

Book 7-A, Dr. 11-A

CONSTRUCTION NOTES

Drill-A-BK. 7A

FIELD BOOK

360 A

PROJ. 33-M17

33-M17

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.

90° 20'

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52+96.90 Brass Plug in Pavement

45+85.20 P.O.T.

26+48.40 Mont.
P.I.

0°00'30"

18+04.5 P.O.T.

0+00 Mont.

Iron Rd. Sq. 2 47.15
15" Dak 63.23

Hub 50' Nail in 18" Dak

G.R. Post. 20.38
100'
Hub. 22.55
G.R. Post

to Willow

B.M.	3.63	911.60		907.97	
T.P.	3.95	910.86	4.69	906.91	
0-186					
-176				06.0	4.9
-170				06.0	4.9
-164				06.0	4.9
-159				06.0	4.9
-150				06.0	4.9
-135			Ditch Lt. 00.8	06.0	4.9
0-100			00.8	05.9	5.0
-50			00.7	05.9	5.0
-20				05.9	5.0
0+0			00.6	05.8	5.1

Spk. in 10" Oak 34 Rt. 5+68

$$\frac{6.0}{40} \quad \frac{6.6}{31} \quad \frac{7.8}{27} \quad \frac{7.8}{24} \quad \frac{4.6}{13} \quad \frac{5.0}{12} \quad \frac{7.0}{21} \quad \frac{7.3}{28} \quad \frac{7.0}{30} \quad \frac{6.8}{40}$$

$$\frac{9.8}{38} \quad \frac{8.0}{30} \quad \frac{8.0}{24} \quad \frac{6.0}{21} \quad \frac{6.9}{19} \quad \frac{5.9}{14} \quad \frac{5.4}{9} \quad \frac{4.6}{9} \quad \frac{4.9}{00} \quad \frac{4.9}{7} \quad \frac{5.1}{15} \quad \frac{6.9}{21.9} \quad \frac{7.3}{28} \quad \frac{6.9}{40}$$

$$\frac{10.0}{40} \quad \frac{8.6}{24} \quad \frac{5.4}{16} \quad \frac{4.4}{8} \quad \frac{4.7}{8} \quad \frac{4.9}{8} \quad \frac{5.1}{18} \quad \frac{6.8}{24} \quad \frac{7.1}{40}$$

$$\frac{10.3}{40} \quad \frac{4.2}{21.4} \quad \frac{5.0}{12} \quad \frac{4.5}{10.4} \quad \frac{4.9}{18} \quad \frac{6.6}{23} \quad \frac{7.2}{40}$$

$$\frac{9.9}{40} \quad \frac{9.8}{22} \quad \frac{8.3}{17} \quad \frac{4.8}{11} \quad \frac{4.4}{15} \quad \frac{4.3}{20} \quad \frac{5.0}{25} \quad \frac{6.7}{25} \quad \frac{7.2}{40}$$

$$\frac{6.3}{50} \quad \frac{10.0}{34} \quad \frac{9.9}{23} \quad \frac{9.9}{18} \quad \frac{6.7}{11} \quad \frac{4.8}{7} \quad \frac{4.4}{10.5} \quad \frac{4.2}{12} \quad \frac{5.0}{21} \quad \frac{5.9}{22.5} \quad \frac{6.8}{26} \quad \frac{7.2}{40}$$

$$\frac{6.1}{40} \quad \frac{6.5}{35} \quad \frac{8.9}{28} \quad \frac{5.9}{23.6} \quad \frac{9.3}{11} \quad \frac{6.8}{8} \quad \frac{5.1}{3} \quad \frac{4.8}{10.1} \quad \frac{4.6}{20} \quad \frac{5.5}{23.1} \quad \frac{7.0}{27} \quad \frac{7.2}{40}$$

$$\frac{6.5}{34.5} \quad \frac{6.6}{27} \quad \frac{8.6}{24} \quad \frac{9.7}{21} \quad \frac{10.4}{14} \quad \frac{9.4}{6} \quad \frac{7.2}{3} \quad \frac{6.1}{7.1} \quad \frac{4.8}{7} \quad \frac{4.5}{16} \quad \frac{4.7}{21} \quad \frac{5.0}{24} \quad \frac{5.9}{28} \quad \frac{7.2}{33} \quad \frac{7.4}{40}$$

$$\frac{7.2}{40} \quad \frac{6.5}{34.5} \quad \frac{7.2}{18} \quad \frac{10.1}{11} \quad \frac{10.5}{4} \quad \frac{10.1}{5.1} \quad \frac{9.8}{2} \quad \frac{7.8}{5} \quad \frac{7.3}{10} \quad \frac{6.2}{19} \quad \frac{6.2}{22.2} \quad \frac{6.2}{32} \quad \frac{7.4}{40}$$

$$\frac{6.4}{40} \quad \frac{5.5}{31} \quad \frac{6.5}{22} \quad \frac{7.9}{13} \quad \frac{10.0}{8} \quad \frac{10.1}{7} \quad \frac{9.0}{7} \quad \frac{7.9}{8} \quad \frac{7.1}{21} \quad \frac{6.4}{40}$$

$$\frac{7.1}{40} \quad \frac{6.2}{35.6} \quad \frac{5.2}{30} \quad \frac{7.3}{13} \quad \frac{10.0}{9} \quad \frac{10.8}{3} \quad \frac{10.6}{5.5} \quad \frac{9.7}{7} \quad \frac{7.8}{9} \quad \frac{6.4}{17} \quad \frac{6.5}{21.9} \quad \frac{6.5}{40}$$

910.86 ✓

0+50

00.5

05.8

10.4
5.1

+75

10.6

19

29.6

00.4

05.7

10.5
5.2

+90

7.2

36.8

00.4

05.7

5.2

1

00.4

05.7

10.5
5.2

+107

00.4

05.7

5.2

+17

00.4

05.7

10.5
5.2

+60

00.3

05.4

10.6
5.3

2

00.2

05.6 ✓

10.7
5.3

T.P.

4.84

911.16 ✓

4.54

906.32

+25

05.6

5.6

+65

05.5

5.7

3

05.5

5.7

+50

05.5

5.7

$$\begin{array}{cccccccccccccccc} \frac{7.3}{40} & \frac{4.0}{35.6} & \frac{6.1}{31} & \frac{6.7}{20} & \frac{9.2}{14} & \frac{10.5}{9} & \frac{10.9}{6} & \frac{10.5}{-5.4} & \frac{7.4}{5} & \frac{7.1}{13} & \frac{6.1}{18} & \frac{6.0}{22.7} & \frac{7.3}{30} & \frac{7.7}{40} \end{array}$$

5.1

$$\begin{array}{cccccccccccccccccccc} \frac{5.9}{40} & \frac{5.7}{36.8} & \frac{5.1}{32} & \frac{7.9}{17} & \frac{10.1}{12} & \frac{10.9}{6} & \frac{10.5}{-5.3} & \frac{10.0}{2} & \frac{8.3}{4} & \frac{7.0}{6} & \frac{7.0}{13} & \frac{4.7}{22} & \frac{4.6}{24.9} & \frac{5.1}{29} & \frac{6.9}{36} & \frac{6.9}{40} \end{array}$$

5.2

$$\begin{array}{cccccccccccccccc} \frac{4.6}{40} & \frac{5.0}{30} & \frac{6.8}{19} & \frac{10.7}{12} & \frac{11.0}{7} & \frac{7.5}{10.1} & \frac{6.2}{4} & \frac{3.2}{11} & \frac{2.4}{17} & \frac{3.5}{31} & \frac{3.4}{38} & \frac{3.4}{43} \end{array}$$

5.2

$$\begin{array}{cccccccccccccccc} \frac{4.8}{50} & \frac{4.0}{39.4} & \frac{4.6}{28} & \frac{6.4}{22} & \frac{10.8}{14} & \frac{11.0}{7} & \frac{10.1}{-9.9} & \frac{7.4}{4} & \frac{3.4}{11} & \frac{2.5}{19} & \frac{2.3}{28.3} & \frac{2.3}{35} & \frac{3.5}{40} \end{array}$$

5.2

$$\begin{array}{cccccccccccc} \frac{3.9}{40} & \frac{4.1}{29} & \frac{6.7}{22} & \frac{10.5}{14} & \frac{10.8}{8} & \frac{9.9}{7.1} & \frac{7.1}{4} & \frac{3.6}{11} & \frac{2.6}{26} & \frac{3.7}{34} & \frac{6.2}{42} \end{array}$$

5.2

$$\begin{array}{cccccccccccccccc} \frac{3.9}{50} & \frac{3.7}{39.9} & \frac{4.9}{29} & \frac{6.9}{21} & \frac{9.9}{17} & \frac{11.0}{8} & \frac{9.1}{-3.4} & \frac{6.4}{6} & \frac{6.5}{9} & \frac{3.9}{17} & \frac{3.8}{26.1} & \frac{6.4}{36} & \frac{6.3}{40} \end{array}$$

5.2

$$\begin{array}{cccccccccccccccc} \frac{4.2}{47} & \frac{4.0}{39.5} & \frac{7.4}{26} & \frac{10.6}{19} & \frac{10.9}{13} & \frac{10.4}{7} & \frac{6.9}{-1.6} & \frac{6.3}{8} & \frac{4.6}{15} & \frac{5.2}{24.2} & \frac{6.5}{32} & \frac{6.4}{40} \end{array}$$

5.3

$$\begin{array}{cccccccccccccccc} \frac{6.1}{37} & \frac{5.9}{42} & \frac{7.2}{35.2} & \frac{10.6}{29} & \frac{10.9}{24.2} & \frac{10.4}{19} & \frac{8.3}{12} & \frac{6.4}{10} & \frac{6.1}{4} & \frac{5.3}{0.0} & \frac{3.6}{5} & \frac{3.5}{12} & \frac{5.7}{23.4} & \frac{5.8}{40} \end{array}$$

5.3

$$\begin{array}{cccccccccccccccc} \frac{8.8}{40} & \frac{10.8}{34} & \frac{11.1}{30} & \frac{10.3}{24} & \frac{9.2}{20.2} & \frac{6.7}{16} & \frac{6.2}{11} & \frac{4.5}{4} & \frac{4.1}{11.5} & \frac{4.2}{5} & \frac{5.6}{14} & \frac{5.8}{18} & \frac{5.7}{23.9} & \frac{5.5}{40} \end{array}$$

5.6

$$\begin{array}{cccccccccccc} \frac{11.2}{42} & \frac{10.0}{35} & \frac{8.2}{31} & \frac{6.9}{30} & \frac{6.0}{23.6} & \frac{4.8}{14} & \frac{4.6}{13} & \frac{6.1}{-0.4} & \frac{6.0}{22.6} & \frac{5.3}{40} \end{array}$$

5.7

$$\begin{array}{cccccccccccc} \frac{6.8}{40} & \frac{5.5}{35} & \frac{6.7}{25.5} & \frac{5.1}{20} & \frac{6.9}{8} & \frac{6.9}{-1.2} & \frac{6.2}{23.3} & \frac{5.5}{40} \end{array}$$

5.7

$$\begin{array}{cccccccccccc} \frac{4.5}{40} & \frac{4.5}{36} & \frac{6.3}{28} & \frac{6.8}{22.4} & \frac{6.9}{14} & \frac{6.8}{-1.1} & \frac{5.9}{23.7} & \frac{5.7}{40} \end{array}$$

5.7

911.16 ✓

4

05.4

5.8 -

+50

05.4

5.8 -

5

05.3

5.9 -

+50

05.3

5.9 -

B.M.

3.00

910.97 ✓

3.20

907.96 ✓

907.97

6

05.2

5.8 -

+50

05.2

5.8 -

7

05.1

5.9 -

+50

05.1

5.9 -

8

05.0

6.0 -

+50

05.0

6.0 -

9

04.9

6.1 -

+50

04.9

6.1 -

5.4

$$\begin{array}{r} 4.5 \\ 45 \end{array} \quad \begin{array}{r} 6.3 \\ 37 \end{array} \quad \begin{array}{r} 5.4 \\ 22.8 \end{array} \quad \begin{array}{r} 6.2 \\ -0.4 \end{array} \quad \begin{array}{r} 5.7 \\ 24.2 \end{array} \quad \begin{array}{r} 5.4 \\ 40 \end{array}$$

5.4

$$\begin{array}{r} 5.9 \\ 40 \end{array} \quad \begin{array}{r} 5.9 \\ 23.9 \end{array} \quad \begin{array}{r} 5.7 \\ +0.1 \end{array} \quad \begin{array}{r} 4.9 \\ 25.4 \end{array} \quad \begin{array}{r} 4.5 \\ 40 \end{array}$$

(5.9)

$$\begin{array}{r} 5.4 \\ 40 \end{array} \quad \begin{array}{r} 5.2 \\ 25.1 \end{array} \quad \begin{array}{r} 4.7 \\ +1.2 \end{array} \quad \begin{array}{r} 3.9 \\ 27 \end{array} \quad \begin{array}{r} 3.7 \\ 40 \end{array}$$

(5.9)

$$\begin{array}{r} 5.5 \\ 40 \end{array} \quad \begin{array}{r} 5.4 \\ 24.8 \end{array} \quad \begin{array}{r} 4.5 \\ +1.4 \end{array} \quad \begin{array}{r} 3.9 \\ 27 \end{array} \quad \begin{array}{r} 3.4 \\ 40 \end{array}$$

Spt. in 10" Oak 34" Rt. 5+68 (5.9)

$$\begin{array}{r} 4.8 \\ 40 \end{array} \quad \begin{array}{r} 4.9 \\ 33 \end{array} \quad \begin{array}{r} 4.0 \\ +1.8 \end{array} \quad \begin{array}{r} 3.7 \\ 33 \end{array} \quad \begin{array}{r} 3.7 \\ 40 \end{array}$$

(5.9)

$$\begin{array}{r} 4.4 \\ 40 \end{array} \quad \begin{array}{r} 4.5 \\ 33 \end{array} \quad \begin{array}{r} 4.7 \\ 20 \end{array} \quad \begin{array}{r} 4.6 \\ +1.2 \end{array} \quad \begin{array}{r} 3.8 \\ 18 \end{array} \quad \begin{array}{r} 3.5 \\ 40 \end{array}$$

(5.9)

$$\begin{array}{r} 4.9 \\ 40 \end{array} \quad \begin{array}{r} 5.0 \\ 33 \end{array} \quad \begin{array}{r} 5.0 \\ 20 \end{array} \quad \begin{array}{r} 4.8 \\ +1.1 \end{array} \quad \begin{array}{r} 4.4 \\ 18 \end{array} \quad \begin{array}{r} 4.7 \\ 33 \end{array} \quad \begin{array}{r} 4.8 \\ 40 \end{array}$$

(5.9)

$$\begin{array}{r} 6.1 \\ 40 \end{array} \quad \begin{array}{r} 6.0 \\ 33 \end{array} \quad \begin{array}{r} 5.4 \\ +0.5 \end{array} \quad \begin{array}{r} 5.1 \\ 33 \end{array} \quad \begin{array}{r} 5.0 \\ 40 \end{array}$$

(6.0)

$$\begin{array}{r} 6.6 \\ 40 \end{array} \quad \begin{array}{r} 6.5 \\ 33 \end{array} \quad \begin{array}{r} 6.1 \\ -0.1 \end{array} \quad \begin{array}{r} 5.5 \\ 33 \end{array} \quad \begin{array}{r} 5.4 \\ 40 \end{array}$$

(6.0)

$$\begin{array}{r} 6.1 \\ 40 \end{array} \quad \begin{array}{r} 6.8 \\ 33 \end{array} \quad \begin{array}{r} 7.5 \\ 27 \end{array} \quad \begin{array}{r} 7.0 \\ 22 \end{array} \quad \begin{array}{r} 7.0 \\ -1.0 \end{array} \quad \begin{array}{r} 6.7 \\ 33 \end{array} \quad \begin{array}{r} 6.5 \\ 40 \end{array}$$

(6.1)

$$\begin{array}{r} 3.5 \\ 40 \end{array} \quad \begin{array}{r} 2.9 \\ 33 \end{array} \quad \begin{array}{r} 4.3 \\ 12 \end{array} \quad \begin{array}{r} 4.8 \\ -0.7 \end{array} \quad \begin{array}{r} 6.4 \\ 33 \end{array} \quad \begin{array}{r} 6.4 \\ 40 \end{array}$$

(6.1)

$$\begin{array}{r} 10.8 \\ 40 \end{array} \quad \begin{array}{r} 9.3 \\ 34 \end{array} \quad \begin{array}{r} 6.3 \\ 33 \end{array} \quad \begin{array}{r} 4.5 \\ 23 \end{array} \quad \begin{array}{r} 4.8 \\ 15 \end{array} \quad \begin{array}{r} 6.2 \\ 7 \end{array} \quad \begin{array}{r} 6.7 \\ -0.6 \end{array} \quad \begin{array}{r} 7.2 \\ 33 \end{array} \quad \begin{array}{r} 7.2 \\ 40 \end{array}$$

910.97 ✓

10

T.P.

