

PREM. LEVELS.

WATERLOO - RAYMOND ROAD

FIELD BOOKS

276 5

THE

C. H. REASE COMPANY

CHICAGO

56

IF Lost. Please Return to  
County Engineers Office  
Court House  
Waterloo Iowa.

**BLACK HAWK COUNTY  
ENGINEER'S OFFICE  
COURT HOUSE  
WATERLOO, IOWA 50703**

LaPorte-Brandon Road

Transit and ~~E~~ Level notes

2-18

Survey Township Road Sec. 1-12 Black Hawk

11

Land Survey - A.H. Refshauge Sec. 24-90-14

20

Ditch Elevations Twp. Rd. Sec. 7-9-89-14

21

Data for Filter Bed Poor Farm

19

Study for Poor Farm Drainage

22-25

Tile Co. Road Sec. 25-36 Black Hawk

26-27

Grades for Filter Bed Tile

29

Final X-Section, Engel Pit

30

Tile Co. Road Sec. <sup>25-26</sup><sub>25-36</sub> Black Hawk

34

Poor Farm Tile

39

Survey Twp. Road Sec. 33, T88N, R12W

40

Waterloo - Raymond Road

X-Section & Profile Notes

47-81

Drainage Investigation near Bunker's

Greenhouse

82-83

Proposed Culvert Notes

87-88

Drainage investigation through the

Draw N. Western of Sta. 58+00 on

back of ——— Page 88

Drainage investigation through Draw

S. Ely, from Sta. 57+00. Pages 84-86

& Levels (LaPorte-Brandon) 13-18

BLACK HAWK COUNTY  
ENGINEER'S OFFICE  
COURT HOUSE  
WATERLOO, IOWA 50703



297

298  
 @ +10.2  $\angle 15^{\circ} 51'$  Left

297

296

295 +89 8 X 6 X27 Colv.

295

294

+55.7  $\angle 21^{\circ} 12'$  Right  
 293  $\pm 9'$  Right

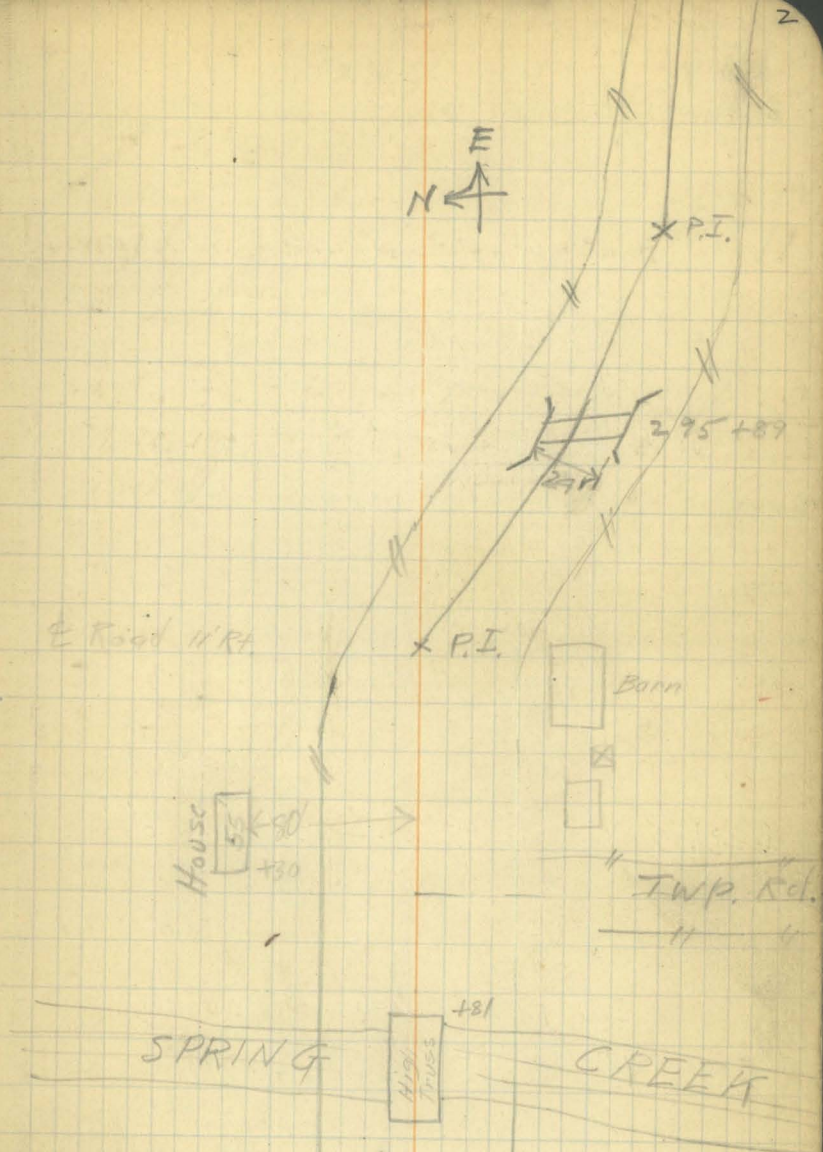
292

291 +00  $\pm$  Road Running South

290

289 +81 E. end High Truss

La Porte-Brandon Road





3/2 f00 P.O.T.

11

10

9

8

7

6

5

4

3

2

1

300x00 50" Elm Left  $\angle 3^{\circ} 12'$  Left  
La Porte - Brandon Co. Road

Sept. 12, 1925

Bright + Clear

field

Timber

Garden

+08

250'

House

+05

12" Culv

Drive

+62

Tot line

+98

23'

26'

Gate

+77

+51

12"

12"

+51

+41

Culv

Drive

37'

School House

+26

Timber

325

324

323

322+00 Hob  $\angle 0^\circ 7'$  Right

321

320

319

318

317

316

315 +27 3X2+24 Colv.

314

313

x

+75

b

b

[ ]

+17

b

+35

orchard

+57



338

337

336

335

334

333

332

331

330

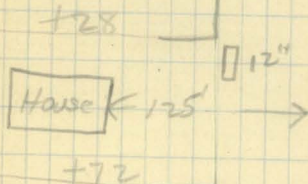
329

328

327

326

corn



corn

Orchard

12" 11 +76

+68  
 Evergreens 0 0 0 0  
 +12 0 0 0

corn

351

+38

50

49

48

47

46

+36 2X2X24

45

44

43 +00 Hub  $\angle 0^{\circ} 4'$  Right

42

41

40

339 +05 2X2X24 R.C.B.

+55



+82

+82

x





364

63

62+00  $\angle 0^\circ 13'$  Left

61

60

59

58

57

56

55

54

53+00  $\angle 0^\circ 21'$  Right

352

+80

+80

+72

+06

+80 Drive

125'

House

Sept. 14, 1925.

