		.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96

Table VI. Deflections for Sub Chords for Short Radius Curves.

Degree of Curve	Radius 50 sin. def. ang.	$\frac{1}{2}$ sub chord R = sin of def. angle				Length of arc for 100 ft.
		12.5 Ft.	15 Ft.	20 Ft.	25 Ft.	
30°	193.18	1° 51'	2° 17'	2° 58'	3° 43'	101.15
32°	181.39	1° 59'	2° 25'	3° 10'	3° 58'	101.33
34°	171.01	2° 06'	2° 33'	3° 21'	4° 12'	101.48
36°	161.80	2° 13'	2° 41'	3° 33'	4° 26'	101.66
38°	153.58	2° 20'	2° 49'	3° 44'	4° 40'	101.85
40°	146.19	2° 27'	2° 57'	3° 55'	4° 54'	102.06
42°	139.52	2° 34'	3° 05'	4° 07'	5° 08'	102.29
44°	133.47	2° 41'	3° 13'	4° 18'	5° 22'	102.53
46°	127.97	2° 48'	3° 21'	4° 29'	5° 36'	102.76
48°	122.92	2° 55'	3° 29'	4° 40'	5° 50'	103.00
50°	118.31	3° 02'	3° 38'	4° 51'	6° 04'	103.24
52°	114.06	3° 09'	3° 46'	5° 02'	6° 17'	103.54
54°	110.11	3° 16'	3° 54'	5° 13'	6° 31'	103.84
56°	106.50	3° 22'	4° 02'	5° 23'	6° 44'	104.14
58°	103.14	3° 29'	4° 10'	5° 34'	6° 57'	104.43
60°	100.00	3° 35'	4° 18'	5° 44'	7° 11'	104.72

CURVE FORMULAS.

$$T = R \tan \frac{1}{2} I$$

$$T = \frac{50 \tan \frac{1}{2} I}{\sin. D}$$

$$\sin. D = \frac{50}{R}$$

$$\sin. D = \frac{50 \tan \frac{1}{2} I}{T}$$

$$R = T \cot. \frac{1}{2} I$$

$$R = \frac{50}{\sin. D}$$

$$E = R \text{ ex. sec. } \frac{1}{2} I$$

$$E = T \tan \frac{1}{4} I$$

$$\text{Chord def.} = \frac{\text{chord}^2}{R}$$

$$\text{No. chords} = \frac{\frac{1}{2} I}{D}$$

$$\text{Tan. def.} = \frac{1}{2} \text{ chord def.}$$

The square of any distance, divided by twice the radius, will equal the distance from tangent to curve, very nearly.

Table IV. contains Tangents and External to a 1° curve. Tan. and Ext. to any other radius may be found, nearly enough, by dividing the Tan. or Ext. opposite the given Central Angle by the given degree of curve.

To find Deg. of Curve, having the Central Angle and Tangent: Divide Tan. opposite the given Central Angle by the given Tangent.

To find Deg. of Curve, having the Central Angle and Tangent: Divide Ext. opposite the given Central Angle by the given External.

To find Nat. Tan. and Nat. Ex. Sec. for any angle by Table IV.: Tan. or Ext. of twice the given angle divided by the radius of a 1° curve will be the Nat. Tan. or Nat. Ex. Sec.

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft.), and divide given deflection by the product.

Rule 2. Multiply given deflection by 57.3, and divide the product by the given distance.

To find deflection for a given angle and distance: Multiply the angle by .01745, and the product by the distance.

RIGHT ANGLE TRIANGLES.— Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

Given Base 100, Alt 10. $10^2 \div 200 = .5$. $100 + .5 = 100.5$ hyp.

Given Hyp. 100, Alt. 25. $25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 = \text{Base}$.

Error in first example, .002; in last, .045.

To find Tons of Rail in one mile of track: multiply weight per yard by 11, and divide by 7.