3.28

908.58 ✓

5.67

04.8 ✓

6.2 -

905.30

+50

04.8

3.8

11

+50

04.7

3.9

04.7

3.9

+93

04.6

4.0

12

+07

04.6

4.0

04.6

4.0

+50

T.P.

5.18

908.88 ✓

4.88

04.6 ✓

4.0

903.70

13

+50

04.5

4.4 -

04.5

4.4

14

+50

04.4

4.5

04.4

4.5

(6.7)

$$\frac{11.3}{35} \quad \frac{10.2}{29} \quad \frac{8.0}{25.1} \quad \frac{7.0}{24} \quad \frac{5.5}{14} \quad \frac{5.5}{5} \quad \frac{6.1}{10.1} \quad \frac{7.0}{9} \quad \frac{2.0}{25.8} \quad \frac{7.4}{33} \quad \frac{7.7}{40}$$

(3.8)

$$\frac{8.7}{38} \quad \frac{9.0}{32} \quad \frac{8.7}{28} \quad \frac{5.8}{22.5} \quad \frac{5.2}{22} \quad \frac{3.2}{12} \quad \frac{2.8}{7} \quad \frac{3.5}{10.3} \quad \frac{5.1}{9} \quad \frac{5.4}{33} \quad \frac{5.6}{40}$$

(3.9)

$$\frac{8.6}{36} \quad \frac{9.1}{29} \quad \frac{8.5}{24} \quad \frac{7.6}{22} \quad \frac{5.0}{20} \quad \frac{4.2}{8} \quad \frac{4.0}{-0.1} \quad \frac{5.7}{10} \quad \frac{5.8}{33} \quad \frac{5.8}{40}$$

(3.9)

$$\frac{7.6}{36} \quad \frac{8.9}{31} \quad \frac{10.0}{25.2} \quad \frac{7.9}{19} \quad \frac{5.9}{16} \quad \frac{5.6}{8} \quad \frac{4.6}{4} \quad \frac{4.5}{-0.6} \quad \frac{4.6}{5} \quad \frac{5.7}{10} \quad \frac{5.6}{33} \quad \frac{5.8}{40}$$

(4.0)

$$\frac{8.9}{32} \quad \frac{9.9}{25} \quad \frac{8.5}{18} \quad \frac{6.4}{15} \quad \frac{5.6}{6} \quad \frac{4.2}{7} \quad \frac{4.0}{7} \quad \frac{5.5}{14} \quad \frac{5.9}{40}$$

(4.0)

$$\frac{6.3}{36} \quad \frac{9.1}{31} \quad \frac{10.0}{25} \quad \frac{7.9}{16} \quad \frac{6.0}{14} \quad \frac{5.4}{-1.4} \quad \frac{5.8}{13} \quad \frac{6.0}{19} \quad \frac{6.1}{40}$$

(4.0)

$$\frac{6.4}{36} \quad \frac{9.1}{32} \quad \frac{9.6}{25} \quad \frac{8.2}{16} \quad \frac{5.8}{12} \quad \frac{5.7}{7} \quad \frac{4.5}{3} \quad \frac{4.3}{8} \quad \frac{4.4}{8} \quad \frac{5.6}{14} \quad \frac{6.3}{40}$$

(4.0)

$$\frac{6.0}{36} \quad \frac{9.5}{30} \quad \frac{10.5}{26} \quad \frac{8.2}{18} \quad \frac{6.2}{14} \quad \frac{5.8}{4} \quad \frac{4.7}{-0.7} \quad \frac{4.8}{9} \quad \frac{6.2}{15} \quad \frac{6.5}{18} \quad \frac{6.3}{40}$$

(4.0)

$$\frac{7.0}{33} \quad \frac{9.4}{31} \quad \frac{10.8}{25.8} \quad \frac{9.2}{19} \quad \frac{6.9}{13} \quad \frac{6.0}{6} \quad \frac{5.0}{-0.6} \quad \frac{5.5}{11} \quad \frac{6.3}{16} \quad \frac{6.4}{17} \quad \frac{6.6}{40}$$

(4.0)

$$\frac{6.7}{38} \quad \frac{9.8}{31} \quad \frac{10.8}{25.8} \quad \frac{9.8}{18} \quad \frac{6.7}{14} \quad \frac{6.6}{9} \quad \frac{5.5}{-1.4} \quad \frac{6.4}{11} \quad \frac{6.4}{17} \quad \frac{6.6}{40}$$

(4.5)

$$\frac{6.5}{36} \quad \frac{9.8}{31} \quad \frac{11.0}{26} \quad \frac{11.0}{22} \quad \frac{9.7}{17} \quad \frac{6.5}{13} \quad \frac{6.5}{7} \quad \frac{5.0}{-0.5} \quad \frac{5.0}{9} \quad \frac{6.3}{14} \quad \frac{6.8}{17.6} \quad \frac{6.6}{40}$$

(4.5)

$$\frac{10.4}{30} \quad \frac{10.8}{25.6} \quad \frac{11.5}{22} \quad \frac{9.2}{16} \quad \frac{6.5}{13} \quad \frac{6.6}{7} \quad \frac{5.0}{2} \quad \frac{5.0}{-0.5} \quad \frac{5.2}{6} \quad \frac{6.3}{13} \quad \frac{6.3}{33} \quad \frac{6.3}{40}$$

908.88 ✓

15

04.4

4.5

+50

04.4

4.5

16

04.5

4.4

+50

04.6

4.3

17

04.7 ✓

4.2

T.P.

3.84

910.07 ✓

2.65

906.23 ✓

+50

04.8

5.3

18

04.9

5.2

+50

05.0

5.1

19

05.1

5.0

+50

05.2

4.9

20

05.3

4.8

+50

05.4 ✓

4.7

T.P.

2.92

909.24 ✓

3.75

906.32 ✓

4.7
 $\frac{9.7}{33} \div \frac{2.8}{25.6} = \frac{10.8}{24} \div \frac{9.6}{18} = \frac{8.6}{15} \div \frac{6.8}{14} = \frac{6.4}{9} \div \frac{5.0}{3} = \frac{4.7}{-0.1} \div \frac{4.7}{7} = \frac{6.1}{15} \div \frac{6.4}{33} = \frac{6.4}{40}$

4.5
 $\frac{9.7}{30} \div \frac{11.3}{26.6} = \frac{11.3}{24} \div \frac{9.6}{19} = \frac{8.6}{15} \div \frac{6.6}{13} = \frac{5.8}{9} \div \frac{5.0}{7} = \frac{4.6}{-0.1} \div \frac{4.6}{8} = \frac{6.0}{14} \div \frac{6.3}{33} = \frac{6.3}{40}$

4.4
 $\frac{6.8}{37} \div \frac{9.5}{33} = \frac{11.4}{27} \div \frac{11.4}{24} = \frac{9.6}{20} \div \frac{8.4}{15} = \frac{6.4}{13} \div \frac{5.8}{9} = \frac{3.4}{+0.5} \div \frac{4.3}{6} = \frac{5.8}{16} \div \frac{6.1}{33} = \frac{6.2}{40}$

4.3
 $\frac{6.8}{38} \div \frac{8.7}{35} = \frac{11.3}{27} \div \frac{11.3}{25} = \frac{9.7}{20} \div \frac{8.3}{15} = \frac{6.5}{13} \div \frac{5.5}{6} = \frac{4.5}{-0.2} \div \frac{3.8}{6} = \frac{4.2}{12} \div \frac{5.9}{22} = \frac{6.1}{33} = \frac{6.1}{40}$

4.2
 $\frac{6.9}{37} \div \frac{10.0}{31} = \frac{11.7}{28} \div \frac{11.7}{24} = \frac{9.7}{17} \div \frac{8.4}{13} = \frac{6.5}{12} \div \frac{3.9}{+0.3} = \frac{3.4}{10} \div \frac{4.4}{17} = \frac{5.7}{23} \div \frac{5.8}{33} = \frac{5.7}{40}$

5.3
 $\frac{7.8}{38} \div \frac{10.3}{33} = \frac{12.0}{26.4} \div \frac{12.5}{24} = \frac{10.4}{18} \div \frac{8.5}{13} = \frac{7.1}{12} \div \frac{6.5}{8} = \frac{4.8}{+0.5} \div \frac{4.4}{9} = \frac{6.8}{21} \div \frac{6.7}{33} = \frac{6.8}{40}$

5.2
 $\frac{6.9}{39} \div \frac{10.0}{31} = \frac{11.7}{26} \div \frac{12.1}{24} = \frac{10.4}{19} \div \frac{9.3}{14} = \frac{6.4}{11} \div \frac{6.2}{4} = \frac{4.9}{+0.3} \div \frac{4.9}{7} = \frac{6.5}{16} \div \frac{6.8}{33} = \frac{6.7}{40}$

5.1
 $\frac{6.5}{40} \div \frac{9.1}{34} = \frac{12.0}{29} \div \frac{11.6}{26} = \frac{10.2}{18} \div \frac{8.8}{14} = \frac{6.4}{11} \div \frac{4.8}{4} = \frac{4.4}{+0.7} \div \frac{4.5}{6} = \frac{5.8}{15} \div \frac{6.3}{23} = \frac{6.3}{33} = \frac{6.3}{40}$

5.0
 $\frac{9.0}{34} \div \frac{9.9}{30} = \frac{11.3}{29.6} \div \frac{11.5}{25} = \frac{10.8}{21} \div \frac{9.0}{15} = \frac{6.1}{11} \div \frac{4.4}{4} = \frac{4.1}{+0.9} \div \frac{4.4}{8} = \frac{5.4}{16} \div \frac{5.6}{33} = \frac{5.6}{40}$

4.9
 $\frac{9.0}{33} \div \frac{10.1}{28} = \frac{10.4}{24} \div \frac{10.3}{23} = \frac{8.0}{17} \div \frac{7.4}{14} = \frac{5.1}{11} \div \frac{3.6}{+1.3} = \frac{4.1}{8} \div \frac{5.1}{21} = \frac{5.3}{33} = \frac{5.4}{40}$

4.8
 $\frac{4.7}{42} \div \frac{9.8}{30} = \frac{10.3}{24} \div \frac{9.5}{19} = \frac{7.4}{13} \div \frac{5.2}{11} = \frac{4.6}{7} \div \frac{4.0}{+0.8} = \frac{4.4}{11} \div \frac{5.9}{21} = \frac{6.2}{33} = \frac{6.3}{40}$

4.7
 $\frac{8.3}{40} \div \frac{10.0}{32} = \frac{10.4}{24.4} \div \frac{9.2}{15} = \frac{7.6}{12} \div \frac{5.7}{10} = \frac{3.9}{+0.8} \div \frac{4.2}{11} = \frac{5.6}{21} \div \frac{6.7}{33} = \frac{7.0}{40}$

909.24

21

05.6

3.6

+35

05.7

3.5

+58

Sp. Ditch wt.

99.5

05.8

9.7

3.4

+65

05.8

3.4

+71

99.5

05.9

9.7

3.3

+83

99.5

06.0

9.7

3.2

+92

06.0

3.2

22

Sp. Di. R #L

03.0

06.1

6.2

3.1

+07

03.0

06.1

6.2

3.1

+18

06.1

6.2

3.1

+30

06.2

3.0

+45

03.1

06.3

6.1

2.9

B.M.

909.25

3.90

905.34

6.1

905.35

T.P.

8.67

912.66

5.26

903.99

3.6

$$\frac{8.3}{40} \quad \frac{9.7}{35} \quad \frac{10.2}{26.2} \quad \frac{9.6}{21} \quad \frac{8.3}{15} \quad \frac{5.7}{11} \quad \frac{3.7}{-0.1} \quad \frac{3.8}{12} \quad \frac{5.4}{25} \quad \frac{5.6}{27} \quad \frac{6.0}{33} \quad \frac{6.0}{40}$$

3.5

$$\frac{6.3}{40} \quad \frac{8.6}{36} \quad \frac{9.7}{33} \quad \frac{10.3}{26.6} \quad \frac{10.4}{24} \quad \frac{9.9}{16} \quad \frac{2.9}{11} \quad \frac{6.4}{10} \quad \frac{4.6}{-1.1} \quad \frac{3.6}{9} \quad \frac{4.6}{16} \quad \frac{4.7}{27} \quad \frac{3.4}{33} \quad \frac{2.1}{37} \quad \frac{2.1}{40}$$

3.4

$$\frac{5.5}{40} \quad \frac{6.0}{34.2} \quad \frac{6.3}{32} \quad \frac{9.7}{25.6} \quad \frac{10.2}{16} \quad \frac{10.1}{7} \quad \frac{9.0}{3} \quad \frac{6.6}{-3.2} \quad \frac{4.4}{10} \quad \frac{5.1}{15} \quad \frac{5.4}{19} \quad \frac{6.2}{40}$$

3.4

$$\frac{5.4}{40} \quad \frac{6.1}{29} \quad \frac{10.0}{20} \quad \frac{10.4}{10} \quad \frac{9.8}{-} \quad \frac{8.2}{6} \quad \frac{6.1}{9} \quad \frac{4.6}{15} \quad \frac{6.4}{20} \quad \frac{6.6}{33} \quad \frac{8.2}{40}$$

3.3

$$\frac{5.5}{40} \quad \frac{5.5}{38.1} \quad \frac{5.4}{31} \quad \frac{6.0}{23} \quad \frac{7.4}{21.2} \quad \frac{9.6}{16} \quad \frac{10.2}{8} \quad \frac{9.9}{-6.6} \quad \frac{9.8}{5} \quad \frac{6.8}{15} \quad \frac{9.1}{23.1} \quad \frac{9.1}{24.6} \quad \frac{10.0}{31} \quad \frac{9.1}{40}$$

3.2

$$\frac{2.7}{40} \quad \frac{8.9}{33.2} \quad \frac{9.5}{25.6} \quad \frac{9.8}{13} \quad \frac{9.8}{-6.6} \quad \frac{10.0}{11} \quad \frac{11.4}{29.4} \quad \frac{10.6}{40}$$

3.2

$$\frac{10.1}{40} \quad \frac{9.8}{14} \quad \frac{8.9}{-3.7} \quad \frac{2.1}{16} \quad \frac{9.4}{24} \quad \frac{9.2}{34} \quad \frac{6.3}{40}$$

3.1

$$\frac{9.5}{40} \quad \frac{8.1}{23} \quad \frac{6.5}{18} \quad \frac{5.6}{-2.5} \quad \frac{5.0}{12} \quad \frac{5.5}{17.8} \quad \frac{6.2}{23} \quad \frac{6.9}{24} \quad \frac{5.8}{30} \quad \frac{5.5}{40}$$

3.1

$$\frac{6.3}{35} \quad \frac{5.3}{26.6} \quad \frac{5.8}{18.4} \quad \frac{5.7}{17} \quad \frac{4.7}{7} \quad \frac{3.7}{-0.6} \quad \frac{4.6}{10} \quad \frac{5.5}{17.8} \quad \frac{5.3}{26.6} \quad \frac{5.5}{40}$$

(25.2)

3.1

$$\frac{4.0}{40} \quad \frac{3.7}{29} \quad \frac{2.8}{7} \quad \frac{3.6}{-0.5} \quad \frac{5.4}{10} \quad \frac{6.0}{18.8} \quad \frac{5.8}{25.8} \quad \frac{5.9}{40}$$

3.0

$$\frac{3.2}{40} \quad \frac{3.4}{29} \quad \frac{4.3}{22} \quad \frac{3.4}{9} \quad \frac{4.6}{9} \quad \frac{5.6}{9} \quad \frac{6.5}{40}$$

2.9

$$\frac{5.8}{40} \quad \frac{6.0}{25.6} \quad \frac{6.0}{19.2} \quad \frac{6.2}{-3.3} \quad \frac{6.4}{20} \quad \frac{6.5}{40}$$

SPK in 12" Poplar 70' Lt. 22+15

912.66 ✓

23

06.6

6.1

+50

06.9

5.8

24

07.2

5.5

+30

07.4

5.3

+50

07.5

5.2

+60

07.5

5.2

+65

07.6

6.1

25

07.8 ✓

4.9

T.P.