377

76

75

74

+77 12" x 20' Corr. pipe

73

72

70

+84.6 Hub

 $\angle 89^{\circ} 58'$  Right

69

68

67

66

365

Corn

Meadow

Corn

Pasture

Rad. of Curve 100'

+29



390

89

88

87

86

85

84

83

382

81 +05.6 HUB 20°2' Left

80

79

378

+80

+96

396+22.45 Hub  $\pm$  Road E&W.

396

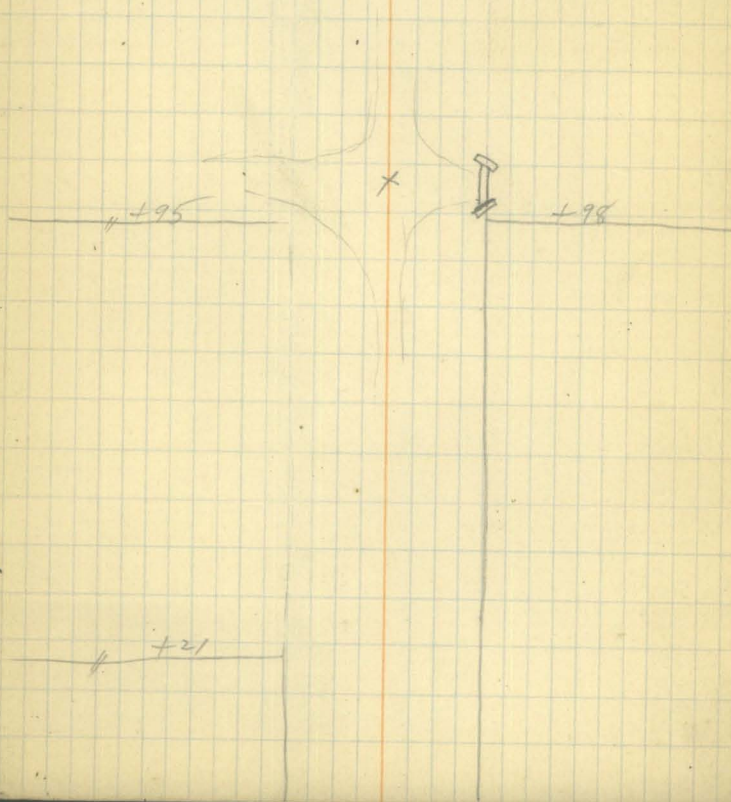
395

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393

392

391





Township Road in  
Sec. 1-12 Black Hawk Twp.

16+83 W. end of 31X16 Wood Br.

13+12.5  $\angle 24^{\circ}52'$  Right Sec. Corner Gas Pipe

7+88.0  $\angle 10^{\circ}18'$  Left

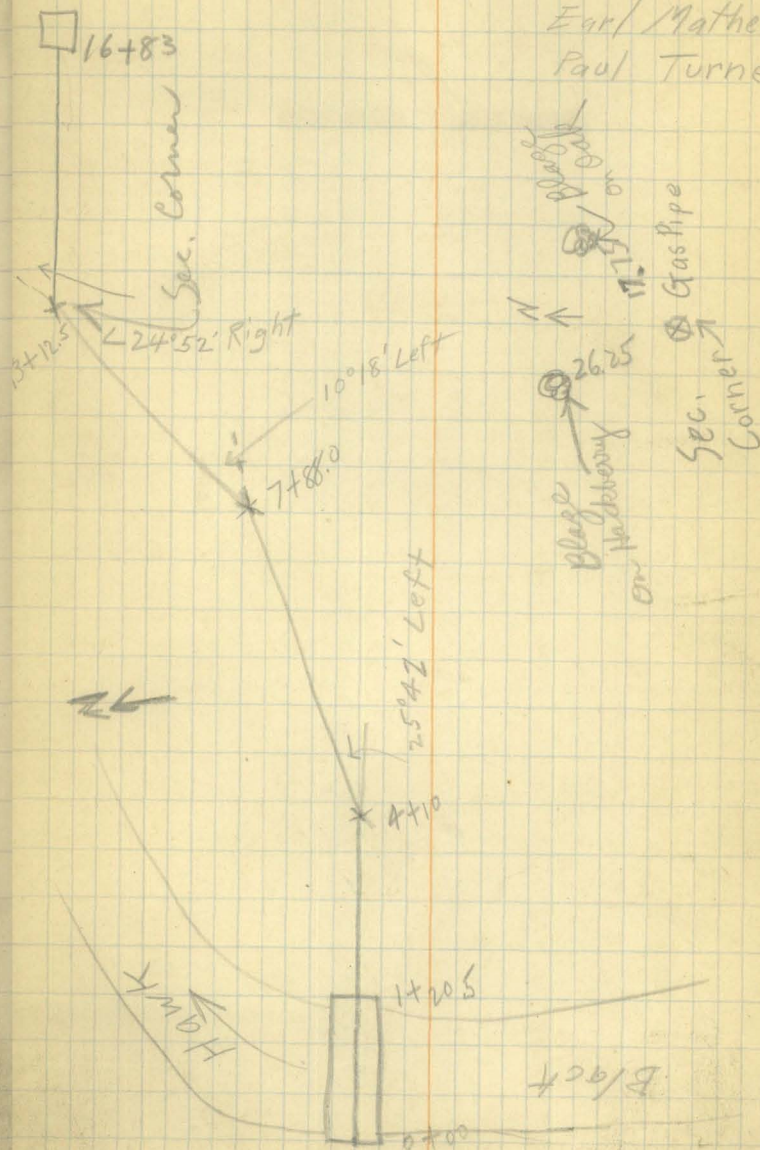
4+13 = Sta. 15+56 Survey Book 10 Page 127

4+10  $\angle 25^{\circ}42'$  Left

1+20.5 Center E. end Br.

0+00 Center W. end Black Hawk Br.

Oct. 1, 1925  
E.B. Spencer  
Eng. Mathews  
Paul Turner







349+72  
350

T.P. 1.56 99.06

51

52

53

B.M.

54

55

56

57

2.47 105.76

58

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4.11 113.99

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|        |      |         |       |         |
|--------|------|---------|-------|---------|
| T.P.   | 0.31 | 72.31   | 7.06  | 72.00 ✓ |
| 333    |      |         | 8.7   | 70.4 ✓  |
| 34     |      |         | 8.1   | 71.0 ✓  |
| 35     |      |         | 6.3   | 72.8 ✓  |
| 36     |      |         | 4.7   | 74.4 ✓  |
| 37     |      |         | 4.8   | 74.3 ✓  |
| 38     |      |         | 4.7   | 74.4 ✓  |
| B.M.   | 2.82 | (79.06) |       | 76.24 ✓ |
| 39     |      |         | 12.2  | 74.6 ✓  |
| B.M.   |      |         | 10.59 | 76.24 ✓ |
| 340    |      |         | 10.0  | 76.8 ✓  |
| 41     |      |         | 7.9   | 78.9 ✓  |
| 42     |      |         | 4.5   | 82.3 ✓  |
| 42+66  |      |         | 2.7   | 84.1 ✓  |
| 43     |      |         | 3.3   | 83.5 ✓  |
| T.P.   | 7.40 | (86.83) | 8.63  | 79.43 ✓ |
| 44     |      |         | 8.5   | 79.6 ✓  |
| 45     |      |         | 10.5  | 77.6 ✓  |
| B.M.   |      |         | 9.98  | 78.08 ✓ |
| 345+56 |      |         | 10.8  | 77.3 ✓  |
| 346    |      |         | 10.1  | 78.0 ✓  |
| 47     |      |         | 7.6   | 80.5 ✓  |
| 48     |      |         | 3.2   | 84.9 ✓  |
| T.P.   | 1.18 | 88.06   | 12.18 | 86.88 ✓ |
| 349    |      |         | 9.5   | 89.6 ✓  |
|        |      | 99.06   |       |         |