Natural Sines

DEG.	0'	10'	20'	30'	40'	50'	DEG.	DEG.	0'	10'	20'	30'	40'	50'	DEG.
0	0000	0029	0058	0087	0116	0145	89	40	6428	6450	6472	6494	6517	6539	49
1	0175	0204	0233	0262	0291	0320	88	41	6561	6583	6604	6626	6648	6670	48
2	0349	0378	0407	0436	0465	0494	87	42	6691	6713	6734	6756	6777	6799	47
3	0523	0552	0581	0610	0640	0669	86	43	6820	6841	6862	6884	6905	6926	46
4	0698	0727	0756	0785	0814	0843	85	44	6947	6967	6988	7009	7030	7050	45
5	0872	0901	0929	0958	0987	1016	84	45	7071	7092	7112	7133	7153	7173	44
6	1045	1074	1103	1132	1161	1190	83	46	7193	7214	7234	7254	7274	7294	43
7	1219	1248	1276	1305	1334	1363	82	47	7314	7333	7353	7373	7392	7412	42
8	1392	1421	1449	1478	1507	1536	81	48	7431	7451	7470	7490	7509	7528	41
9	1564	1593	1622	1650	1679	1708	80	49	7547	7566	7585	7604	7623	7642	40
10	1736	1765	1794	1822	1851	1880	79	50	7660	7679	7698	7716	7735	7753	39
11	1908	1937	1965	1994	2022	2051	78	51	7771	7790	7808	7826	7844	7862	38
12	2079	2108	2136	2164	2193	2221	77	52	7880	7908	7916	7934	7951	7969	37
13	2250	2278	2306	2334	2363	2391	76	53	7986	8004	8021	8039	8056	8073	36
14	2419	2447	2476	2504	2532	2560	75	54	8090	8107	8124	8141	8158	8175	35
15	2588	2616	2644	2672	2700	2728	74	55	8192	8208	8225	8241	8258	8274	34
16	2756	2784	2812	2840	2868	2896	73	56	8290	8307	8323	8339	8355	8371	33
17	2924	2952	2979	3007	3035	3062	72	57	8387	8403	8418	8434	8450	8465	32
18	3090	3118	3145	3173	3201	3228	71	58	8480	8496	8511	8526	8542	8557	31
19	3256	3283	3311	3338	3365	3393	70	59	8572	8587	8601	8616	8631	8646	30
20	3420	3448	3475	3502	3529	3557	69	60	8660	8675	8689	8704	8718	8732	29
21	3584	3611	3638	3665	3692	3719	68	61	8746	8760	8774	8788	8802	8816	28
22	3746	3773	3800	3827	3854	3881	67	62	8829	8843	8857	8870	8884	8897	27
23	3907	3934	3961	3987	4014	4041	66	63	8910	8923	8936	8949	8962	8975	26
24	4067	4094	4120	4147	4173	4200	65	64	8988	9001	9013	9026	9038	9051	25
25	4226	4253	4279	4305	4331	4358	64	65	9063	9075	9088	9100	9112	9124	24
26	4384	4410	4436	4462	4488	4514	63	66	9135	9147	9159	9171	9182	9194	23
27	4540	4566	4592	4617	4643	4669	62	67	9205	9216	9228	9239	9250	9261	22
28	4695	4720	4746	4772	4797	4823	61	68	9272	9283	9293	9304	9315	9325	21
29	4848	4874	4899	4924	4950	4975	60	69	9336	9346	9356	9367	9377	9387	20
30	5000	5025	5050	5075	5100	5125	59	70	9397	9407	9417	9426	9436	9446	19
31	5150	5175	5200	5225	5250	5275	58	71	9455	9465	9474	9483	9492	9502	18
32	5299	5324	5348	5373	5398	5422	57	72	9511	9520	9528	9537	9546	9555	17
33	5446	5471	5495	5519	5544	5568	56	73	9563	9572	9580	9588	9596	9605	16
34	5592	5616	5640	5664	5688	5712	55	74	9613	9621	9628	9636	9644	9652	15
35	5736	5760	5783	5807	5831	5854	54	75	9659	9667	9674	9681	9689	9696	14
36	5878	5901	5925	5948	5972	5995	53	76	9703	9710	9717	9724	9730	9737	13
37	6018	6041	6065	6088	6111	6134	52	77	9744	9750	9757	9763	9769	9775	12
38	6157	6180	6202	6225	6248	6271	51	78	9781	9787	9793	9799	9805	9811	11
39	6293	6316	6338	6361	6383	6406	50	79	9816	9822	9827	9833	9838	9843	10