4.84

913.27 ✓

4.23

908.43

+50

08.1

5.2

26

08.4

4.9

+50

08.7

4.6

27

08.9 ✓

4.4

T.P.

3.02

913.23 ✓

3.06

910.21

$$\begin{array}{r} 9.2 \\ 40 \end{array} \quad \begin{array}{r} 9.2 \\ 192 \end{array} \quad \begin{array}{r} 9.2 \\ -31 \end{array} \quad \begin{array}{r} 9.2 \\ 19.4 \end{array} \quad \begin{array}{r} 9.4 \\ 40 \end{array}$$

$$\begin{array}{r} 8.9 \\ 40 \end{array} \quad \begin{array}{r} 8.8 \\ 19 \end{array} \quad \begin{array}{r} 8.6 \\ -2.8 \end{array} \quad \begin{array}{r} 8.5 \\ 18.4 \end{array} \quad \begin{array}{r} 8.7 \\ 40 \end{array}$$

$$\begin{array}{r} 8.3 \\ 40 \end{array} \quad \begin{array}{r} 8.0 \\ 18 \end{array} \quad \begin{array}{r} 7.8 \\ -2.3 \end{array} \quad \begin{array}{r} 7.6 \\ 17.4 \end{array} \quad \begin{array}{r} 7.3 \\ 40 \end{array}$$

$$\begin{array}{r} 7.8 \\ 40 \end{array} \quad \begin{array}{r} 7.3 \\ 17 \end{array} \quad \begin{array}{r} 6.8 \\ -1.5 \end{array} \quad \begin{array}{r} 5.9 \\ 18 \end{array} \quad \begin{array}{r} 5.4 \\ 29 \end{array} \quad \begin{array}{r} 4.7 \\ 33 \end{array} \quad \begin{array}{r} 4.1 \\ 40 \end{array}$$

$$\begin{array}{r} 7.0 \\ 40 \end{array} \quad \begin{array}{r} 6.3 \\ 23 \end{array} \quad \begin{array}{r} 5.5 \\ 5 \end{array} \quad \begin{array}{r} 4.5 \\ 10.7 \end{array} \quad \begin{array}{r} 4.4 \\ 17 \end{array} \quad \begin{array}{r} 4.6 \\ 27 \end{array} \quad \begin{array}{r} 4.8 \\ 40 \end{array}$$

$$\begin{array}{r} 6.6 \\ 40 \end{array} \quad \begin{array}{r} 6.2 \\ 33 \end{array} \quad \begin{array}{r} 6.0 \\ 28 \end{array} \quad \begin{array}{r} 5.0 \\ 21 \end{array} \quad \begin{array}{r} 5.2 \\ 9 \end{array} \quad \begin{array}{r} 4.6 \\ 10.6 \end{array} \quad \begin{array}{r} 5.5 \\ 5 \end{array} \quad \begin{array}{r} 5.3 \\ 16 \end{array} \quad \begin{array}{r} 4.8 \\ 33 \end{array} \quad \begin{array}{r} 4.9 \\ 40 \end{array}$$

$$\begin{array}{r} 6.3 \\ 40 \end{array} \quad \begin{array}{r} 6.1 \\ 34 \end{array} \quad \begin{array}{r} 4.8 \\ 25 \end{array} \quad \begin{array}{r} 4.7 \\ 9 \end{array} \quad \begin{array}{r} 5.7 \\ 3 \end{array} \quad \begin{array}{r} 5.9 \\ 20 \end{array} \quad \begin{array}{r} 5.1 \\ 20 \end{array} \quad \begin{array}{r} 4.7 \\ 40 \end{array}$$

$$\begin{array}{r} 5.4 \\ 40 \end{array} \quad \begin{array}{r} 5.4 \\ 33 \end{array} \quad \begin{array}{r} 6.2 \\ 31 \end{array} \quad \begin{array}{r} 6.2 \\ 18 \end{array} \quad \begin{array}{r} 6.0 \\ -1.1 \end{array} \quad \begin{array}{r} 5.4 \\ 19 \end{array} \quad \begin{array}{r} 5.4 \\ 33 \end{array} \quad \begin{array}{r} 4.6 \\ 40 \end{array}$$

$$\begin{array}{r} 5.0 \\ 40 \end{array} \quad \begin{array}{r} 5.0 \\ 37 \end{array} \quad \begin{array}{r} 6.4 \\ 33 \end{array} \quad \begin{array}{r} 6.0 \\ 15 \end{array} \quad \begin{array}{r} 5.5 \\ -0.3 \end{array} \quad \begin{array}{r} 5.0 \\ 15 \end{array} \quad \begin{array}{r} 4.8 \\ 33 \end{array} \quad \begin{array}{r} 4.7 \\ 40 \end{array}$$

$$\begin{array}{r} 6.0 \\ 40 \end{array} \quad \begin{array}{r} 5.8 \\ 33 \end{array} \quad \begin{array}{r} 5.3 \\ 17 \end{array} \quad \begin{array}{r} 4.9 \\ 00 \end{array} \quad \begin{array}{r} 4.9 \\ 19 \end{array} \quad \begin{array}{r} 4.3 \\ 33 \end{array} \quad \begin{array}{r} 4.4 \\ 40 \end{array}$$

$$\begin{array}{r} 5.2 \\ 40 \end{array} \quad \begin{array}{r} 5.0 \\ 33 \end{array} \quad \begin{array}{r} 5.0 \\ 21 \end{array} \quad \begin{array}{r} 4.8 \\ -0.2 \end{array} \quad \begin{array}{r} 4.6 \\ 20 \end{array} \quad \begin{array}{r} 4.6 \\ 33 \end{array} \quad \begin{array}{r} 4.6 \\ 40 \end{array}$$

$$\begin{array}{r} 5.2 \\ 40 \end{array} \quad \begin{array}{r} 4.8 \\ 33 \end{array} \quad \begin{array}{r} 4.5 \\ 23 \end{array} \quad \begin{array}{r} 3.9 \\ 10.5 \end{array} \quad \begin{array}{r} 4.6 \\ 15 \end{array} \quad \begin{array}{r} 4.7 \\ 33 \end{array} \quad \begin{array}{r} 4.6 \\ 40 \end{array}$$

913.23

27+50

08.8

4.4

28

08.4

4.6

T.P.

3.28

912.06

4.45

908.78

+50

08.1

4.0

29

07.5

4.6

+50

06.9

5.2

30

06.3

5.8

+50

05.7

6.4

31.

05.1

7.0

+50

04.7

7.4

32

04.3

7.7

+50

04.0

8.1

B.M.

3.87

908.72

7.20

904.86

904.85

+66

03.9

4.8

$$\begin{array}{cccccccc} & & & & 4.4 & & & \\ \frac{3.7}{40} & \frac{3.7}{33} & \frac{3.9}{17} & \frac{3.9}{3} & \frac{3.5}{40.9} & \frac{3.9}{3} & \frac{4.2}{16} & \frac{4.6}{33} & \frac{4.5}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 4.6 & & & \\ \frac{4.4}{40} & \frac{4.4}{33} & \frac{4.1}{7} & \frac{4.0}{40.6} & \frac{4.0}{6} & \frac{4.6}{14} & \frac{4.6}{33} & \frac{4.6}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 4.0 & & & \\ \frac{4.6}{40} & \frac{4.6}{33} & \frac{5.2}{12} & \frac{5.1}{5} & \frac{4.9}{-0.9} & \frac{4.7}{4} & \frac{5.4}{14} & \frac{5.0}{22} & \frac{4.7}{33} & \frac{4.6}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 4.0 & & & \\ \frac{5.1}{40} & \frac{5.2}{33} & \frac{5.4}{25} & \frac{5.2}{3} & \frac{5.4}{-0.8} & \frac{5.2}{5} & \frac{5.8}{14} & \frac{5.5}{21} & \frac{5.6}{33} & \frac{5.5}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 5.2 & & & \\ \frac{5.6}{40} & \frac{5.6}{33} & \frac{5.9}{6} & \frac{5.4}{3} & \frac{5.8}{-0.6} & \frac{6.1}{13} & \frac{6.1}{33} & \frac{6.1}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 5.8 & & & \\ \frac{6.0}{40} & \frac{6.0}{33} & \frac{6.0}{6} & \frac{5.6}{3} & \frac{6.0}{-0.2} & \frac{5.8}{4} & \frac{6.3}{13} & \frac{6.1}{33} & \frac{6.1}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 6.4 & & & \\ \frac{6.8}{40} & \frac{6.7}{33} & \frac{6.6}{6} & \frac{6.2}{3} & \frac{6.6}{-0.2} & \frac{6.4}{6} & \frac{6.9}{13} & \frac{6.6}{21} & \frac{6.6}{33} & \frac{6.3}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 7.0 & & & \\ \frac{7.8}{40} & \frac{7.8}{33} & \frac{7.6}{10} & \frac{7.5}{-0.5} & \frac{7.2}{5} & \frac{7.5}{14} & \frac{7.3}{33} & \frac{7.0}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 7.4 & & & \\ \frac{8.8}{40} & \frac{8.6}{33} & \frac{8.3}{9} & \frac{8.1}{-0.7} & \frac{7.9}{5} & \frac{8.2}{14} & \frac{7.8}{19} & \frac{7.8}{33} & \frac{7.5}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 7.7 & & & \\ \frac{8.9}{40} & \frac{9.7}{33} & \frac{9.2}{16} & \frac{9.0}{6} & \frac{8.5}{3} & \frac{9.0}{-1.3} & \frac{8.5}{5} & \frac{8.9}{14} & \frac{8.3}{33} & \frac{8.1}{40} \end{array}$$

$$\begin{array}{cccccccc} & & & & 4.1 & & & \\ \frac{10.4}{40} & \frac{12.2}{29} & \frac{10.1}{17.8} & \frac{9.8}{17} & \frac{9.6}{12} & \frac{8.5}{8} & \frac{8.4}{-0.3} & \frac{7.9}{11} & \frac{8.7}{22} & \frac{8.4}{33} & \frac{8.1}{40} \end{array}$$

Spk. in Triple Poplar 50' Rt. 33+25

$$\begin{array}{cccccccc} & & & & 4.4 & & & \\ \frac{6.8}{40} & \frac{6.8}{28} & \frac{8.7}{18} & \frac{9.2}{14} & \frac{6.2}{3} & \frac{6.0}{13} & \frac{4.7}{22} & \frac{4.8}{40} \end{array}$$

908.72

sp. Ditch

01.2

03.8

2.5 4.9

32+82

33

01.3

03.7

2.4 5.0

+12

03.7

5.0

+40

01.4

03.6

2.3 5.1

34

01.5

03.5

5.2

+50

03.5

5.2

35

03.6

5.1

+50

03.6

5.1

36

03.7

5.0

+50

03.7

5.0

37

03.8

4.9

T.P.

6.38

908.97

6.13

902.59

+50

03.9

5.1

4.9

$$\frac{6.1}{40} \quad \frac{5.6}{28} \quad \frac{5.19}{25.1} \quad \frac{6.3}{13} \quad \frac{7.9}{6} \quad \frac{8.4}{-3.7} \quad \frac{8.0}{7} \quad \frac{6.3}{16} \quad \frac{5.1}{18} \quad \frac{3.9}{33} \quad \frac{3.8}{40}$$

5.0

$$\frac{7.0}{40} \quad \frac{6.9}{31} \quad \frac{6.1}{23.8} \quad \frac{4.6}{12} \quad \frac{4.9}{7} \quad \frac{5.9}{-0.9} \quad \frac{6.1}{5} \quad \frac{8.8}{15} \quad \frac{8.3}{20} \quad \frac{6.2}{27} \quad \frac{5.8}{31} \quad \frac{4.7}{33} \quad \frac{3.8}{40}$$

5.0

$$\frac{7.0}{40} \quad \frac{6.5}{21} \quad \frac{5.7}{17} \quad \frac{5.4}{10} \quad \frac{4.4}{5} \quad \frac{4.2}{14} \quad \frac{5.3}{28} \quad \frac{8.5}{35} \quad \frac{7.0}{40}$$

5.1

$$\frac{6.2}{40} \quad \frac{5.4}{23.5} \quad \frac{5.6}{12} \quad \frac{5.4}{-0.3} \quad \frac{4.2}{13} \quad \frac{3.2}{21} \quad \frac{3.1}{27} \quad \frac{3.6}{38} \quad \frac{4.6}{40} \quad \frac{5.7}{40}$$

5.2

$$\frac{5.1}{40} \quad \frac{4.8}{24.6} \quad \frac{4.8}{13} \quad \frac{4.5}{10.7} \quad \frac{4.4}{5} \quad \frac{4.7}{24.8} \quad \frac{5.0}{40}$$

5.2

$$\frac{4.8}{40} \quad \frac{4.9}{24.5} \quad \frac{5.1}{7} \quad \frac{4.4}{3} \quad \frac{4.7}{10.5} \quad \frac{5.0}{10} \quad \frac{4.8}{24.6} \quad \frac{4.8}{40}$$

5.1

$$\frac{4.8}{40} \quad \frac{5.3}{23.7} \quad \frac{5.7}{8} \quad \frac{5.7}{-0.6} \quad \frac{5.7}{12} \quad \frac{5.3}{23.7} \quad \frac{5.1}{40}$$