Center N. Headwall Conc. Culv. 339+05

Center N. Headwall Conc. Culv. 345+56



311+45  
12  
13  
14  
15  
B.M.  
16  
17  
18  
19  
20  
T.P.  
21  
22  
23  
24  
25  
26  
T.P.  
27  
28  
29  
30  
31  
332

6.51 60.02

0.19

(66.83)

6.90

(71.78)

(72.31)

4.9 55.1 ✓  
5.1 54.9 ✓  
7.1 52.9 ✓  
8.0 52.0 ✓  
7.8 52.2 ✓  
13.32 53.51 ✓  
14.2 52.6 ✓  
12.6 54.2 ✓  
9.4 57.4 ✓  
4.5 62.3 ✓  
1.6 65.2 ✓  
5.14 66.64 ✓  
4.7 67.1 ✓  
4.4 67.4 ✓  
4.7 67.1 ✓  
5.0 66.8 ✓  
5.6 66.2 ✓  
6.3 65.5 ✓  
7.43 64.88 ✓  
6.8 65.5 ✓  
6.7 65.6 ✓  
6.5 65.8 ✓  
5.3 67.0 ✓  
3.3 69.0 ✓  
2.7 69.6 ✓

Centen N. Headwall Conc. Culv. 315+27

|        |      |         |         |                                                                                     |
|--------|------|---------|---------|-------------------------------------------------------------------------------------|
| 294    |      | 8.7     | 13.2 ✓  | Note - Corrected Sea Level Elev. of this<br>B.M. = 824.48 - See Page 55 of Book #54 |
| 294+50 |      | 11.1    | 10.8 ✓  |                                                                                     |
| v95    |      | 11.8    | 10.1 ✓  |                                                                                     |
| B.M.   | 8.00 | 21.90   | 12.10   | Center N. Headwall Conc. Culv. 295+89                                               |
| 296    |      |         | 13.90 ✓ |                                                                                     |
| 297    |      |         | 14.6    |                                                                                     |
| 297+30 |      |         | 11.4 ✓  |                                                                                     |
| 298    |      |         | 12.3    |                                                                                     |
| 298+39 |      |         | 13.7 ✓  |                                                                                     |
| 299    |      |         | 10.8    |                                                                                     |
| B.M.   | 1.00 | (26.00) | 15.2 ✓  |                                                                                     |
| 300    |      |         | 5.8     |                                                                                     |
| 1      |      |         | 20.2 ✓  |                                                                                     |
| 2      |      |         | 4.2     |                                                                                     |
| 3      |      |         | 21.8 ✓  |                                                                                     |
| 3+63   |      |         | 2.1     |                                                                                     |
| P.P.   | 0.37 | (36.94) | 22.9 ✓  |                                                                                     |
| 4      |      |         | 11.94   |                                                                                     |
| 5      |      |         | 25.00 ✓ |                                                                                     |
| 6      |      |         | 13.0    |                                                                                     |
| 7      |      |         | 23.9 ✓  |                                                                                     |
| 8      |      |         | 11.6    |                                                                                     |
| T.P.   | 1.09 | (48.36) | 25.3 ✓  |                                                                                     |
| 9+00   |      |         | 8.5     |                                                                                     |
| 309+39 |      |         | 28.4 ✓  |                                                                                     |
| 310    |      |         | 4.8     |                                                                                     |
| 311    |      |         | 32.1 ✓  |                                                                                     |
|        |      |         | 1.9     |                                                                                     |
|        |      |         | 35.0 ✓  |                                                                                     |
|        |      |         | 11.79   |                                                                                     |
|        |      |         | 36.57 ✓ |                                                                                     |
|        |      |         | 12.1    |                                                                                     |
|        |      |         | 36.3 ✓  |                                                                                     |
|        |      |         | 11.1    |                                                                                     |
|        |      |         | 37.3 ✓  |                                                                                     |
|        |      |         | 8.9     |                                                                                     |
|        |      |         | 39.5 ✓  |                                                                                     |
|        |      |         | 6.2     |                                                                                     |
|        |      |         | 42.2 ✓  |                                                                                     |
|        |      |         | 2.7     |                                                                                     |
|        |      |         | 45.7 ✓  |                                                                                     |
|        |      |         | 12.75   |                                                                                     |
|        |      |         | 47.27 ✓ |                                                                                     |
|        |      |         | 10.9    |                                                                                     |
|        |      |         | 49.1 ✓  |                                                                                     |
|        |      |         | 9.5     |                                                                                     |
|        |      |         | 50.5 ✓  |                                                                                     |
|        |      |         | 7.9     |                                                                                     |
|        |      |         | 52.1 ✓  |                                                                                     |
|        |      |         | 5.9     |                                                                                     |
|        |      |         | 54.1 ✓  |                                                                                     |
|        |      | 60.02   |         |                                                                                     |

Nail in Large Tree 20' Left of 300+00



|          |       |        |       |        |
|----------|-------|--------|-------|--------|
| 391      |       |        | 12.2  | 85.8   |
| 390      |       |        | 8.0   | 90.0   |
| 389      |       |        | 5.5   | 92.5   |
| 388      |       |        | 3.4   | 94.6   |
| T.P.     | 2.30  | 98.01  | 12.85 | 95.71  |
| 387      |       |        | 11.6  | 97.0   |
| 386      |       |        | 8.7   | 99.9   |
| 385      |       |        | 5.8   | 102.8  |
| 384      |       |        | 3.5   | 105.1  |
| 383      | 2.02  | 108.56 | 4.22  | 106.54 |
| 382      |       |        | 2.9   | 107.9  |
| 381 + 15 |       |        | 1.4   | 109.4  |
| 381      |       |        | 1.4   | 109.4  |
| 380      |       |        | 3.2   | 107.6  |
| 379      |       |        | 6.3   | 104.5  |
| 378      |       |        | 9.7   | 101.1  |
| T.P.     | 10.56 | 110.76 | 0.68  | 100.20 |
| 377      |       |        | 2.6   | 98.3   |
| 376      |       |        | 5.4   | 95.5   |
| 375      |       |        | 7.7   | 93.2   |
| T.P.     | 9.45  | 100.88 | 8.75  | 91.43  |
| 374      |       |        | 8.8   | 91.4   |
| 373      |       |        | 8.5   | 91.7   |
| 372      |       |        | 7.5   | 92.7   |
| 371      |       |        | 6.1   | 94.1   |
| 370      |       |        | 3.9   | 96.3   |
| B.M.     | 0.18  | 100.18 |       | 100.00 |