DEG.	60'	50'	40'	30'	20'	10'	DEG.	DEG.	60'	50'	40'	30'	20'	10'	DEG.
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DEG.	0'	10'	20'	30'	40'	50'	DEG.
80	9848	9853	9858	9863	9868	9872	9
81	9877	9881	9886	9890	9894	9899	8
82	9903	9907	9911	9914	9918	9922	7
83	9925	9929	9932	9936	9939	9942	6
84	9945	9948	9951	9954	9957	9959	5
85	9962	9964	9967	9969	9971	9974	4
86	9976	9978	9980	9981	9983	9985	3
87	9986	9988	9989	9990	9992	9993	2
88	9994	9995	9996	9997	9997	9998	1
89	9998	9999	9999	9999	1.0000	1.0000	0

DEG.	60'	50'	40'	30'	20'	10'	DEG.
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Natural Cosines

Natural Tangents

deg.	0'	10'	20'	30'	40'	50'	deg.	0'	10'	20'	30'	40'	50'	deg.	
0	0000	0029	0058	0087	0116	0145	89	40	8391	8441	8491	8541	8591	8642	49
1	0175	0204	0233	0262	0291	0320	88	41	8693	8744	8796	8847	8899	8952	48
2	0349	0378	0407	0437	0466	0495	87	42	9004	9057	9110	9163	9217	9271	47
3	0524	0553	0582	0612	0641	0670	86	43	9325	9380	9435	9490	9545	9601	46
4	0699	0729	0758	0787	0816	0846	85	44	9657	9713	9770	9827	9884	9942	45
5	0875	0904	0934	0963	0992	1022	84	45	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295	44
6	1051	1080	1110	1139	1169	1198	83	46	1.0355	1.0416	1.0477	1.0533	1.0599	1.0661	43
7	1228	1257	1287	1317	1346	1376	82	47	1.0724	1.0786	1.0850	1.0913	1.0977	1.1041	42
8	1405	1435	1465	1495	1524	1554	81	48	1.1106	1.1171	1.1237	1.1303	1.1369	1.1436	41
9	1584	1614	1644	1673	1703	1733	80	49	1.1504	1.1571	1.1640	1.1708	1.1778	1.1847	40
10	1763	1793	1823	1853	1883	1914	79	50	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276	39
11	1944	1974	2004	2035	2065	2095	78	51	1.2349	1.2423	1.2497	1.2572	1.2647	1.2723	38
12	2126	2156	2186	2217	2247	2278	77	52	1.2799	1.2876	1.2954	1.3032	1.3111	1.3190	37
13	2309	2339	2370	2401	2432	2462	76	53	1.3270	1.3351	1.3432	1.3514	1.3597	1.3680	36
14	2493	2524	2555	2586	2617	2648	75	54	1.3764	1.3848	1.3934	1.4019	1.4106	1.4193	35
15	2679	2711	2742	2773	2805	2836	74	55	1.4281	1.4370	1.4460	1.4550	1.4641	1.4735	34
16	2867	2899	2931	2962	2994	3026	73	56	1.4826	1.4919	1.5013	1.5108	1.5204	1.5301	33
17	3057	3089	3121	3153	3185	3217	72	57	1.5399	1.5497	1.5597	1.5697	1.5798	1.5900	32
18	3249	3281	3314	3346	3378	3411	71	58	1.6003	1.6107	1.6212	1.6319	1.6426	1.6534	31
19	3443	3476	3508	3541	3574	3607	70	59	1.6643	1.6753	1.6864	1.6977	1.7090	1.7205	30
20	3640	3673	3706	3739	3772	3805	69	60	1.7321	1.7437	1.7556	1.7675	1.7797	1.7917	29