5.1

$$\frac{4.8}{40} \quad \frac{5.1}{24} \quad \frac{5.1}{7} \quad \frac{5.0}{10.1} \quad \frac{5.1}{3} \quad \frac{4.7}{6} \quad \frac{5.0}{24.2} \quad \frac{5.1}{40}$$

5.0

$$\frac{5.2}{40} \quad \frac{5.2}{23.7} \quad \frac{5.1}{-0.1} \quad \frac{4.9}{7} \quad \frac{5.1}{23.9} \quad \frac{5.3}{40}$$

5.0

$$\frac{5.9}{40} \quad \frac{5.9}{22.7} \quad \frac{5.9}{-0.9} \quad \frac{6.1}{15} \quad \frac{5.9}{22.7} \quad \frac{5.8}{40}$$

4.9

$$\frac{6.9}{40} \quad \frac{7.1}{18.4} \quad \frac{6.8}{-1.9} \quad \frac{6.3}{8} \quad \frac{6.0}{22.4} \quad \frac{6.0}{40}$$

5.1

$$\frac{6.2}{40} \quad \frac{6.2}{22.4} \quad \frac{6.2}{-0.9} \quad \frac{5.8}{14} \quad \frac{5.7}{23.1} \quad \frac{5.6}{40}$$

908.97 ✓

38

04.1

4.9 -

+50

04.4

4.6 -

39

04.7

4.3 -

+50

05.0

4.0 -

40

05.3

3.7 -

+50

05.6

3.4 -

41

05.9

3.1 -

+50

06.2

2.8 -

42

06.5

2.5 -

+50

06.8

2.2 -

T.R

4.20

912.17 ✓

1.00

907.97 ✓

43

07.1

5.1 -

+50

07.4

4.8 -

19

$$\frac{6.2}{40} \quad \frac{6.0}{22.4} \quad \frac{6.0}{14} \quad \frac{6.0}{-1.1} \quad \frac{5.8}{12} \quad \frac{5.8}{22.7} \quad \frac{5.7}{40}$$

$$\frac{7.0}{40} \quad \frac{6.4}{17.6} \quad \frac{6.7}{-2.1} \quad \frac{6.3}{7} \quad \frac{6.3}{21.5} \quad \frac{6.2}{40}$$

$$\frac{7.6}{40} \quad \frac{7.2}{18.8} \quad \frac{6.7}{-2.4} \quad \frac{6.4}{7} \quad \frac{6.1}{21.3} \quad \frac{5.8}{40}$$

$$\frac{7.1}{40} \quad \frac{6.5}{18} \quad \frac{6.4}{-2.4} \quad \frac{5.8}{2} \quad \frac{5.6}{21.6} \quad \frac{5.2}{40}$$

$$\frac{6.7}{40} \quad \frac{5.9}{17.4} \quad \frac{5.6}{-1.9} \quad \frac{5.1}{8} \quad \frac{4.6}{21.4} \quad \frac{4.6}{40}$$

$$\frac{5.9}{40} \quad \frac{5.6}{17.4} \quad \frac{5.5}{6} \quad \frac{5.9}{2} \quad \frac{5.4}{-2.0} \quad \frac{4.8}{7} \quad \frac{4.6}{22.2} \quad \frac{4.2}{40}$$

$$\frac{5.1}{40} \quad \frac{5.0}{21.2} \quad \frac{4.9}{7} \quad \frac{5.5}{3} \quad \frac{4.7}{2} \quad \frac{4.7}{-1.6} \quad \frac{4.3}{8} \quad \frac{4.3}{22.2} \quad \frac{3.8}{40}$$

$$\frac{4.2}{40} \quad \frac{4.2}{21.9} \quad \frac{4.1}{7} \quad \frac{4.8}{3} \quad \frac{3.9}{2} \quad \frac{3.9}{-1.1} \quad \frac{3.7}{9} \quad \frac{3.4}{23.1} \quad \frac{3.2}{40}$$

$$\frac{2.9}{40} \quad \frac{3.2}{23} \quad \frac{2.8}{7} \quad \frac{3.6}{3} \quad \frac{2.8}{2} \quad \frac{2.8}{-0.3} \quad \frac{2.4}{10} \quad \frac{2.4}{24.2} \quad \frac{2.0}{40}$$

$$\frac{2.4}{40} \quad \frac{2.2}{24} \quad \frac{2.0}{8} \quad \frac{2.5}{3} \quad \frac{1.6}{2} \quad \frac{1.6}{10.6} \quad \frac{1.2}{9} \quad \frac{1.6}{14} \quad \frac{1.3}{25.4} \quad \frac{0.8}{40}$$

$$\frac{5.8}{40} \quad \frac{5.5}{23.4} \quad \frac{5.0}{8} \quad \frac{5.3}{3} \quad \frac{4.8}{2} \quad \frac{4.6}{10.5} \quad \frac{3.5}{10} \quad \frac{3.8}{15.6} \quad \frac{3.5}{26.4} \quad \frac{3.2}{40}$$

$$\frac{6.2}{40} \quad \frac{5.9}{22.4} \quad \frac{5.5}{7} \quad \frac{6.1}{3} \quad \frac{5.4}{2} \quad \frac{5.3}{-0.5} \quad \frac{4.3}{10} \quad \frac{4.9}{16} \quad \frac{4.4}{24.6} \quad \frac{4.2}{40}$$

9/2.17

44

07.7

4.5 -

+50

08.0

4.2 -

45

22.2

Sp. Ditch Lt.

05.7

08.3

6.5

3.9 -

+50

22.6

05.7

08.5

6.5

3.7 -

46

22.6

05.8

08.4

6.4

3.6 -

T.P.

5.44

915.14

2.47

909.70

+50

22.6

05.9

08.7

9.2

6.4

47

22.6

05.9

08.7

9.2

6.4

+50

22.6

06.0

08.8

9.1

6.3

48

22.6

06.0

08.8

9.1

6.3

+50

22.6

06.1

08.9

9.0

6.2

49

22.6

06.1

08.9

9.0

6.2

+50

22.6

06.2

09.0

8.9

6.1

$$\frac{6.4}{40} \quad \frac{5.0}{21.8} \quad \frac{5.8}{4} \quad \frac{6.1}{3} \quad \frac{5.6}{2} \quad \frac{5.5}{-1.0} \quad \frac{4.6}{9} \quad \frac{4.9}{16} \quad \frac{4.0}{24} \quad \frac{4.5}{40}$$

$$\frac{6.2}{40} \quad \frac{5.0}{26.3} \quad \frac{5.5}{-1.3} \quad \frac{4.7}{8} \quad \frac{4.8}{18} \quad \frac{4.1}{5} \quad \frac{4.5}{23.6} \quad \frac{4.3}{40}$$

$$\frac{5.5}{40} \quad \frac{5.0}{23.7} \quad \frac{5.2}{5} \quad \frac{5.2}{-1.3} \quad \frac{5.1}{5} \quad \frac{4.7}{9} \quad \frac{4.1}{5} \quad \frac{4.7}{22.8} \quad \frac{4.4}{40}$$

$$\frac{4.1}{40} \quad \frac{4.3}{25.4} \quad \frac{4.6}{7} \quad \frac{4.4}{-0.7} \quad \frac{4.5}{6} \quad \frac{4.1}{10} \quad \frac{4.6}{15} \quad \frac{4.1}{22.7} \quad \frac{4.6}{40}$$

$$\frac{3.4}{40} \quad \frac{3.3}{27.3} \quad \frac{3.3}{13} \quad \frac{3.8}{9} \quad \frac{3.4}{-0.3} \quad \frac{3.5}{10} \quad \frac{4.1}{23.3} \quad \frac{4.6}{40}$$

$$\frac{6.3}{40} \quad \frac{6.3}{27} \quad \frac{6.3}{9} \quad \frac{6.2}{3} \quad \frac{6.5}{-0.1} \quad \frac{6.6}{8} \quad \frac{7.1}{15} \quad \frac{7.3}{22.7} \quad \frac{8.0}{40}$$

$$\frac{6.8}{40} \quad \frac{6.5}{26.7} \quad \frac{6.6}{15} \quad \frac{6.2}{+0.2} \quad \frac{5.9}{7} \quad \frac{6.5}{14} \quad \frac{6.6}{23.7} \quad \frac{7.4}{40}$$

$$\frac{6.5}{40} \quad \frac{5.9}{27.4} \quad \frac{5.4}{7} \quad \frac{5.4}{+0.9} \quad \frac{4.7}{7} \quad \frac{5.3}{14} \quad \frac{5.5}{25.4} \quad \frac{6.1}{40}$$

$$\frac{5.3}{40} \quad \frac{5.0}{28.8} \quad \frac{4.5}{8} \quad \frac{4.4}{+1.4} \quad \frac{3.8}{6} \quad \frac{4.2}{10} \quad \frac{4.7}{26.4} \quad \frac{5.2}{40}$$

$$\frac{4.9}{40} \quad \frac{4.6}{29.2} \quad \frac{4.7}{17} \quad \frac{4.0}{+2.2} \quad \frac{3.4}{6} \quad \frac{4.2}{27} \quad \frac{4.8}{40}$$

$$\frac{6.3}{40} \quad \frac{6.2}{24.8} \quad \frac{2.0}{12} \quad \frac{4.7}{4} \quad \frac{6.1}{+0.1} \quad \frac{5.4}{2} \quad \frac{5.6}{24.9} \quad \frac{6.0}{40}$$

$$\frac{8.0}{40} \quad \frac{8.3}{29} \quad \frac{8.9}{27} \quad \frac{8.8}{22.8} \quad \frac{9.0}{8} \quad \frac{9.5}{3} \quad \frac{9.1}{-3.0} \quad \frac{9.1}{19} \quad \frac{8.9}{40}$$

✓
915.14

50

22.6

06.2

09.0

8.9

6.1

+50

09.1

6.0

51

T.P.

4.10

✓
914.34

4.90

09.1

✓
6.0

910.24

+50

09.2

5.1

52

09.2

5.1

+56

09.3

5.0

+60

08.3

6.0

+69

08.9

5.4

+77

09.1

5.2

+97

€ Pavement.

09.0

5.3

B.M.

5.32

908.92

908.96

909.02

6.1

$$\frac{7.6}{40} \quad \frac{8.2}{28} \quad \frac{9.0}{26} \quad \frac{3.1}{19.2} \quad \frac{10.3}{7} \quad \frac{10.7}{3} \quad \frac{10.6}{-4.5} \quad \frac{11.0}{4} \quad \frac{10.5}{6} \quad \frac{10.4}{21.6} \quad \frac{9.4}{40}$$

$$\frac{6.6}{40} \quad \frac{8.4}{17.8} \quad \frac{8.9}{10} \quad \frac{9.3}{-3.8} \quad \frac{9.3}{6} \quad \frac{9.6}{14} \quad \frac{9.2}{19.4} \quad \frac{8.4}{40}$$

$$\frac{6.8}{40} \quad \frac{8.4}{21.9} \quad \frac{8.1}{10} \quad \frac{8.2}{-2.2} \quad \frac{8.1}{3} \quad \frac{7.5}{6} \quad \frac{7.0}{22.5} \quad \frac{6.3}{40}$$

$$\frac{4.7}{40} \quad \frac{5.0}{37} \quad \frac{4.8}{24.5} \quad \frac{5.4}{15} \quad \frac{5.5}{4} \quad \frac{4.8}{+0.3} \quad \frac{4.3}{4} \quad \frac{4.3}{25.2} \quad \frac{4.4}{40}$$

$$\frac{4.1}{40} \quad \frac{4.0}{29} \quad \frac{4.3}{25.2} \quad \frac{4.3}{19} \quad \frac{4.7}{11} \quad \frac{4.1}{+1.0} \quad \frac{4.3}{25.2} \quad \frac{4.5}{40}$$

$$\frac{5.5}{40} \quad \frac{5.5}{23.3} \quad \frac{5.3}{18} \quad \frac{5.2}{7} \quad \frac{5.7}{2} \quad \frac{5.4}{-0.4} \quad \frac{5.8}{11} \quad \frac{6.2}{22.2} \quad \frac{5.9}{40}$$

$$\frac{7.9}{40} \quad \frac{7.6}{30} \quad \frac{6.8}{23} \quad \frac{5.3}{18} \quad \frac{5.2}{5} \quad \frac{5.7}{3} \quad \frac{7.2}{9} \quad \frac{7.7}{40}$$

$$\frac{8.2}{40} \quad \frac{7.4}{27} \quad \frac{5.3}{20} \quad \frac{5.0}{10} \quad \frac{5.4}{2} \quad \frac{6.2}{10} \quad \frac{7.0}{40}$$

$$\frac{4.9}{40} \quad \frac{4.8}{28} \quad \frac{5.1}{22} \quad \frac{4.8}{10} \quad \frac{5.2}{9} \quad \frac{4.8}{9} \quad \frac{4.7}{40}$$

$$\frac{5.4}{40} \quad \frac{5.3}{40} \quad \frac{5.2}{40}$$

BRASS Plug in Pavement E S.T.H. #63

B.M.	5.15	910.00		904.85	
26+50				908.7	1.3 ✓
27				08.9	1.1 ✓
+50				08.8	1.2 ✓
28				08.6	1.4 ✓
+50				08.1	1.9 ✓
29				07.5	2.5 ✓
+50				06.9	3.1 ✓
30				06.3	3.7 ✓
+50				05.7	4.3 ✓
31				05.1	4.9 ✓
+50				04.7	5.3 ✓
32				04.3	5.7 ✓
+50				04.0	6.0 ✓
33				03.7	6.3 ✓
+50				03.6	6.4 ✓
34				03.5	6.5 ✓
+50				03.5	6.5 ✓
35				03.4	6.4 ✓
+50				03.6	6.4 ✓
36				03.7	6.3 ✓
+50	3.75	908.60	5.15	904.85	4.9 ✓
37				03.7	4.9 ✓
+50				03.8	4.8 ✓
38				03.9	4.7 ✓
				04.1	4.5 ✓

$$\begin{array}{r} 904.85 \\ 5.15 \\ \hline 910.00 \end{array}$$

$$\begin{array}{r} 904.85 \\ 3.75 \\ \hline 908.60 \end{array}$$

908.60

38+50		04.4	4.2 ✓
39		04.7	3.9 ✓
+50		05.0	3.6 ✓
40		05.3	3.3 ✓
+50		05.4	3.0 ✓
41		05.9	2.7 ✓
+50		06.2	2.4 ✓
42		06.5	2.1 ✓
+50		06.8	1.8 ✓
43		07.1	1.5 ✓
+50	911.31	07.4	3.91 ✓
44		07.7	3.41 ✓
+50		08.0	3.31 ✓
45		08.3	3.01 ✓
+50		08.5	2.81 ✓
46		08.6	2.71 ✓
+50		08.7	2.61 ✓
47		08.7	2.61 ✓
+50		08.8	2.51 ✓
48		08.8	2.51 ✓
+50		08.9	2.41 ✓
49		08.9	2.41 ✓
+50		09.0	2.31 ✓
50		09.0	2.31 ✓

$$\begin{array}{r} 908.60 \\ 1.50 \\ \hline 907.10 \\ 4.21 \\ \hline 911.31 \end{array}$$

911.31

2.28

909.03

50 + 50

09.1

2.21 ✓

51

09.1

2.21

+ 50

09.2

2.11 ✓

52

09.2

2.11 ✓

+ 50

09.3

2.01 ✓

B.M.