Nail in Cor, Post NW Cor Intersection

|        |       |        |                           |
|--------|-------|--------|---------------------------|
| 289+81 | 10.97 | 10.93✓ | E. end. High Truss Bridge |
| 290    | 10.9  | 11.00✓ |                           |
| 290+50 | 9.8   | 12.1✓  |                           |
| 291    | 6.1   | 15.8✓  |                           |
| 291+40 | 3.4   | 18.5✓  |                           |
| 292    | 2.4   | 19.5✓  |                           |
| 293    | 4.0   | 17.9✓  |                           |

21.90

|          |       |        |                                                   |
|----------|-------|--------|---------------------------------------------------|
| B.M.     | 7.70  | 78.46✓ | Center N. Headwall Conc. Culv. W. of Intersection |
| 396+22.4 | 9.9   | 76.3✓  |                                                   |
| 396      | 9.6   | 76.6✓  |                                                   |
| 395      | 8.6   | 77.6✓  |                                                   |
| 394      | 7.0   | 79.2✓  |                                                   |
| 393      | 5.2   | 81.0✓  |                                                   |
| 392      | 2.9   | 83.3✓  |                                                   |
| 1.1      | 0.86  | 86.46  |                                                   |
|          | 98.01 | 12.11  | 85.30✓                                            |



# Data for Filter Bed at Co. Poor Farm

Oct. 12, 1925 19  
F. B. Spencer  
Paul Turner

NE cor. of Bed 74' W. of S. Outlet.

|       |       |
|-------|-------|
| 4.36  | 98.74 |
| 5.75  | 97.35 |
| 6.1   | 97.0  |
| 13.46 | 89.64 |
| 4.2   | 98.9  |
| 4.3   | 98.8  |
| 4.42  | 98.68 |
| 4.4   | 98.7  |
| 4.6   | 98.5  |
| 4.36  | 98.74 |
| 4.5   | 98.6  |
| 4.33  | 98.77 |
| 4.31  | 98.79 |
| 4.2   | 98.9  |
| 4.10  | 99.1  |
| 4.23  | 98.87 |

|      |       |        |
|------|-------|--------|
| 6.17 | 96.93 | } 1.0% |
| 7.19 | 95.91 |        |
| 7.99 | 95.11 | } 0.8% |
| 8.20 | 94.90 |        |
|      |       | } 2.5% |
|      |       |        |

Gr. = SE. cor. Bed 190' from Sta. 2+13.  
Gr. 100' from Sta. 2+10  
Gr. at Sta. 2+13  
FL. 10" Tile Sta. 2+13  
Gr. 10' E. of NE. Cor. F. Bed.  
Gr. 10' N. of NE. Cor. " "  
Hub NE Cor. " "  
Gr. 10' E. of SW. Cor. " "  
Gr. 10' S. of SW. Cor. " "  
Hub at SE Cor. " "  
Ground 10' S. of SW. Cor. " "  
Ground 10' W. of SW. Cor. " "  
Hub S-W Corner " "  
Ground 10' W. of NW Cor. " "  
Ground 10' N. of NW Cor. " "  
Hub at N-W corner " "

|               |      |           |
|---------------|------|-----------|
| 5" Tile Sewer | 2+08 | Flow Line |
| 5" Tile       | 1+08 | Flow Line |
| 5" Tile Line  | 0+08 | " "       |
| 5" " OutLet   | 0+00 | " "       |

B.M. 3.10 103.10 100.00

X on S-W wing of I-B. Bridge

Sept. 19/1925  
E. B. Spencer  
Earl Mathews.

Washington Twp.  
Sec. 24 - T90N, R14W

A. H. Refshauge Land.

Survey of East 60 Ac. of  
South  $\frac{1}{2}$  of SW  $\frac{1}{4}$  Sec. 24-90-14

Nov. 3, 1925

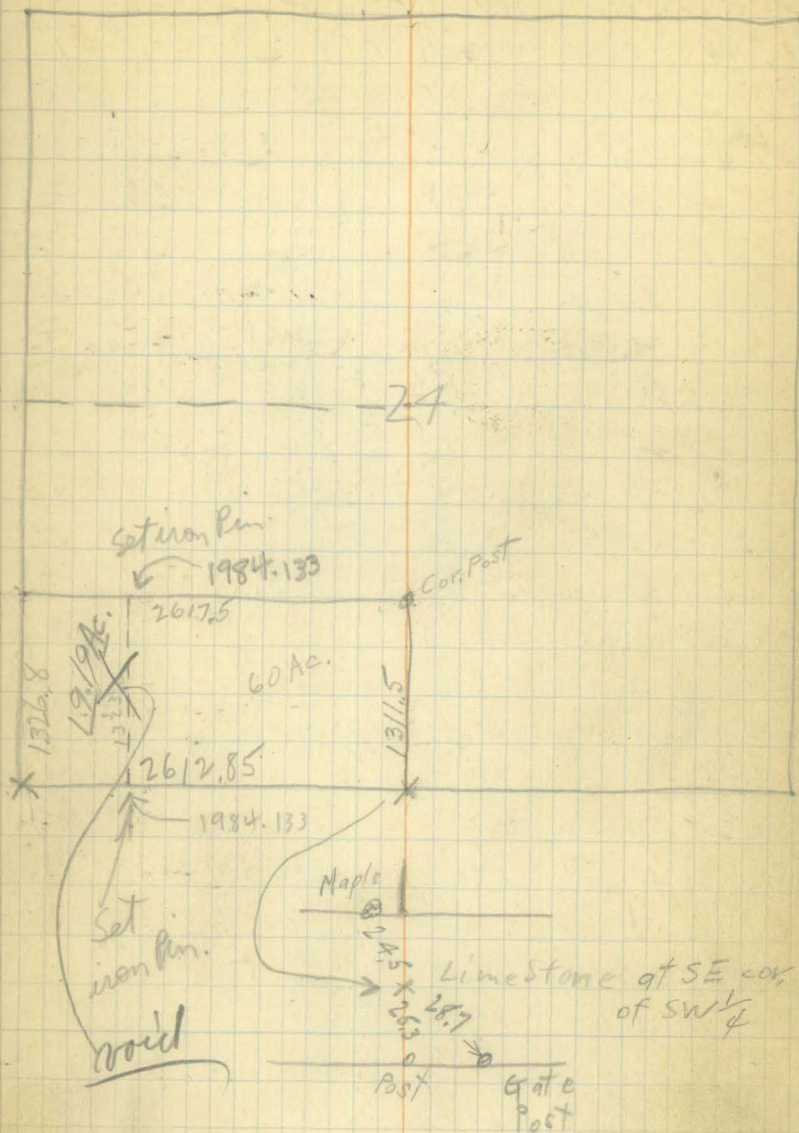
States were set on West Line  
of the 60 Acres for Fence.