21	3839	3872	3906	3939	3973	4006	68	61	1.8040	1.8165	1.8291	1.8418	1.8546	1.8676	28
22	4040	4074	4108	4142	4176	4210	67	62	1.8807	1.8940	1.9074	1.9210	1.9347	1.9486	27
23	4245	4279	4314	4348	4383	4417	66	63	1.9626	1.9768	1.9912	2.0057	2.0204	2.0353	26
24	4452	4487	4522	4557	4592	4628	65	64	2.0503	2.0655	2.0809	2.0965	2.1123	2.1283	25
25	4663	4699	4734	4770	4806	4841	64	65	2.1445	2.1609	2.1775	2.1943	2.2113	2.2286	24
26	4877	4913	4950	4986	5022	5059	63	66	2.2450	2.2637	2.2817	2.2998	2.3183	2.3369	23
27	5095	5132	5169	5206	5243	5280	62	67	2.3559	2.3750	2.3945	2.4142	2.4342	2.4545	22
28	5317	5354	5392	5430	5467	5505	61	68	2.4751	2.4960	2.5172	2.5386	2.5605	2.5826	21
29	5543	5581	5619	5658	5696	5735	60	69	2.6051	2.6279	2.6511	2.6746	2.6985	2.7228	20
30	5774	5812	5851	5890	5930	5969	59	70	2.7475	2.7725	2.7980	2.8239	2.8502	2.8770	19
31	6009	6048	6088	6128	6168	6208	58	71	2.9042	2.9319	2.9600	2.9887	3.0178	3.0475	18
32	6249	6289	6330	6371	6412	6453	57	72	3.0777	3.1084	3.1397	3.1716	3.2041	3.2371	17
33	6494	6536	6577	6619	6661	6703	56	73	3.2709	3.3052	3.3402	3.3759	3.4124	3.4495	16
34	6745	6787	6830	6873	6916	6959	55	74	3.4874	3.5261	3.5656	3.6059	3.6470	3.6891	15
35	7002	7046	7089	7133	7177	7221	54	75	3.7321	3.7760	3.8208	3.8667	3.9136	3.9617	14
36	7265	7310	7355	7400	7445	7490	53	76	4.0108	4.0611	4.1126	4.1653	4.2193	4.2747	13
37	7536	7581	7627	7673	7720	7766	52	77	4.3315	4.3897	4.4494	4.5107	4.5736	4.6382	12
38	7813	7860	7907	7954	8002	8050	51	78	4.7046	4.7729	4.8430	4.9152	4.9894	5.0658	11
39	8098	8146	8195	8243	8292	8342	50	79	5.1446	5.2257	5.3093	5.3955	5.4845	5.5764	10
deg.	60'	50'	40'	30'	20'	10'	deg.	deg.	60'	50'	40'	30'	20'	10'	deg.

deg.	0'	10'	20'	30'	40'	50'	deg.
80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970	9
81	6.3138	6.4348	6.5606	6.6912	6.8269	6.9682	8
82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530	7
83	8.1443	8.3450	8.5555	8.7769	9.0098	9.2553	6
84	9.5144	9.7882	10.078	10.385	10.711	11.059	5
85	11.430	11.826	12.250	12.706	13.197	13.727	4
86	14.300	14.924	15.605	16.350	17.169	18.075	3
87	19.081	20.206	21.470	22.903	24.542	26.432	2
88	28.636	31.242	34.368	38.189	42.964	49.104	1
89	57.290	68.750	85.940	114.588	171.885	343.770	0

deg. 60' 50' 40' 30' 20' 10' deg.

Natural Cotangents

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 14 FEET WIDE. SIDE SLOPES 1½ TO 1.