3.13

911.10

907.97

0-176

06.0

5.1 ✓

-150

06.0

5.1 ✓

-100

05.9

5.2 ✓

-50

05.9

5.2 ✓

0 + 0

05.8

5.3 ✓

+ 50

05.8

5.3 ✓

1

05.7

5.4 ✓

+ 50

05.7

5.4 ✓

2

05.6

5.5 ✓

+ 50

05.6

5.5 ✓

3

05.5

5.6 ✓

+ 50

05.5

5.6 ✓

4

05.4

5.7 ✓

+ 50

05.4

5.7 ✓

5

05.3

5.8 ✓

+ 50

05.3

5.8

911.82

6.12 ✓

6.12 ✓

6.22 ✓

6.22 ✓

6.32 ✓

6.32 ✓

6.42 ✓

6.42 ✓

6.52 ✓

9.10 C/D 6.52 ✓

9/11.10

6			05.2	5.9
+50			05.2	5.9
7	905.92		05.1	3.82 ✓
+50			05.1	3.82 ✓
8			05.0	3.92 ✓
+50			05.0	3.92 ✓
9			04.9	4.02 ✓
+50		04.8	04.9	4.02 ✓
10		04.7	04.8	4.12 ✓
+50		04.6	04.8	4.12 ✓
11		04.5	04.7	4.22 ✓
+50		04.4	04.7	4.22 ✓
12		04.3	04.6	4.32 ✓
+50			04.6	4.32 ✓
13			04.5	4.42 ✓
+50			04.5	4.42 ✓
14			04.4	4.52 ✓
+50			04.4	4.52 ✓
15		-0.3	04.4	4.52 ✓
+50			04.4	4.52 ✓
16	910.24		04.5	5.74 ✓
+50			04.6	5.64 ✓
17			04.7	5.54 ✓
+50			04.8	5.44 ✓
18			04.9	5.34 ✓

911.82

C1.0 C1.0 6.62 ✓

911.10

C1.0 C1.0 6.62 ✓

3.13

6.72 ✓

907.97

6.72 ✓

.95

6.82 ✓

908.92

6.82 ✓

4.51

6.92 ✓

904.41

7.02 ✓

5.83

7.12 ✓

910.24

910.24

18+50

19

+50

20

+50

21

+50

22

+50

23

+50

24

+50

25

+50

26

+50

-0.3

~~05.0~~
~~07.1~~
~~05.2~~

05.0

05.2

05.4

05.7

06.0

~~05.3~~

05.4

~~05.6~~

05.8

~~06.1~~

06.3

06.6

06.9

07.2

07.5

07.8

08.1

08.4

08.7

5.24

5.14

5.04

4.94

4.84

4.64

4.44

4.14

3.94

3.64

3.34

3.04

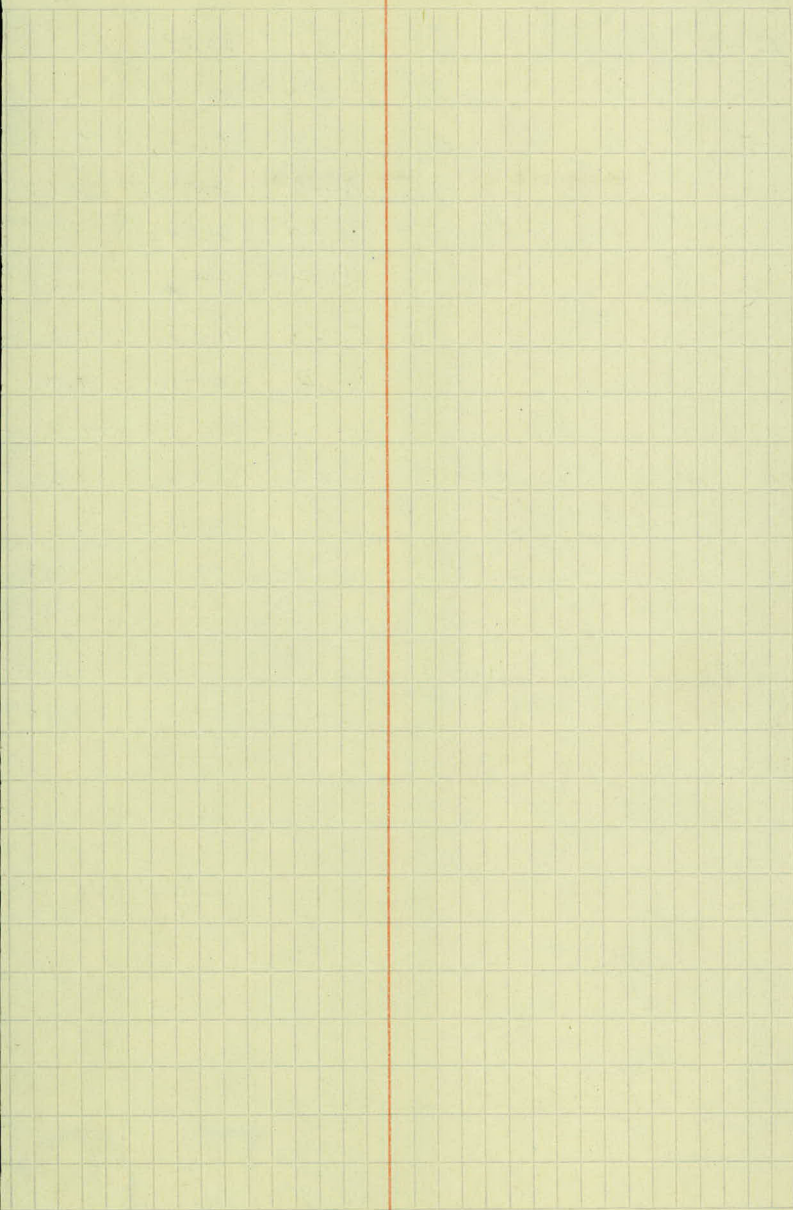
2.74

2.44

2.14

1.84

1.54



B.M.	3.85	911.82	907.97	
0-135			00.8	11.02
0-100			00.8	11.02
0-50			00.7	11.12
0+00			00.6	11.22
+50			00.5	11.32
1+00			00.4	11.42
+50			00.3	11.52
2			00.2	11.62

C.2.0

C2.0

C.2.0

C2.0

C2.0

C2.0

C2.0

C2.0

B.M. 2.63 910.60 907.97

0-175	04.0	4.6 ✓
-150	04.0	4.65 ✓
-100	05.9	4.7 ✓
-50	05.9	4.75 ✓
0+00	05.8	4.8 ✓
+50	05.8	4.85 ✓
1	05.7	4.9 ✓
+50	05.7	4.95 ✓
2	05.6	5.0 ✓
+50	05.6	5.05 ✓
3	05.5	5.1 ✓

B.M. 1.53 909.50 907.97

9	04.9	
+50	04.8	
10	04.7	4.8 ✓
+50	04.6	4.9 ✓
11	04.5	5.0 ✓
+50	04.4	5.1 ✓
12	04.3	5.2 ✓
+50	04.3	5.25 ✓
13	04.2	5.3 ✓
+50	04.2	4.72 ✓
14	04.1	4.77 ✓

908.87

0-176 Lt. Beg

907.97

2.63

910.60

175

275

12/450 37

24

12

90

74

84

27

6

444

175

269

907.97

1.53

909.50

5.30

904.20

4.67

908.87

2+67 Lt. End

76
43.5

444

250

176

420

354

14/420

34

66

60

50

10+04 Lt. Beg.

22+25

10+04

12 21

908.87

14+50	04.1	4.77✓
15	04.1	4.77✓
+50	04.1	4.77✓
16	04.2	4.67✓
+50	04.3	4.57✓
17	04.4	4.47✓
+50	04.5	4.37✓
18	04.6	4.27✓
+50	04.7	4.17✓
19	04.8	4.07✓
+50	04.9	3.97✓
20	05.0	3.87✓
+50	05.2	4.67✓
21	05.4	4.47✓
+50	05.7	4.17✓
22	06.0	3.87✓
+50	06.3	3.57✓
23	06.6	3.27

909.87

0-176 to 2+67.5 Lt = 443.5' 2 Anchors

10+04 to 22+25 Lt = 1221.0' 4 "

20+81 to 22+25 Rt = 144.0' 2 "

1808.5' - 8 Anchors

$$\begin{array}{r}
 908.87 \\
 3.87 \\
 \hline
 905.00 \\
 4.87 \\
 \hline
 909.87
 \end{array}$$

$$\begin{array}{r}
 1224 \\
 120 \\
 444 \\
 \hline
 1788
 \end{array}$$

$$\begin{array}{r}
 22+25 \\
 102 \\
 12 \overline{) 1224} \\
 \underline{12} \\
 024
 \end{array}$$

$$\begin{array}{r}
 22+25 \\
 1224 \\
 \hline
 10+01
 \end{array}$$

~~21105~~ Rt. Beg. 20+81 ✓
~~120' R~~ 144' R ✓ 2A.

22+25 Lt. & Rt. End ✓

$$\begin{array}{r}
 22+25 \\
 20+82 \\
 \hline
 143
 \end{array}$$

1221' Lt.
4 Anc.

B.M.	3.66	911.63 ✓	907.97 ✓
T.P.	4.76	910.42	5.97 905.66 ✓
0-186			905.9
-176			905.9
-170			905.9
-164			906.0
-159			906.1
-150			906.1
-135			905.9
-100			905.7
-50			905.5
-20			905.3
0+00			905.5

6-14-33

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{2.0}{21} & \frac{4.2}{13} & 4.5 & \frac{4.6}{13} & \frac{6.7}{21} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{6.5}{21} & \frac{6.5}{18} & \frac{4.5}{13} & 4.5 & \frac{4.5}{13} \frac{6.2}{17} \frac{6.5}{22} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{6.8}{21} & \frac{6.7}{19} & \frac{4.3}{13} & 4.5 & \frac{4.5}{13} \frac{6.1}{17} \frac{6.2}{22} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{9.2}{24} & \frac{4.4}{13} & 4.4 & \frac{4.4}{13} & \frac{6.2}{17} \frac{6.2}{23} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{9.2}{24} & \frac{4.5}{13} & 4.3 & \frac{4.3}{13} & \frac{6.2}{17} \frac{6.2}{23} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{9.8}{24} & \frac{4.4}{13} & 4.3 & \frac{4.3}{13} & \frac{6.2}{18} \frac{6.2}{22} \frac{5.8}{23} \end{array}$$

$$\begin{array}{ccccc} & & 4.4 & & \\ \frac{6.0}{35} & \frac{9.8}{30} & \frac{9.8}{24} & \frac{4.6}{13} & 4.5 \frac{6.2}{15} \frac{6.2}{18} \frac{5.1}{23} \end{array}$$

$$\begin{array}{ccccc} & & 4.5 & & \\ \frac{6.2}{34} & \frac{9.6}{30} & \frac{9.6}{24} & \frac{5.0}{13} & 4.7 \frac{4.5}{13} \frac{6.6}{18} \frac{6.6}{21} \frac{4.6}{24} \end{array}$$

$$\begin{array}{ccccc} & & 4.5 & & \\ \frac{6.6}{34} & \frac{9.9}{30} & \frac{9.9}{24} & \frac{5.2}{13} & 4.9 \frac{4.8}{13} \frac{7.5}{19} \frac{7.5}{23} \frac{5.8}{26} \end{array}$$

$$\begin{array}{ccccc} & & 4.5 & & \\ \frac{6.1}{35} & \frac{9.7}{29} & \frac{9.7}{24} & \frac{5.2}{13} & 5.1 \frac{5.0}{13} \frac{6.8}{18} \frac{6.8}{24} \frac{6.2}{26} \end{array}$$

$$\begin{array}{ccccc} & & 4.6 & & \\ \frac{6.0}{35} & \frac{9.7}{30} & \frac{9.7}{24} & \frac{5.0}{13} & 4.9 \frac{4.9}{13} \frac{6.9}{17} \frac{6.9}{21} \frac{6.1}{24} \end{array}$$

910.42 ✓

0+50

905.6

+75

905.5

+90

905.4

1

905.5

+07

905.5

+17

905.5

+60

905.6

2

905.6

+25

905.6

+65

905.6

3

905.4

+50

905.5 ✓

T.P.

2.51

909.93 ✓

3.00

907.42

$$\frac{6.4}{35} \quad \frac{9.7}{30} \quad \frac{9.7}{24} \quad \frac{5.0}{13} \quad \begin{matrix} 4.6 \\ 4.8 \end{matrix} \quad \frac{4.8}{13} \quad \frac{6.8}{17} \quad \frac{6.8}{21} \quad \frac{5.7}{23}$$

$$\frac{5.3}{37} \quad \frac{9.8}{30} \quad \frac{9.8}{24} \quad \frac{5.1}{13} \quad \begin{matrix} 4.1 \\ 4.9 \end{matrix} \quad \frac{4.9}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{4.4}{24}$$

$$\frac{4.4}{38} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.1}{13} \quad \begin{matrix} 4.1 \\ 5.0 \end{matrix} \quad \frac{4.8}{13} \quad \frac{6.6}{17} \quad \frac{6.6}{21} \quad \frac{2.2}{26}$$

$$\frac{7.7}{39} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.2}{13} \quad \begin{matrix} 4.1 \\ 4.9 \end{matrix} \quad \frac{4.7}{13} \quad \frac{6.8}{17} \quad \frac{6.8}{21} \quad \frac{2.0}{27}$$

$$\frac{3.5}{39} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.2}{13} \quad \begin{matrix} 4.1 \\ 4.9 \end{matrix} \quad \frac{4.7}{13} \quad \frac{6.8}{17} \quad \frac{6.8}{21} \quad \frac{2.6}{27}$$

$$\frac{3.3}{39} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.1}{13} \quad \begin{matrix} 4.7 \\ 4.9 \end{matrix} \quad \frac{4.7}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{2.6}{26}$$

$$\frac{3.7}{39} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.0}{13} \quad \begin{matrix} 4.8 \\ 4.8 \end{matrix} \quad \frac{4.7}{13} \quad \frac{6.5}{17} \quad \frac{6.5}{21} \quad \frac{4.8}{24}$$

$$\frac{6.7}{35} \quad \frac{10.0}{30} \quad \frac{10.0}{24} \quad \frac{5.0}{13} \quad \begin{matrix} 4.4 \\ 4.8 \end{matrix} \quad \frac{4.8}{13} \quad \frac{6.9}{17} \quad \frac{6.9}{21} \quad \frac{5.4}{24}$$

$$\frac{10.7}{25} \quad \frac{5.0}{13} \quad \begin{matrix} 4.8 \\ 4.8 \end{matrix} \quad \frac{5.0}{13} \quad \frac{7.0}{17} \quad \frac{7.0}{21} \quad \frac{5.0}{24}$$

$$\frac{7.5}{31} \quad \frac{8.1}{29} \quad \frac{8.1}{25} \quad \frac{7.3}{20} \quad \frac{5.0}{13} \quad \begin{matrix} 4.9 \\ 4.8 \end{matrix} \quad \frac{5.0}{13} \quad \frac{7.3}{17} \quad \frac{7.3}{21} \quad \frac{5.2}{24}$$

$$\frac{4.4}{32} \quad \frac{7.4}{29} \quad \frac{7.4}{19} \quad \frac{5.0}{13} \quad \begin{matrix} 4.9 \\ 5.0 \end{matrix} \quad \frac{5.0}{13} \quad \frac{7.1}{17} \quad \frac{7.1}{21} \quad \frac{5.5}{23}$$

$$\frac{4.0}{33} \quad \frac{7.3}{29} \quad \frac{7.3}{19} \quad \frac{5.1}{13} \quad \begin{matrix} 4.9 \\ 4.9 \end{matrix} \quad \frac{5.0}{13} \quad \frac{7.2}{17} \quad \frac{7.2}{21} \quad \frac{5.2}{23}$$

✓
909.93

4

905.3

+50

905.3

5

905.4

+50

905.2

6

905.3

+50

905.1 ✓

B.M.