E. B. Spencer  
Paul Turner

Note:

Mr. Fivash holds deed for West 20 Acres.

Mr. Johnson " " for all except the  
West 20 Acres.



79.19 Ac.



# Cedar Falls 4-9 Sec Levels on North Ditch Line

Sept. 23 1925  
W.D. Johnston  
E.B. Spencer

5.4

F.L. N. end of Culv.

#6 Ditch  
#5 Ditch  
#4 Ditch  
#3 Ditch  
#2 Ditch  
#1 Ditch

10.73

9.1

8.2

7.2

6.8

5.8

B.M. 0.40 104.00

100.00

6th. Pole W. of Culv. 2' from Pole

5th. Pole " " " " "

4th. Pole " " " " "

3rd. Pole " " " " "

2nd. Pole W. " " " " "

1st. Pole W. of Culv. " " " " "

Center N. Headwall

# Stadia of Co. Farm Drainage

#24 35°37' 170' 670'

#23 37°40' 135'

#22 28°52' 613'

#21 26°35' 544'

#20 29°34' 505'

#19 33°22' 845'

#18 34°35' 815'

#17 36°01' 588'

#16 38°27' 490'

#15 46°30' 388'

#14 37°12' 464'

#13 45°04' 389'

#12 47°55' 315'

#11 36°25' 301'

#10 59°28' 293'

#9 37°15' 242'

#8 50°18' 285'

#7 54°03' 280'

#6 62°23' 265'

#5 76°47' 283'

#4 90° 304'

#3 90° 285'

#2 124°41' 320'

#1 90°00' 275'

Δ 1/4 - 1/4 Corner

9482 Tile crosses Fence Oct. 12, 1925. 22

Cor. Post

N. Bank

N. Bank

W. Bank

W. Bank

Tile

Tile

Tile

Tile 5475

Tile Line

W. Bank 20' wide

W. Bank 20' wide

W. Bank 25' wide

Jet. with Stub to West

10" Tile Line

NE Cor. Pit & 5" Tile

5" Tile Outlet

W. Bank 20' wide

W. Bank 20' wide

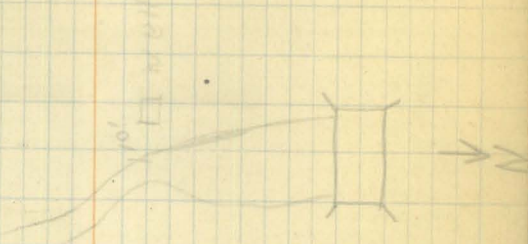
W. bank Stream 20' wide

End Br. - 100' to Fence Running N.

10" Tile Line

NW. Cor. of Pit 6x4 - 8' deep

& W. end I.B. Br. - 24'-6" E. to F. Abut.





## Co. Farm Tile

Oct. 15, 1925.

E. B. Spencer  
Paul Turner

|          |      |        |       |      |      |
|----------|------|--------|-------|------|------|
| 16+40    | 3.92 | 101.92 | 98.3  | 3.62 |      |
| 16+00    | 4.87 | 100.97 | 98.1  | 2.87 | 2.70 |
| 15+00    | 5.45 | 100.39 | 97.6  | 2.79 | 2.63 |
| 14+00    | 5.86 | 99.98  | 97.1  | 2.88 | 2.40 |
| 13+00    | 6.40 | 99.44  | 96.60 | 2.84 |      |
| 12+00    | 6.67 | 99.17  | 96.35 | 2.82 | 1.83 |
| 11+50    | 6.45 | 99.39  | 96.23 | 1.17 |      |
| 11+00    | 6.47 | 99.37  | 96.13 | 0.27 | 2.67 |
| 10+00    | 7.24 | 98.60  | 95.85 | 0.75 |      |
|          | 7.30 |        |       |      |      |
| B.M. +50 | 7.30 | 105.84 | 98.54 |      |      |

Relay Sta. 10+00  
to Sta. 15+50

Poor Farm Drainage  
Stadia

24

336°25' 385'

348°05' 108'

142°22' 770'

① #2

347°57' 227'

333°25' 193'

331°21' 500'

321°41' 592'

320°30' 735'

326°42' 735'

② #2

322°22' 770'

322°20' 775'

0°42' 610'

5°22' 542'

9°29' 490'

12°25' 440'

13°45' 413'

13°59' 377'

16°58' 313'

15°28' 287'

9°0' 248'

356°40' 219'

353°19' 202'

352°50' 133'

213°-22' 845'

Δ #1

Br. #2 Edge Corn

Br. #2 Crosses NYS. F.

Lane. 16' wide

Br. #2

Tile Br. #1

Tile Branch #2

Tile line Br. #1

Br. #1 Cross NYS. Fence

Br. #2 Cross E & W. Fence

Corn Post

Fence Line #1

" #1

" #1

Line #1

Line #1

Line #1

Line #1

Line #1

Line #1

Bend Line #1

Jct. #2

Jct. #1

1/4 - 1/4 Corner

Sta. 9+50 on Tile Line



275° 43' 673'  
 272° 40' 590'  
 269° 26' 547'  
 264° 15' 463'  
 261° 18' 420'  
 259° 51' 328'  
 262° 37' 290'  
 272° 47' 228'  
 296° 22' 101'  
 286° 20' 188'  
 278° 12' 485'  
 289° 17' 880'  
 288° 58' 740'  
 290° 11' 655'  
 290° 17' 609'  
 288° 41' 523'  
 287° 56' 460'  
 288° 40' 422'  
 309° 58' 192'  
 314° 28' 164'  
 312° 47' 136'  
 300° 50' 73'  
 267° 22' 35'

#1 AB  
 #1 AB  
 #1 AB

#1 AB  
 #1 AB

#1 AB

#1 AB

#1 AB

Br. #1 A

Br. #1 A (Jct) 2

Br. #1 A - Jct. End

Br. #1 A

Br. #1

Br. #1

Br. #1

Br. #1

Br. #1

Br. #1

Br. #1

Br. #1

Br. #1

Jct.

Line #1



Co. Road Tile East end

of Sec. 25-36 Black Hawk Twp.