FOR SINGLE TRACK EMBANKMENT.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	7.0	7.2	7.3	7.5	7.6	7.8	7.9	8.1	8.2	8.4	0
1	8.5	8.7	8.8	9.0	9.1	9.3	9.4	9.6	9.7	9.9	1
2	10.0	10.2	10.3	10.5	10.6	10.8	10.9	11.1	11.2	11.4	2
3	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	3
4	13.0	13.2	13.3	13.5	13.6	13.8	13.9	14.1	14.2	14.4	4
5	14.5	14.7	14.8	15.0	15.1	15.3	15.4	15.6	15.7	15.9	5
6	16.0	16.2	16.3	16.5	16.6	16.8	16.9	17.1	17.2	17.4	6
7	17.5	17.7	17.8	18.0	18.1	18.3	18.4	18.6	18.7	18.9	7
8	19.0	19.2	19.3	19.5	19.6	19.8	19.9	20.1	20.2	20.4	8
9	20.5	20.7	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.9	9
10	22.0	22.2	22.3	22.5	22.6	22.8	22.9	23.1	23.2	23.4	10
11	23.5	23.7	23.8	24.0	24.1	24.3	24.4	24.6	24.7	24.9	11
12	25.0	25.2	25.3	25.5	25.6	25.8	25.9	26.1	26.2	26.4	12
13	26.5	26.7	26.8	27.0	27.1	27.3	27.4	27.6	27.7	27.9	13
14	28.0	28.2	28.3	28.5	28.6	28.8	28.9	29.1	29.2	29.4	14
15	29.5	29.7	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.9	15
16	31.0	31.2	31.3	31.5	31.6	31.8	31.9	32.1	32.2	32.4	16
17	32.5	32.7	32.8	33.0	33.1	33.3	33.4	33.6	33.7	33.9	17
18	34.0	34.2	34.3	34.5	34.6	34.8	34.9	35.1	35.2	35.4	18
19	35.5	35.7	35.8	36.0	36.1	36.3	36.4	36.6	36.7	36.9	19
20	37.0	37.2	37.3	37.5	37.6	37.8	37.9	38.1	38.2	38.4	20
21	38.5	38.7	38.8	39.0	39.1	39.3	39.4	39.6	39.7	39.9	21
22	40.0	40.2	40.3	40.5	40.6	40.8	40.9	41.1	41.2	41.4	22
23	41.5	41.7	41.8	42.0	42.1	42.3	42.4	42.6	42.7	42.9	23
24	43.0	43.2	43.3	43.5	43.6	43.8	43.9	44.1	44.2	44.4	24
25	44.5	44.7	44.8	45.0	45.1	45.3	45.4	45.6	45.7	45.9	25
26	46.0	46.2	46.3	46.5	46.6	46.8	46.9	47.1	47.2	47.4	26
27	47.5	47.7	47.8	48.0	48.1	48.3	48.4	48.6	48.7	48.9	27
28	49.0	49.2	49.3	49.5	49.6	49.8	49.9	50.1	50.2	50.4	28
29	50.5	50.7	50.8	51.0	51.1	51.3	51.4	51.6	51.7	51.9	29
30	52.0	52.2	52.3	52.5	52.6	52.8	52.9	53.1	53.2	53.4	30
31	53.5	53.7	53.8	54.0	54.1	54.3	54.4	54.6	54.7	54.9	31
32	55.0	55.2	55.3	55.5	55.6	55.8	55.9	56.1	56.2	56.4	32
33	56.5	56.7	56.8	57.0	57.1	57.3	57.4	57.6	57.7	57.9	33
34	58.0	58.2	58.3	58.5	58.6	58.8	58.9	59.1	59.2	59.4	34
35	59.5	59.7	59.8	60.0	60.1	60.3	60.4	60.6	60.7	60.9	35
36	61.0	61.2	61.3	61.5	61.6	61.8	61.9	62.1	62.2	62.4	36

Calculated by Julien A. Hall, M. Am. Soc. C. E.

MADE IN GERMANY.

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