2.00

✓
909.97

2.00

907.93

907.97

7

905.1

+50

905.1

8

904.9

+50

904.9

9

904.7

+50

904.7

$$\begin{array}{ccccccc} \frac{5.3}{33} & \frac{6.9}{21} & \frac{6.8}{18} & \frac{4.7}{13} & \frac{4.9}{13} & \frac{6.2}{17} & \frac{6.2}{21} & \frac{4.5}{24} \end{array}$$

$$\begin{array}{ccccccc} \frac{4.8}{33} & \frac{7.0}{30} & \frac{6.8}{18} & \frac{4.9}{13} & \frac{4.7}{13} & \frac{6.5}{17} & \frac{6.5}{21} & \frac{3.4}{25} \end{array}$$

$$\begin{array}{ccccccc} \frac{4.2}{33} & \frac{7.2}{30} & \frac{7.0}{18} & \frac{4.8}{13} & \frac{4.6}{4.5} & \frac{4.8}{10} & \frac{6.5}{17} & \frac{6.5}{21} & \frac{2.8}{27} \end{array}$$

$$\begin{array}{ccccccc} \frac{4.2}{33} & \frac{7.3}{29} & \frac{6.8}{18} & \frac{4.8}{13} & \frac{4.6}{4.7} & \frac{4.8}{13} & \frac{6.5}{17} & \frac{6.5}{21} & \frac{2.6}{27} \end{array}$$

$$\begin{array}{ccccccc} \frac{3.9}{33} & \frac{7.0}{28} & \frac{6.8}{18} & \frac{4.9}{13} & \frac{4.7}{4.6} & \frac{4.7}{13} & \frac{6.6}{17} & \frac{6.8}{26} & \frac{2.8}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{3.6}{33} & \frac{6.6}{29} & \frac{6.6}{17} & \frac{4.8}{13} & \frac{4.7}{4.8} & \frac{4.8}{13} & \frac{6.8}{17} & \frac{7.0}{27} & \frac{2.8}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{4.0}{33} & \frac{6.9}{28} & \frac{6.6}{17} & \frac{5.0}{13} & \frac{4.9}{4.9} & \frac{5.1}{13} & \frac{7.0}{17} & \frac{7.0}{29} & \frac{3.4}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{5.0}{33} & \frac{7.2}{28} & \frac{7.0}{17} & \frac{5.1}{13} & \frac{4.9}{4.9} & \frac{4.9}{13} & \frac{7.0}{17} & \frac{7.0}{29} & \frac{4.1}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{5.5}{33} & \frac{7.3}{30} & \frac{7.0}{18} & \frac{5.1}{13} & \frac{5.0}{5.1} & \frac{5.0}{13} & \frac{6.9}{17} & \frac{7.1}{29} & \frac{4.5}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{5.8}{33} & \frac{7.2}{30} & \frac{7.1}{18} & \frac{5.2}{13} & \frac{5.0}{5.1} & \frac{5.2}{13} & \frac{7.2}{17} & \frac{7.2}{30} & \frac{5.5}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{2.2}{33} & \frac{7.4}{27} & \frac{7.4}{17} & \frac{5.4}{13} & \frac{5.1}{5.3} & \frac{5.2}{13} & \frac{7.3}{18} & \frac{7.5}{30} & \frac{5.9}{33} \end{array}$$

$$\begin{array}{ccccccc} \frac{5.5}{32} & \frac{7.8}{28} & \frac{7.8}{18} & \frac{5.3}{13} & \frac{5.1}{5.3} & \frac{5.3}{13} & \frac{7.5}{17} & \frac{7.5}{30} & \frac{6.2}{33} \end{array}$$

✓
909.97

10

904.6

+50

904.4

11

✓

904.5/

T.P.

2.57

908.80

3.74

906.23

+50

904.2

+93

904.2

12

904.2

+0.7

904.3

+50

904.1

13

904.1

+50

904.3

14

904.0

+50

904.3

$$\frac{10.0}{31} \quad \frac{8.1}{27} \quad \frac{7.8}{18} \quad \frac{5.6}{13} \quad \frac{5.2}{54} \quad \frac{5.5}{13} \quad \frac{7.5}{17} \quad \frac{7.5}{30} \quad \frac{6.5}{33}$$

$$\frac{10.0}{28} \quad \frac{8.8}{26} \quad \frac{8.5}{19} \quad \frac{5.8}{10} \quad \frac{5.2}{56} \quad \frac{5.6}{13} \quad \frac{7.6}{18} \quad \frac{7.6}{32} \quad \frac{6.8}{33}$$

$$\frac{10.0}{26} \quad \frac{8.5}{20} \quad \frac{5.8}{13} \quad \frac{5.3}{55} \quad \frac{5.6}{13} \quad \frac{7.8}{17} \quad \frac{7.8}{32} \quad \frac{7.2}{33}$$

$$\frac{9.1}{25} \quad \frac{8.0}{22} \quad \frac{4.7}{13} \quad \frac{4.1}{46} \quad \frac{4.6}{13} \quad \frac{6.6}{17} \quad \frac{6.7}{32} \quad \frac{6.0}{33}$$

$$\frac{9.2}{24} \quad \frac{8.0}{21} \quad \frac{4.8}{13} \quad \frac{4.2}{46} \quad \frac{4.6}{13} \quad \frac{6.3}{17} \quad \frac{6.5}{32}$$

$$\frac{9.8}{24} \quad \frac{8.0}{21} \quad \frac{4.8}{13} \quad \frac{4.2}{46} \quad \frac{4.6}{13} \quad \frac{6.3}{17} \quad \frac{6.4}{33}$$

$$\frac{9.4}{24} \quad \frac{7.6}{20} \quad \frac{4.9}{13} \quad \frac{4.2}{45} \quad \frac{4.5}{13} \quad \frac{6.3}{17} \quad \frac{6.5}{33}$$

$$\frac{9.3}{23} \quad \frac{7.7}{19} \quad \frac{5.0}{13} \quad \frac{4.2}{47} \quad \frac{4.7}{13} \quad \frac{6.6}{17} \quad \frac{6.8}{28}$$

$$\frac{9.6}{24} \quad \frac{7.8}{18} \quad \frac{5.0}{13} \quad \frac{4.3}{47} \quad \frac{4.7}{13} \quad \frac{6.4}{17}$$

$$\frac{9.3}{24} \quad \frac{8.0}{20} \quad \frac{4.9}{13} \quad \frac{4.3}{45} \quad \frac{4.8}{13} \quad \frac{6.6}{17}$$

$$\frac{9.4}{23} \quad \frac{7.7}{18} \quad \frac{4.9}{13} \quad \frac{4.4}{48} \quad \frac{4.8}{13} \quad \frac{6.6}{17}$$

$$\frac{9.8}{23} \quad \frac{8.0}{20} \quad \frac{5.0}{13} \quad \frac{4.4}{45} \quad \frac{4.7}{13} \quad \frac{6.3}{17}$$

908.80 ✓

15

904.0

+50

904.1

16

904.2

+50

904.1

17

904.4

+50

904.5

18

904.5

+50

904.8

19

904.9 ✓

T.F.

5.32

910.27 ✓

3.85

904.95

+50

904.9

20

904.9

+50

904.8

$$\frac{9.0}{25} \quad \frac{7.6}{20} \quad \frac{4.9}{13} \quad 4.4 \quad \frac{4.4}{13} \quad \frac{6.4}{17} \quad \frac{6.8}{23} \quad \frac{6.4}{24}$$

$$\frac{9.7}{24} \quad \frac{8.0}{19} \quad \frac{4.8}{13} \quad 4.4 \quad \frac{4.7}{13} \quad \frac{6.6}{17} \quad \frac{6.6}{32} \quad \frac{6.3}{33}$$

$$\frac{9.1}{24} \quad \frac{7.3}{19} \quad \frac{4.7}{13} \quad 4.3 \quad \frac{4.6}{13} \quad \frac{6.1}{17} \quad \frac{6.2}{32} \quad \frac{6.3}{33}$$

$$\frac{8.8}{26} \quad \frac{7.1}{20} \quad \frac{4.7}{13} \quad 4.2 \quad \frac{4.5}{13} \quad \frac{6.3}{17} \quad \frac{6.5}{32} \quad \frac{6.0}{33}$$

$$\frac{9.4}{27} \quad \frac{7.4}{21} \quad \frac{4.5}{13} \quad 4.1 \quad \frac{4.4}{13} \quad \frac{6.1}{17} \quad \frac{6.5}{32} \quad \frac{5.7}{33}$$

$$\frac{9.3}{25} \quad \frac{7.8}{21} \quad \frac{4.7}{13} \quad 4.0 \quad \frac{4.3}{13} \quad \frac{5.9}{17} \quad \frac{6.3}{31} \quad \frac{5.4}{33}$$

$$\frac{9.4}{26} \quad \frac{7.6}{22} \quad \frac{4.5}{13} \quad 3.9 \quad \frac{4.3}{13} \quad \frac{5.9}{17} \quad \frac{6.4}{31} \quad \frac{5.5}{33}$$

$$\frac{9.3}{26} \quad \frac{8.0}{23} \quad \frac{4.3}{13} \quad 3.8 \quad \frac{4.2}{13} \quad \frac{6.1}{17} \quad \frac{6.2}{30} \quad \frac{5.1}{33}$$

$$\frac{9.1}{26} \quad \frac{7.6}{22} \quad \frac{4.3}{13} \quad 3.8 \quad \frac{4.0}{13} \quad \frac{5.9}{17} \quad \frac{6.3}{24} \quad \frac{4.4}{33}$$

$$\frac{10.4}{24} \quad \frac{8.6}{20} \quad \frac{5.5}{10} \quad 5.1 \quad \frac{5.4}{13} \quad \frac{7.3}{17} \quad \frac{7.5}{24} \quad \frac{5.5}{33}$$

$$\frac{10.4}{24} \quad \frac{9.0}{21} \quad \frac{5.5}{13} \quad 5.0 \quad \frac{5.5}{13} \quad \frac{7.3}{17} \quad \frac{8.0}{24} \quad \frac{6.5}{31}$$

$$\frac{10.5}{25} \quad \frac{9.0}{22} \quad \frac{5.6}{13} \quad 4.9 \quad \frac{5.5}{13} \quad \frac{7.8}{18} \quad \frac{8.1}{30} \quad \frac{7.1}{33}$$

910.27 ✓

21

905.3

+35

905.4

+58

905.6

+65

905.7

+71

905.6

+83

905.7

+92

905.8

22

905.8

+07

905.9

+18

906.0 ✓

B.M.

4.93

910.28

4.93

905.34

905.35

+30

905.9

+45

906.0

$$\begin{array}{ccccccc} 11.0 & 10.0 & 5.2 & 4.7 & 5.2 & 8.2 & 8.2 & 7.0 \\ \hline 25 & 22 & 13 & 5.0 & 13 & 20 & 29 & 31 \end{array}$$

$$\begin{array}{ccccccc} 11.0 & 5.2 & 4.6 & 4.9 & 8.5 & 8.5 & 4.3 \\ \hline 23 & 13 & 4.9 & 13 & 20 & 21 & 33 \end{array}$$

$$\begin{array}{ccccccc} 7.2 & 10.5 & 10.2 & 5.1 & 4.7 & 4.8 & 8.8 & 9.2 & 7.2 \\ \hline 37 & 31 & 24 & 13 & 4.7 & 13 & 21 & 31 & 33 \end{array}$$

$$\begin{array}{ccccccc} 6.8 & 10.5 & 10.3 & 9.8 & 4.9 & 4.9 & 9.2 & 9.8 & 8.4 \\ \hline 36 & 30 & 25 & 23 & 13 & 4.6 & 15 & 22 & 32 & 33 \end{array}$$

$$\begin{array}{ccccccc} 6.8 & 10.4 & 10.4 & 4.8 & 4.4 & 4.9 & 9.5 & 10.0 \\ \hline 36 & 31 & 24 & 13 & 4.7 & 13 & 22 & 33 \end{array}$$

$$\begin{array}{ccccccc} 9.6 & 10.5 & 10.2 & 4.7 & 4.3 & 4.8 & 9.6 & 10.7 \\ \hline 32 & 31 & 23 & 13 & 4.6 & 13 & 23 & 28 \end{array}$$

$$\begin{array}{ccccccc} 10.4 & 9.8 & 4.8 & 4.3 & 4.8 & 9.1 & 9.5 & 10.5 \\ \hline 30 & 22 & 15 & 4.5 & 13 & 22 & 27 & 31 \end{array}$$

$$\begin{array}{ccccccc} 9.1 & 9.1 & 4.6 & 4.2 & 4.6 & 8.6 & 8.5 & 7.2 \\ \hline 24 & 21 & 13 & 4.5 & 15 & 21 & 25 & 27 \end{array}$$

$$\begin{array}{ccccccc} 6.8 & 8.5 & 8.4 & 4.3 & 4.2 & 4.5 & 8.0 & 8.1 & 6.6 \\ \hline 27 & 24 & 20 & 13 & 4.4 & 13 & 21 & 25 & 26 \end{array}$$

$$\begin{array}{ccccccc} 4.7 & 7.5 & 7.7 & 4.4 & 4.2 & 4.4 & 7.6 & 7.7 & 7.0 \\ \hline 29 & 25 & 20 & 15 & 4.3 & 13 & 20 & 24 & 25 \end{array}$$

$$\begin{array}{ccccccc} 4.6 & 7.4 & 7.4 & 4.4 & 4.1 & 4.4 & 7.4 \\ \hline 29 & 24 & 20 & 13 & 4.4 & 13 & 19 \end{array}$$

$$\begin{array}{ccccccc} 6.8 & 4.3 & 4.0 & 4.3 & 7.4 \\ \hline 19 & 13 & 4.3 & 13 & 20 \end{array}$$

✓
910.28

23

906.4

+50

906.7

24

907.1

+30

907.3

+50

907.4

+60

907.4

+65

907.5

25

907.9

+50

908.1

26

908.4

+50

2.84

✓
911.45

1.47

✓
908.41

T.P.