Hudson to E.C. Road

Oct. 16, 1925  
E.B. Spencer  
Paul Turner

North side

Sta. 10+75 - Connect Field Tile - 15' Req.

|        |          |        |        |        |                                |
|--------|----------|--------|--------|--------|--------------------------------|
| 13+25  | 2.30     | 121.22 | 116.43 | 4.79 ✓ | End of Tile near X-Road        |
| 13     | 3.10     | 120.42 | 116.0  | 4.42 ✓ | 1 1/2 Sta. tenths.             |
| 12     | (123.52) | 117.90 | 114.3  | 3.60 ✓ |                                |
| 11     | 3.03     | 116.27 | 112.6  | 3.67 ✓ |                                |
| 10     | 4.56     | 114.74 | 110.9  | 3.84 ✓ |                                |
| 9      | 5.98     | 113.32 | 109.2  | 4.12 ✓ | 1 Sta. tenth                   |
| 8      | 7.68     | 111.62 | 107.5  | 4.12 ✓ | 3 Sta. tenths                  |
| 7      | 9.08     | 110.22 | 105.8  | 4.42 ✓ | 1 Sta. tenth                   |
| 6      | 11.42    | 107.88 | 104.6  | 3.78 ✓ |                                |
| 5      | (119.30) | 105.70 | 102.4  | 3.30 ✓ |                                |
| 4      |          | 104.07 | 100.7  | 3.37 ✓ |                                |
| 3      |          | 102.22 | 99.0   | 3.22 ✓ |                                |
| 2      |          | 100.66 | 97.3   | 3.36 ✓ |                                |
| 1      |          | 99.47  | 95.6   | 0.390  |                                |
| 0      |          | 99.39  | 95.3   | 4.09 ✓ | Outlet in Culvert              |
| F.L.N. |          | 13.00  | 95.29  |        |                                |
| B.M.   | 8.29     | 108.29 | 100.00 |        | Center N. Headwall Conc. Culv. |

Tile to be 13' from E Road



Co. Road Tile East end of  
South Side  
Hudson - Eagle Center Road

B.M. 6.03 99.99  
T.P. 1.96 106.22 11.37 104.06 N4+00

T.P. 2.38 115.43 10.47 113.05 5.94  
B.M. +0.96 124.48

13+25 1.95 121.57 116.53  
13 3.21 120.31 116.10

T.P. 5.50 123.52 1.28 118.02  
12 1.28 118.02 114.4

11 3.08 116.22 112.7  
10 4.72 114.58 111.0

9 6.24 113.06 109.3  
8 7.79 111.51 107.6

7 9.20 110.10 105.9  
6 11.39 107.91 104.2

T.P. 11.42 119.30 0.41 107.88  
5 2.61 105.68 102.5

4 4.31 103.98 100.80  
3 6.20 102.09 99.1

2 7.80 100.49 97.4  
1 8.86 99.43 95.70

0+00 8.88 99.41 95.40  
F.L.S. 12.90 95.39

B.M. 108.29

Sec. 25-36 Black Hawk Twp. 27

Oct. 16/1925  
E.B. Spencer  
Paul Turner

Center N. Headwall Sta. 0+00

Center W. Headwall Conc. Culv.

5.04 ✓ End of Tile W. of Road Intersection  
4.21 ✓ 3 Sta. ten tho

3.62 ✓  
3.52 ✓  
3.58 ✓  
3.76 ✓  
3.91 ✓  
4.20 ✓  
3.71 ✓

1 Sta. tenth  
over depth

3.18 ✓  
3.18 ✓  
2.99 ✓  
3.09 ✓  
3.73 ✓  
4.01 ✓

Outlet in Culvert

1.70 %

0.37 %

Tile to be 13' from E Road.



Gr.

$$\begin{array}{r} 1.2670 \\ 63 \\ \hline 1.84 \end{array}$$

East

West

965.00 4.76 4.90

4.90 4.90

965.00 4.97 4.90

4.94 4.90

965.18 4.76 4.72

4.72 4.72

East

West

984.00

5.26

5.20

5.15

5.15

4.96

East

West

988.00

5.55 5.40

5.42 5.40

988.00

5.18 5.30

5.03 5.20

988.36

4.65 4.80

4.85 4.80

974.98

4.62 4.61

974.55

4.96 5.04

974.5

5.43 5.19

~~446+94~~  
~~445+44~~
~~424+62~~
~~423+57~~
~~422+52~~
~~372+39~~
~~371+35~~
~~330+10~~
~~329~~
~~328+02~~
~~218+67~~
~~218+07~~
~~217+47~~



Oct. 21, 1925

Co. Poor Farm  
Filter Bed Tile  
5" Line

E. B. Spencer 98.24  
Paul Turner 97.77

|           |      |        |       |      |
|-----------|------|--------|-------|------|
| 2+00      | 5.05 | 98.85  | 97.54 | 1.31 |
| 1+00      | 4.05 | 99.85  | 97.66 | 2.19 |
| 0+00      | 3.06 | 100.84 | 97.77 | 3.07 |
| Top of 5" | 5.66 | 98.24  |       |      |

|      |      |       |       |      |
|------|------|-------|-------|------|
| D+26 | 8.43 | 95.47 | 94.57 | 0.90 |
| C+26 | 8.50 | 95.40 | 94.56 | 0.84 |
| B+26 | 8.61 | 95.29 | 94.54 | 0.75 |
| A+26 | 8.65 | 95.25 | 94.53 | 0.72 |

|     |      |       |       |      |
|-----|------|-------|-------|------|
| D 0 | 8.59 | 95.31 | 94.53 | 0.78 |
| C 0 | 8.81 | 95.09 | 94.52 | 0.57 |
| B 0 | 8.85 | 95.05 | 94.50 | 0.55 |
| A 0 | 8.92 | 94.98 | 94.49 | 0.49 |

## 6" Out let Line

|        |      |       |       |      |
|--------|------|-------|-------|------|
| 2+16.5 | 5.03 | 98.87 | 94.54 | 4.33 |
| 1+95   | 5.13 | 98.77 | 94.48 | 4.29 |
| 1+73   | 5.36 | 98.54 | 94.26 | 4.28 |
| 1+00   | 6.47 | 97.43 | 93.53 | 3.90 |
| 0+15   | 6.80 | 97.10 | 92.68 | 4.42 |
| 0+00   | 7.00 | 96.90 | 89.31 | 7.59 |