27

908.7

$$\frac{6.7}{19} \quad \frac{3.9}{13} \quad \frac{3.1}{3.9} \quad \frac{3.9}{13} \quad \frac{6.9}{19}$$

$$\frac{6.4}{20} \quad \frac{3.5}{13} \quad \frac{3.4}{3.6} \quad \frac{3.6}{13} \quad \frac{6.1}{18}$$

$$\frac{5.6}{18} \quad \frac{3.2}{13} \quad \frac{3.1}{3.2} \quad \frac{3.2}{13} \quad \frac{5.2}{18} \quad \frac{5.2}{31}$$

$$\frac{5.2}{28} \quad \frac{5.2}{18} \quad \frac{3.0}{13} \quad \frac{2.9}{3.0} \quad \frac{2.9}{13} \quad \frac{4.8}{17} \quad \frac{5.0}{29} \quad \frac{2.4}{33}$$

$$\frac{4.6}{33} \quad \frac{5.2}{31} \quad \frac{5.0}{18} \quad \frac{2.9}{13} \quad \frac{2.8}{2.9} \quad \frac{2.8}{18} \quad \frac{4.7}{17} \quad \frac{4.8}{29} \quad \frac{2.3}{33}$$

$$\frac{4.0}{33} \quad \frac{5.4}{31} \quad \frac{5.0}{18} \quad \frac{2.8}{13} \quad \frac{2.8}{2.9} \quad \frac{2.8}{13} \quad \frac{4.7}{18} \quad \frac{5.0}{29} \quad \frac{2.5}{33}$$

$$\frac{3.7}{33} \quad \frac{5.4}{31} \quad \frac{5.0}{18} \quad \frac{2.8}{13} \quad \frac{2.7}{2.8} \quad \frac{2.7}{13} \quad \frac{4.7}{18} \quad \frac{5.0}{29} \quad \frac{2.5}{33}$$

$$\frac{3.2}{33} \quad \frac{5.3}{30} \quad \frac{4.8}{18} \quad \frac{2.5}{13} \quad \frac{2.7}{2.4} \quad \frac{2.6}{13} \quad \frac{4.7}{18} \quad \frac{4.7}{29} \quad \frac{2.2}{33}$$

$$\frac{3.4}{33} \quad \frac{5.0}{30} \quad \frac{4.7}{18} \quad \frac{2.2}{13} \quad \frac{2.2}{2.2} \quad \frac{2.2}{13} \quad \frac{4.5}{18} \quad \frac{4.5}{29} \quad \frac{1.8}{33}$$

$$\frac{2.7}{33} \quad \frac{4.6}{31} \quad \frac{4.4}{18} \quad \frac{1.8}{13} \quad \frac{1.9}{1.9} \quad \frac{1.9}{13} \quad \frac{4.0}{18} \quad \frac{4.0}{29} \quad \frac{1.7}{33}$$

$$\frac{2.0}{33} \quad \frac{4.2}{30} \quad \frac{4.0}{18} \quad \frac{1.8}{13} \quad \frac{1.6}{1.7} \quad \frac{1.7}{13} \quad \frac{3.8}{18} \quad \frac{4.0}{29} \quad \frac{1.7}{33}$$

$$\frac{3.0}{33} \quad \frac{5.2}{30} \quad \frac{5.1}{18} \quad \frac{2.7}{13} \quad \frac{2.6}{2.8} \quad \frac{2.6}{13} \quad \frac{4.9}{18} \quad \frac{5.2}{29} \quad \frac{2.9}{33}$$

✓
911.45

27+50

908.9

28

908.7

+50

908.2

29

907.5

+50

907.2

30

906.5

+50

905.9

31

905.5

+50

904.9

32

904.4

+50

904.0

+66

903.9

$$\frac{2.0}{33} \quad \frac{5.0}{29} \quad \frac{5.0}{18} \quad \frac{2.8}{13} \quad 2.1 \quad \frac{2.6}{13} \quad \frac{4.8}{18} \quad \frac{5.1}{29} \quad \frac{2.7}{33}$$

$$\frac{2.5}{33} \quad \frac{5.1}{29} \quad \frac{5.1}{18} \quad \frac{3.0}{13} \quad 2.9 \quad \frac{2.9}{13} \quad \frac{5.0}{18} \quad \frac{5.2}{30} \quad \frac{2.7}{33}$$

$$\frac{4.1}{33} \quad \frac{5.7}{30} \quad \frac{5.7}{18} \quad \frac{3.5}{13} \quad 3.1 \quad \frac{3.5}{13} \quad \frac{5.5}{18} \quad \frac{5.5}{31} \quad \frac{4.0}{33}$$

$$\frac{4.7}{33} \quad \frac{6.3}{30} \quad \frac{6.3}{18} \quad \frac{3.9}{13} \quad 4.0 \quad \frac{4.0}{13} \quad \frac{6.3}{18} \quad \frac{6.3}{30} \quad \frac{5.0}{33}$$

$$\frac{4.9}{33} \quad \frac{6.9}{30} \quad \frac{6.9}{18} \quad \frac{4.7}{13} \quad 4.6 \quad \frac{4.7}{13} \quad \frac{6.8}{18} \quad \frac{6.8}{30} \quad \frac{5.5}{33}$$

$$\frac{5.3}{33} \quad \frac{7.5}{30} \quad \frac{7.3}{17} \quad \frac{5.1}{13} \quad 5.2 \quad \frac{5.2}{13} \quad \frac{7.2}{18} \quad \frac{7.2}{30} \quad \frac{5.5}{33}$$

$$\frac{6.1}{33} \quad \frac{8.1}{30} \quad \frac{7.8}{18} \quad \frac{5.8}{13} \quad 5.8 \quad \frac{5.7}{13} \quad \frac{7.7}{18} \quad \frac{7.7}{30} \quad \frac{5.9}{33}$$

$$\frac{7.1}{33} \quad \frac{9.0}{30} \quad \frac{8.6}{18} \quad \frac{6.5}{13} \quad 6.4 \quad \frac{6.3}{13} \quad \frac{8.5}{18} \quad \frac{8.5}{30} \quad \frac{6.7}{33}$$

$$\frac{8.0}{33} \quad \frac{9.4}{30} \quad \frac{9.1}{18} \quad \frac{6.9}{13} \quad 6.8 \quad \frac{6.8}{13} \quad \frac{9.0}{18} \quad \frac{9.1}{29} \quad \frac{7.1}{33}$$

$$\frac{9.0}{33} \quad \frac{10.0}{32} \quad \frac{9.8}{18} \quad \frac{7.2}{13} \quad 7.2 \quad \frac{7.2}{13} \quad \frac{9.6}{18} \quad \frac{9.5}{30} \quad \frac{7.7}{33}$$

$$\frac{10.0}{37} \quad \frac{11.4}{23} \quad \frac{11.4}{27} \quad \frac{10.8}{20} \quad \frac{7.4}{13} \quad 7.5 \quad \frac{7.5}{13} \quad \frac{9.8}{18} \quad \frac{9.8}{30} \quad \frac{7.8}{33}$$

$$\frac{9.5}{26} \quad \frac{10.6}{24} \quad \frac{10.6}{22} \quad \frac{10.5}{19} \quad \frac{7.5}{13} \quad 7.6 \quad \frac{7.5}{13} \quad \frac{9.8}{18} \quad \frac{9.8}{29} \quad \frac{7.5}{33}$$

911.45



32+82

903.9

33

903.9

+12

903.9

+40

903.9

34



903.8✓

B. M.

3.72

908.57

6.59

904.86

904.85

+50

903.8

35

903.8

+50

903.9

36

903.8

+50

903.8

37

903.9

+50

904.0

$$\frac{8.4}{25} \quad \frac{10.3}{22} \quad \frac{10.2}{18} \quad \frac{7.6}{13} \quad 1.1 \quad \frac{7.6}{13} \quad \frac{10.0}{19} \quad \frac{10.0}{28} \quad \frac{6.8}{33}$$

$$\frac{9.0}{25} \quad \frac{10.2}{22} \quad \frac{10.2}{18} \quad \frac{7.7}{13} \quad 1.4 \quad \frac{7.7}{13} \quad \frac{10.7}{21} \quad \frac{10.6}{27} \quad \frac{7.3}{33}$$

$$\frac{9.4}{24} \quad \frac{10.2}{22} \quad \frac{10.2}{18} \quad \frac{7.8}{13} \quad 1.8 \quad \frac{7.8}{13} \quad \frac{11.0}{20} \quad \frac{11.0}{26} \quad \frac{10.4}{32} \quad \frac{7.7}{33}$$

$$\frac{8.7}{24} \quad \frac{9.9}{22} \quad \frac{9.9}{18} \quad \frac{7.9}{13} \quad 1.9 \quad \frac{7.8}{13} \quad \frac{10.5}{18} \quad \frac{10.5}{22} \quad \frac{6.4}{28}$$

$$\frac{7.6}{25} \quad \frac{9.7}{22} \quad \frac{9.7}{18} \quad \frac{7.9}{13} \quad 4.0 \quad \frac{7.8}{13} \quad \frac{10.0}{18} \quad \frac{10.0}{24} \quad \frac{7.4}{25}$$

$$\frac{4.8}{25} \quad \frac{6.8}{24} \quad \frac{6.7}{17} \quad \frac{5.0}{13} \quad 5.1 \quad \frac{5.0}{13} \quad \frac{7.0}{18} \quad \frac{7.0}{22} \quad \frac{4.7}{24}$$

$$\frac{5.2}{24} \quad \frac{6.7}{24} \quad \frac{6.6}{17} \quad \frac{4.8}{13} \quad 5.0 \quad \frac{4.8}{13} \quad \frac{7.1}{18} \quad \frac{7.1}{22} \quad \frac{5.3}{24}$$

$$\frac{5.0}{24} \quad \frac{4.8}{24} \quad \frac{6.8}{17} \quad \frac{4.9}{13} \quad 5.0 \quad \frac{4.8}{13} \quad \frac{6.8}{18} \quad \frac{6.8}{22} \quad \frac{4.9}{24}$$

$$\frac{5.0}{24} \quad \frac{6.7}{24} \quad \frac{6.7}{17} \quad \frac{4.9}{13} \quad 4.9 \quad \frac{4.8}{13} \quad \frac{7.0}{17} \quad \frac{7.0}{24} \quad \frac{5.0}{24}$$

$$\frac{5.9}{23} \quad \frac{6.9}{24} \quad \frac{6.9}{17} \quad \frac{4.9}{13} \quad 4.9 \quad \frac{4.8}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{24} \quad \frac{5.7}{23}$$

$$\frac{7.0}{24} \quad \frac{7.1}{17} \quad \frac{4.8}{13} \quad 4.8 \quad \frac{4.8}{13} \quad \frac{6.8}{17} \quad \frac{6.8}{24} \quad \frac{5.9}{22}$$

$$\frac{5.8}{22} \quad \frac{6.6}{24} \quad \frac{6.6}{17} \quad \frac{4.8}{13} \quad 4.7 \quad \frac{4.7}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{24} \quad \frac{5.3}{23}$$

908.57

38

904.1

+50

904.1

39

904.4

+50

904.8

40

905.1

+50

905.5

41

905.7

+50

906.3

42

906.5

+50

907.0

T.P.

7.03

913.43

2.17

906.40

43

907.4

+50

907.5

$$\frac{5.6}{23} \quad \frac{6.5}{21} \quad \frac{6.4}{17} \quad \frac{4.5}{13} \quad \frac{4.5}{4.5} \quad \frac{4.5}{13} \quad \frac{6.6}{17} \quad \frac{6.6}{21} \quad \frac{5.4}{23}$$

$$\frac{6.5}{22} \quad \frac{7.0}{21} \quad \frac{7.0}{17} \quad \frac{4.5}{13} \quad \frac{4.2}{4.5} \quad \frac{4.5}{13} \quad \frac{6.5}{17} \quad \frac{6.5}{21} \quad \frac{6.0}{23}$$

$$\frac{6.8}{18} \quad \frac{4.2}{13} \quad \frac{3.9}{4.2} \quad \frac{4.0}{13} \quad \frac{6.2}{18} \quad \frac{6.3}{21} \quad \frac{5.8}{22}$$

$$\frac{6.2}{18} \quad \frac{3.6}{13} \quad \frac{3.6}{3.8} \quad \frac{3.8}{13} \quad \frac{6.0}{17} \quad \frac{5.9}{20} \quad \frac{5.3}{21}$$

$$\frac{5.7}{18} \quad \frac{3.5}{13} \quad \frac{3.3}{3.5} \quad \frac{3.5}{12} \quad \frac{5.5}{17} \quad \frac{5.5}{21} \quad \frac{4.7}{22}$$

$$\frac{5.3}{18} \quad \frac{3.2}{13} \quad \frac{3.0}{3.1} \quad \frac{3.1}{13} \quad \frac{5.2}{17} \quad \frac{5.2}{21} \quad \frac{4.3}{22}$$

$$\frac{4.9}{22} \quad \frac{4.9}{18} \quad \frac{2.9}{13} \quad \frac{2.7}{2.9} \quad \frac{2.8}{13} \quad \frac{5.0}{17} \quad \frac{5.0}{21} \quad \frac{3.9}{22}$$

$$\frac{3.9}{23} \quad \frac{4.6}{21} \quad \frac{4.6}{17} \quad \frac{2.5}{13} \quad \frac{2.8}{2.3} \quad \frac{2.4}{13} \quad \frac{4.6}{17} \quad \frac{4.6}{21} \quad \frac{3.2}{23}$$

$$\frac{2.8}{24} \quad \frac{4.1}{21} \quad \frac{4.1}{17} \quad \frac{2.1}{13} \quad \frac{2.1}{2.1} \quad \frac{2.0}{13} \quad \frac{4.0}{17} \quad \frac{4.0}{21} \quad \frac{2.1}{24}$$

$$\frac{1.9}{24} \quad \frac{3.6}{21} \quad \frac{3.6}{17} \quad \frac{1.6}{13} \quad \frac{1.8}{1.6} \quad \frac{1.8}{13} \quad \frac{3.6}{17} \quad \frac{3.6}{21} \quad \frac{1.0}{25}$$

$$\frac{6.7}{24} \quad \frac{8.2}{21} \quad \frac{8.2}{17} \quad \frac{6.3}{13} \quad \frac{6.3}{6.0} \quad \frac{6.2}{13} \quad \frac{8.3}{17} \quad \frac{8.3}{21} \quad \frac{5.2}{26}$$

$$\frac{7.2}{23} \quad \frac{8.1}{21} \quad \frac{8.1}{17} \quad \frac{6.1}{13} \quad \frac{6.0}{5.9} \quad \frac{6.0}{13} \quad \frac{8.2}{17} \quad \frac{8.2}{21} \quad \frac{6.2}{24}$$

✓
913.43

44

907.8

+50

908.0

45

908.2

+50

908.4

46

908.7

+50

908.8

47

908.7

+50

908.8

48

908.7

+50

908.7

49

908.7

+50

908.5

$$\frac{2.4}{22} \quad \frac{2.8}{21} \quad \frac{2.8}{17} \quad \frac{5.8}{13} \quad \frac{5.7}{5.6} \quad \frac{5.8}{13} \quad \frac{8.0}{17} \quad \frac{8.0}{21} \quad \frac{5.8}{24}$$

$$\frac{2.4}{23} \quad \frac{8.2}{22} \quad \frac{8.2}{17} \quad \frac{5.7}{13} \quad \frac{5.4}{5.4} \quad \frac{5.4}{13} \quad \frac{2.4}{17} \quad \frac{2.4}{21} \quad \frac{5.8}{24}$$

$$\frac{2.0}{24} \quad \frac{8.0}{22} \quad \frac{8.0}{18} \quad \frac{5.5}{13} \quad \frac{5.1}{5.2} \quad \frac{5.2}{13} \quad \frac{2.2}{17} \quad \frac{7.2}{21} \quad \frac{6.0}{23}$$

$$\frac{5.6}{26} \quad \frac{2.7}{22} \quad \frac{2.7}{18} \quad \frac{5.1}{13} \quad \frac{4.9}{5.0} \quad \frac{5.1}{13} \quad \frac{2.1}{17} \quad \frac{2.1}{21} \quad \frac{5.7}{23}$$

$$\frac{4.6}{28} \quad \frac{2.4}{24} \quad \frac{2.4}{19} \quad \frac{4.9}{13} \quad \frac{4.8}{4.7} \quad \frac{4.7}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{5.4}{23}$$

$$\frac{4.6}{27} \quad \frac{2.5}{23} \quad \frac{2.5}{19} \quad \frac{4.8}{13} \quad \frac{4.7}{4.6} \quad \frac{4.8}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{5.5}{23}$$

$$\frac{4.8}{27} \quad \frac{2.5}{23} \quad \frac{2.5}{19} \quad \frac{4.9}{13} \quad \frac{4.7}{4.7} \quad \frac{4.9}{13} \quad \frac{6.9}{17} \quad \frac{6.9}{21} \quad \frac{5.0}{24}$$

$$\frac{4.5}{28} \quad \frac{2.3}{23} \quad \frac{2.3}{19} \quad \frac{4.6}{13} \quad \frac{4.6}{4.6} \quad \frac{4.7}{13} \quad \frac{6.9}{17} \quad \frac{6.9}{21} \quad \frac{3.9}{25}$$

$$\frac{3.3}{29} \quad \frac{2.3}{23} \quad \frac{2.3}{19} \quad \frac{4.6}{13} \quad \frac{4.6}{4.7} \quad \frac{4.7}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{3.4}{26}$$

$$\frac{2.9}{29} \quad \frac{2.2}{23} \quad \frac{2.2}{19} \quad \frac{4.8}{13} \quad \frac{4.7}{4.7} \quad \frac{4.7}{13} \quad \frac{6.7}{17} \quad \frac{6.7}{21} \quad \frac{2.6}{27}$$

$$\frac{4.5}{27} \quad \frac{2.4}{23} \quad \frac{2.4}{19} \quad \frac{4.8}{13} \quad \frac{4.7}{4.7} \quad \frac{4.7}{13} \quad \frac{2.0}{17} \quad \frac{2.0}{21} \quad \frac{4.0}{25}$$

$$\frac{6.9}{23} \quad \frac{2.0}{20} \quad \frac{4.8}{13} \quad \frac{4.7}{4.9} \quad \frac{4.7}{13} \quad \frac{2.5}{19}$$

913.43 ✓

50

908.6

+50

908.9

51

909.0

+50

909.2

52

909.3 ✓

T.P.