B.M. 390 10390

100.00

End of SW Wing IB Bridge



Final X-Sec.  
Engel Pit  
Stripping

30

Oct. 21, 1925  
E. B. Spencer  
Paul Turner

N-E Cor.  
Extra

$$68 \times 15 \times 1.3 = 49.1 \text{ Cu. Yds.}$$

27

1102.1

1151.2 Cu. Yds Total Exc.  
10.0 Lumps

1161.2

|       |      |      |      |      |      |      |      |
|-------|------|------|------|------|------|------|------|
| 96.3  | 95.3 | 96.1 | 96.3 | 96.7 | 97.4 | 96.3 | 97.3 |
| 8.3   | 9.3  | 8.5  | 8.3  | 7.9  | 7.2  | 8.3  | 7.3  |
| 16.8  | 95.9 | 96.3 | 97.1 | 96.8 | 96.5 | 96.2 | 95.8 |
| 7.8   | 4.7  | 8.3  | 7.2  | 7.8  | 8.1  | 8.4  | 9.6  |
| 98.2  | 97.0 | 96.8 | 97.7 | 98.6 | 98.2 | 98.8 | 98.9 |
| 6.4   | 7.6  | 7.8  | 6.9  | 6.0  | 6.4  | 5.8  | 5.7  |
| 98.6  | 97.3 | 97.8 | 98.6 | 99.0 | 98.6 | 98.3 | 98.5 |
| 6.0   | 7.3  | 6.8  | 6.0  | 5.6  | 6.8  | 6.5  | 6.1  |
| 99.0  | 98.0 | 98.6 | 99.1 | 99.3 | 98.8 | 98.6 | 98.1 |
| 5.6   | 6.6  | 6.0  | 5.5  | 5.3  | 5.8  | 6.0  | 6.5  |
| 99.9  | 99.9 | 98.6 | 99.1 | 99.5 | 99.5 | 99.1 | 98.5 |
| 4.7   | 4.7  | 6.0  | 5.5  | 5.1  | 5.1  | 5.5  | 6.7  |
| 100.1 | 99.3 | 98.9 | 99.2 | 98.7 | 98.5 | 99.8 | 98.1 |
| 4.5   | 5.3  | 5.7  | 5.4  | 5.9  | 6.1  | 4.8  | 6.5  |
| 0     | 8    | 30   | 70   | 100  | 120  | 132  | 115  |
|       |      |      |      |      |      |      | 125  |
|       |      |      |      |      |      |      | 130  |
|       |      |      |      |      |      |      | 131  |

Gas Pipe S-W. Cor. Pit  
" " S-E Cor. Pit

2+45

2+17

2

1+45

1+30

1

0+50

0+08 = SW Cor. Pit  
B.M. 4.31 104.62

100.31  
100.00



Right

485+92  
 485+22  
 484+52  
 484  
~~483+50~~  
 483+12

952.64  
 951.84  
 951.66  
 951.99  
~~952.74~~  
 953.57

4.18

4.84

5.14

4.78

3.50

4.15

4.95

5.13

4.80

3.22

Left

486+17  
 485+50  
 485+07  
 484+50  
 483+97

952.96  
 952.12  
 951.71  
 951.66  
~~952.02~~

4.06

4.77

5.12

5.20

4.80

3.83

4.67

5.08

5.03

4.77

~~Left~~  
 Out

486+17  
 485+07  
 483+97

952.95  
 951.71  
 952.02

Right

Out

485+92  
 484+52  
 483+12

952.64  
 951.66  
 952.57



$$\text{culv}_1 = 578 + 56$$

$$\text{Left} = 170'$$

579+51

579

578+50

577+81

936.90

936.07

935.66

935.80

4.08

4.80

5.24

4.96

3.81

4.64

5.05

4.91

Left

535+34

~~534+84~~

534+34

945.50

945.50

945.63

5.59

5.40

5.21

5.30

5.30

5.17

Right

535+34

~~534+84~~

534+34

945.50

945.50

945.63

5.31

5.18

5.09

5.30

5.30

5.17

$$\text{Left} \& \text{Right} = 1.259 \text{ G.R. East}$$

492+53

491+53

4.30

5.7

West

4.55

6.00

4.48

5.74



Right-120

579+01  
578+75  
578+50  
578+16  
577+81

936.08  
935.85  
935.66  
935.72  
935.80

|      |      |
|------|------|
| 4.65 | 4.63 |
| 4.94 | 4.86 |
| 4.91 | 5.05 |
| 4.86 | 4.99 |
| 4.68 | 4.91 |

Right=120'

579+01  
578+50  
577+81

936.08  
935.66  
935.80

# County Road Hudson - E.C. Road

Tile  
+ Cor. of Sec. { 25-26  
35-36

Oct. 22, 1925  
E. B. Spencer  
Paul Turner

|       |       |        |        |        |        |
|-------|-------|--------|--------|--------|--------|
| B.M.  |       | 1028   | 99.98  |        |        |
| B6+50 |       | 3.08   | 107.18 | 103.38 | 3.80 ✓ |
| B6    |       | 3.46   | 106.80 | 102.80 | 4.00 ✓ |
| B5    |       | 4.70   | 105.56 | 101.64 | 3.92 ✓ |
| B4    |       | 5.10   | 105.16 | 100.48 | 4.68 ✓ |
| B3    |       | 6.15   | 104.11 | 99.32  | 4.79 ✓ |
| T.P.  | 8.53  | 110.26 | 5.04   | 101.73 |        |
| B2    |       |        | 5.04   | 101.73 | 99.16  |
| B1    |       |        | 6.80   | 99.97  | 97.0   |
| B0+00 |       |        | 6.54   | 100.23 | 96.4   |
| F.L.  |       |        | 10.4   | 96.37  |        |
|       |       | 106.77 |        |        |        |
| A7    |       |        | 4.03   | 116.96 | 112.8  |
| A6    |       |        | 3.46   | 113.47 | 109.88 |
| A5    |       |        | 7.00   | 109.93 | 106.96 |
| A4    |       |        | 10.05  | 106.88 | 104.04 |
| A3    | 12.53 | 116.93 | 2.37   | 104.40 | 101.12 |
| A2    |       |        | 4.78   | 101.99 | 98.2   |
| A1    |       |        | 6.29   | 100.48 | 97.3   |
| A0+00 |       |        | 6.49   | 100.28 | 96.4   |
| F.L.  |       |        | 10.4   | 96.37  |        |
|       | 6.77  | 106.77 |        | 100.00 |        |

Sta. B3 to Sta. B4 =  
100 ft. of Road Crossing.

Tile to be  
on South side  
of Highway  
approx 13' from 4

Center North Headwall Culv.



P. Road #57  
P. R. Proj. #331  
Right

|        |        |
|--------|--------|
| 101+87 | 953.11 |
| 101+77 | 953.00 |
| 101+47 | 952.71 |
| 101+17 | 952.62 |
| 100+87 | 952.60 |
| 100+57 | 952.68 |
| 100+27 | 952.91 |
| 99+97  | 953.19 |

• Culv. 101+12

Left

|        |        |
|--------|--------|
| 101+72 | 952.96 |
| 101+42 | 952.72 |
| 101+12 | 952.62 |
| 100+82 | 952.62 |
| 100+52 | 952.69 |
| 100+32 | 952.65 |

Both sides - 130' Each

|       |        |
|-------|--------|
| 74+54 | 965.12 |
| 74    | 965.48 |
| 73+50 | 966.00 |
| 73+24 | 966.38 |

|      |      |      |
|------|------|------|
| 5.65 | 4.40 | 4.44 |
| 5.70 | 4.52 | 4.55 |
| 5.05 | 4.78 | 4.84 |
| 5.53 | 5.07 | 4.93 |
| 5.37 | 5.01 | 4.95 |
| 5.10 | 4.81 | 4.87 |
| 4.66 | 4.50 | 4.64 |
| 3.82 | 4.22 | 4.36 |

|      |      |
|------|------|
| 5.45 | 5.10 |
| 5.55 | 5.34 |
| 5.36 | 5.44 |
| 5.40 | 5.44 |
| 5.20 | 5.37 |
| 5.00 | 5.21 |

| East | West |
|------|------|
| 5.60 | 5.49 |
| 5.28 | 5.32 |
| 4.74 | 4.60 |
| 4.48 | 4.21 |



Right and Left

174+61  
174+06  
173+66  
173+11  
172+61

± C.W.