5.25

914.50

4.18

909.25

+50

909.3

+60

909.4

+69

909.4

+77

0.0 Section

+97

± Pavement

B.M.

5.48

909.02 ✓

$$\frac{2.4}{20} \quad \frac{4.7}{13} \quad 4.4 \quad \frac{4.5}{13} \quad \frac{8.7}{22}$$

$$\frac{6.1}{25} \quad \frac{6.4}{24} \quad \frac{7.2}{19} \quad \frac{4.5}{10} \quad 4.3 \quad \frac{4.6}{13} \quad \frac{7.4}{19}$$

$$\frac{5.8}{23} \quad \frac{6.3}{19} \quad \frac{4.4}{10} \quad 4.3 \quad \frac{4.3}{10} \quad \frac{6.4}{17} \quad \frac{6.4}{21} \quad \frac{5.2}{23}$$

$$\frac{3.7}{26} \quad \frac{5.8}{22} \quad \frac{5.8}{18} \quad \frac{4.2}{13} \quad 4.2 \quad \frac{4.3}{13} \quad \frac{6.4}{17} \quad \frac{6.4}{21} \quad \frac{3.7}{25}$$

$$\frac{3.5}{26} \quad \frac{6.2}{22} \quad \frac{6.2}{18} \quad \frac{4.2}{10} \quad 4.2 \quad \frac{4.2}{13} \quad \frac{6.2}{17} \quad \frac{6.2}{21} \quad \frac{3.4}{25}$$

$$\frac{5.7}{23} \quad \frac{7.1}{22} \quad \frac{7.1}{18} \quad \frac{5.2}{13} \quad 5.2 \quad \frac{5.3}{13} \quad \frac{7.5}{17} \quad \frac{7.5}{21} \quad \frac{6.4}{23}$$

$$\frac{6.4}{23} \quad \frac{7.2}{22} \quad \frac{7.2}{19} \quad \frac{5.3}{14} \quad 6.2 \quad \frac{5.4}{14} \quad \frac{7.6}{19}$$

$$\frac{7.4}{26} \quad \frac{5.2}{15} \quad 5.6 \quad \frac{5.2}{18} \quad \frac{7.4}{24}$$

0-40 18"X42' P3 X-Drain

0+00 E Dr. Rt.

10+00 E Dr. Rt. 15"X 20' C.M.

15+00 18"X42' P3 X-Drain

21+85 36"X48' P3 X-Drain

32+82 24"X60' P3 X-Drain

42+90 E Dr. Rt. 15"X20' C.M.

44+25 E Dr. Lt. 15"X20' C.M.

49+62 E Dr Lt

51+35 E Dr. Lt

Sp. Ditch - Pt. 6' X 16' X 1' Cut 2

18' X 18' X 1' Fill 6

18' X 18' X 1.5' Fill 8

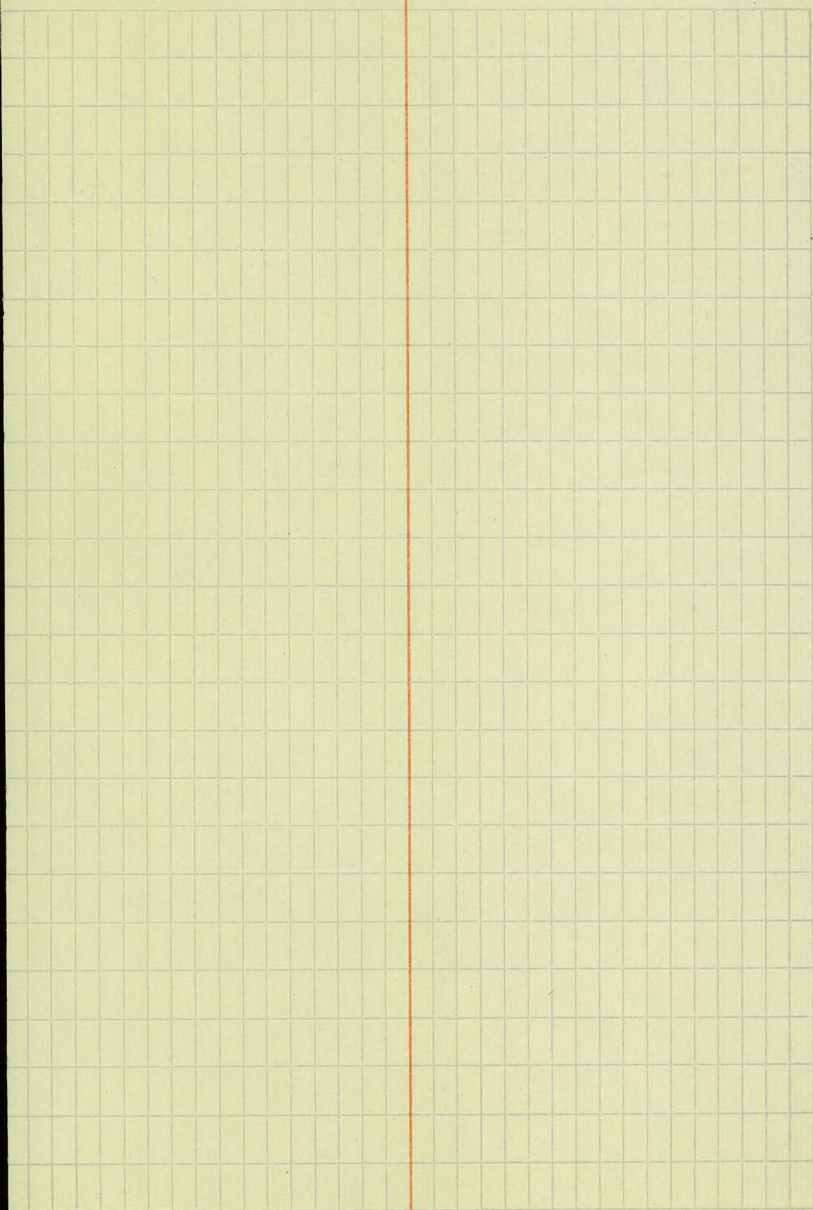
17' X 12' X 1.5' Fill 6

17' X 17' X 1' Fill 5

17' X 20' X 1' Fill 6

22' X 10' X 1' Fill 6

D-176 to 2+67.5	Lt.	443.5'	2 Anchors
10+04 to 22+25	Lt.	1221'	4 "
20+81 to 22+25	Rt.	144'	2 "
		1808.5'	8 Anchors



2.42

909.33

906.91

8.53 ✓

6.93 ✓

0-40

18" X 42' P3

900.8

902.4

22.6 Lt.

19.4' Rt.

4' Down

2' Down

B.M.

0.70

905.55

904.85

5.8

5.5

32+81.5

24" X 60' P3

899.8

900.1

30.5 Lt.

29.5 Rt.

B.M.

2.75

908.10

905.35

9.1

9.1

21+85

36" X 48' P3

899.0

899.0

24' Lt.

24' Rt.

908.5

10.1

6.6

15+00

18" X 42' P3

898.4

901.9

24.5' Lt.

17.5' Rt.

3' Down

1' Down

$$\begin{array}{r} 2.4 \\ 00.8 \\ \hline 02 \\ 1.6 \end{array}$$

$$\begin{array}{r} 19.4 \\ 22.6 \\ \hline 42.0 \end{array}$$

$$\begin{array}{r} 23L \quad 19.8R \\ 19.8 \\ \hline 42.8 \end{array}$$

05.8 Grade

$$\begin{array}{r} 3.4 \quad 6.8 \\ 12 \\ \hline 19.8 \end{array}$$

$$\begin{array}{r} 906.81 \\ 2.42 \\ \hline 909.33 \end{array}$$

3.8 Grade 1.8 Red.

2.6

06.0 Grade 2.1 Red.

$$\begin{array}{r} 04.4 \\ 2.8 \\ \hline 02.9 \\ 101.9 \end{array}$$

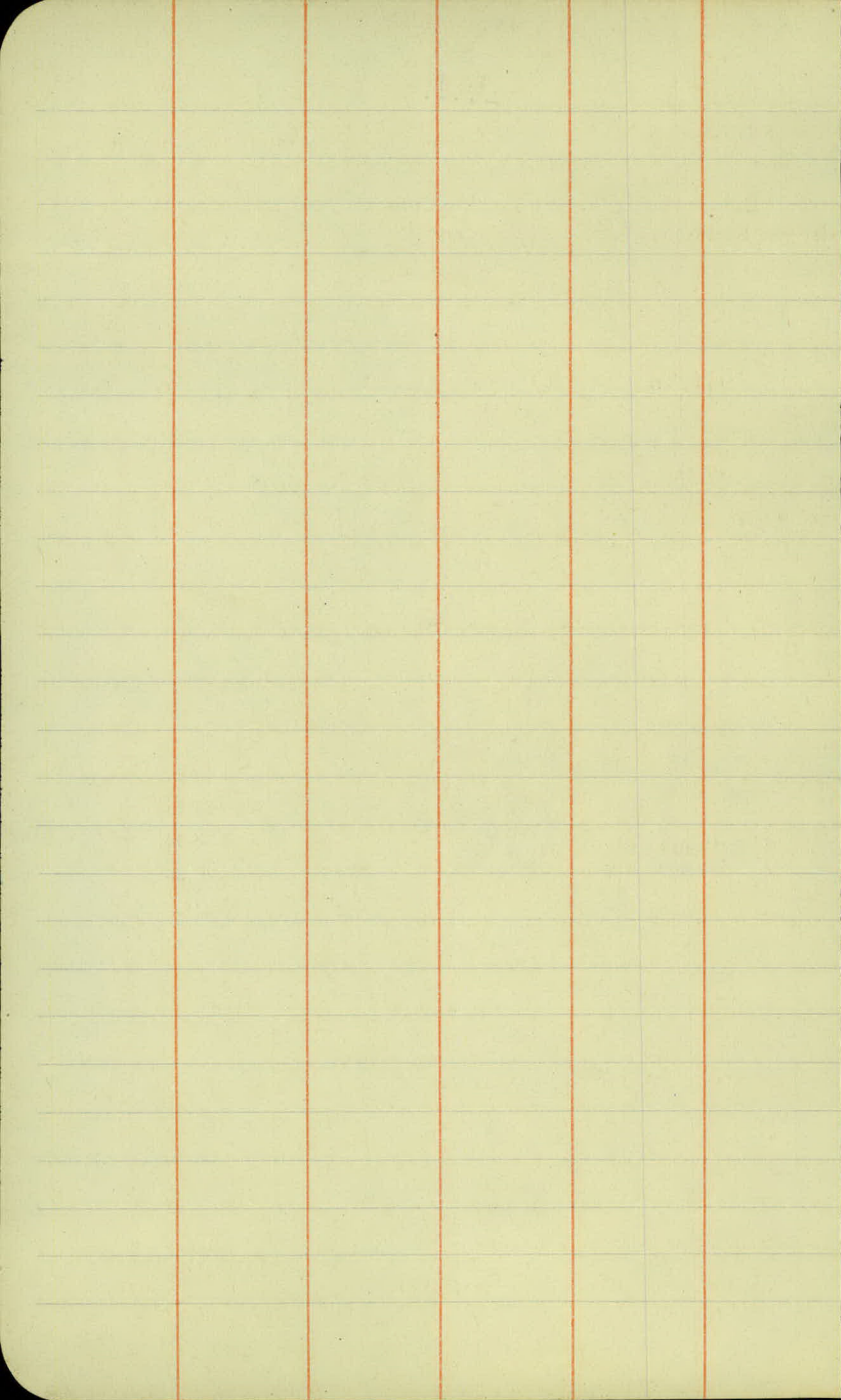
04.4 Grade

00.9 2.5

$$\begin{array}{r} 12.4 \\ 12 \\ \hline 25.6 \\ 18 \\ \hline 43.6 \end{array}$$

$$\begin{array}{r} 25 \quad 18 \\ 18 \\ \hline 43 \quad 16.5 \end{array}$$

$$\begin{array}{r} 25 \\ 18 \\ \hline 43 \end{array} \quad \begin{array}{r} 23.5 \\ 24.5 \\ 17.5 \\ \hline 42.0 \end{array}$$



KEITH'S RAILROAD CURVE TABLES.

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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.=	1.18.47
$7^{\circ} 19\frac{1}{2}' =$ " " "	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.)

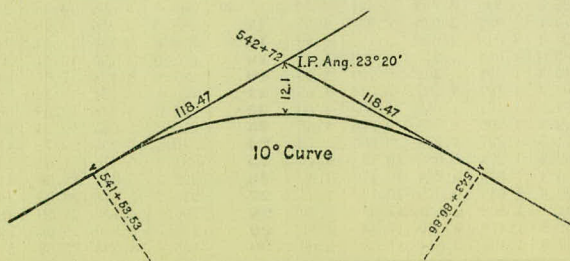


TABLE I. — Minutes in Decimals of a Degree.

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.	.073	.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	6.139	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	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

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

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 Externals 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	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69	3937.9	1222.7	79	4723.2	1695.8	89	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70	4011.9	1265.0	80	4807.7	1749.9	90	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

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

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. $25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 =$ 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	7898	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.

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.

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	1.4733	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	2.2460	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.	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.
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Natural Cotangents

.10

Ga. 4612

1.29
1
1.29

Cen. #9

N.
↑

□ 34.41 F.P.
77.01 Pople

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.

42577
MADE IN GERMANY.