917.41  
917.13  
917.00  
917.00  
917.00

Left

442  
439  
448  
489  
479

~~417~~  
~~456~~  
~~458~~  
~~458~~  
~~458~~

4.28  
4.56  
4.68  
4.69  
4.69

Right

155+2v  
154+47  
153+72

953.80  
953.81  
954.01

Left

154+87  
154+47  
154+07

± C.W.

953.80  
953.81  
953.87

5.02

4.98  
4.97  
4.77

5.08  
4.97  
4.89

4.98  
4.97  
4.91

Right and Left

110'-  
128+96  
128+47  
127+86

128+41

975.79  
975.68  
975.57

Right

5.08  
5.52  
5.67

Gr.

5.18  
5.29  
5.40

Left

5.33  
5.13  
5.26



Level  
249+

Right = 40'

889.00  
889.00

Level  
248+

Left = 80'

889.00  
889.00  
889.00

Left

208+35  
207+95  
207+55

905.00  
905.00  
905.00

Right

208+55  
207+95  
207+55

905.00  
905.00  
905.00

Left

Right  
5.60  
5.20

6.06

5.41

5.18

5.20

5.20

5.18

5.10

5.00

5.14

5.25

5.28

4.95

5.15

5.03

5.16

5.19

4.85

4.97

4.98

4.98

4.98

4.98

4.98

4.98

4.98

$$\begin{array}{r} 45 \\ 21 \\ \hline 66 \end{array}$$

~~Left and Right~~

~~268+34~~

~~269+54  
269+29  
268+79  
268+29  
267+79  
267+29~~

~~911.84  
911.45  
910.79  
910.48  
910.45  
910.12~~

~~Left~~

~~3.72~~

~~3.72  
4.11  
4.67  
5.09  
5.22  
4.90~~

~~Right~~

~~3.75~~

~~3.83  
4.22  
4.88  
5.19  
5.22  
5.05~~

~~3.75  
4.15  
4.92  
5.15  
5.46  
5.15~~



# Prop. Tile Line Poor Farm

1.96 100.00  
5.70 101.96 3.85 96.26

Nov. 5, 1925

Spencer  
Turner

| Hole      |      |        |              |
|-----------|------|--------|--------------|
|           | 7.7  |        |              |
| 0         | 8.0  | 92.11  | ✓            |
| 1         | 6.63 | 93.48  | ✓            |
| 2         | 5.92 | 94.19  | ✓            |
| 3         | 5.19 | 94.92  | ✓            |
| 4         | 5.20 | 94.91  | ✓            |
| 5         | 5.09 | 95.02  | ✓            |
| 6         | 4.51 | 95.60  | ✓            |
|           | 4.09 | 96.02  | ✓            |
|           | 3.86 | 100.11 | 4.89 96.25 ✓ |
| 7         |      | 4.89   | 96.25 ✓      |
| 8         |      | 4.76   | 96.38 ✓      |
| 9         |      | 4.98   | 96.16 ✓      |
| 10        |      | 5.49   | 95.65 ✓      |
| 11        |      | 4.72   | 96.42 ✓      |
| 11 + 74.3 |      | 0.87   | 100.27 ✓     |
| 11 + 94.3 |      | 0.88   | 100.26 ✓     |
| 12 + 25   |      | 4.02   | 97.12 ✓      |
| 13        |      | 3.84   | 97.30 ✓      |
| 13 + 92   |      | 3.13   | 98.01 ✓      |

Hole at Corner Water 0.7 deep

at Fence

10' East of N&S. Fence - 169' N. of E&W. Fence

Wheel Guard

Water 4' Deep

" Guard

95.3 Elev. Water

-2.80 = 95.21 = F.L. of 5" Tile

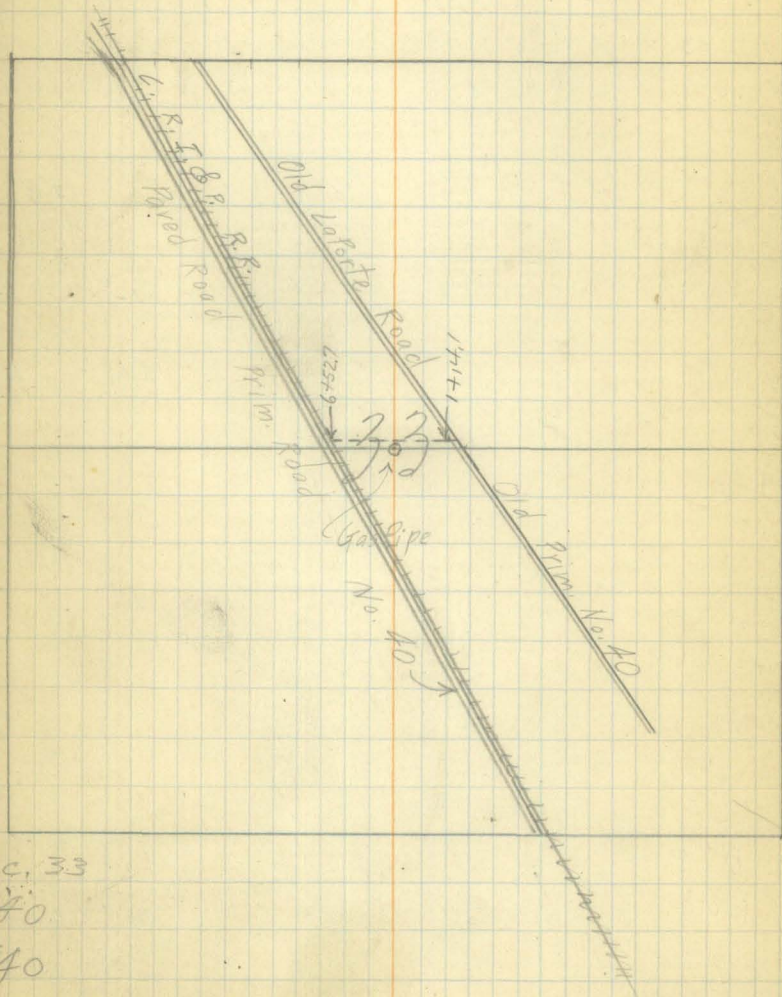
B.M. 1.14 101.14 100.00

on End of S-W

Survey of  
Township Road to be  
40' in width—

Starting on the East Line  
of the Old Prim. Road No. 40  
thence West to the East  
R. of W. Line of the new  
Prim. Rd. No. 40 and to be on  
the North side of the South  
Line of North 1/2 of Sec. 33.

Sec. 33 - T88N - R12W.  
Cedar Twp.



7+34 E. Paving  
6+99 West R. I. Fence  
6+64.4 E. R. I. Track  
6+30.0 East. Fence R. I.  
4+44.0 Corner Post Gas Pipe - Sec. 33  
0+83.3 West side Old La Porte Rd. - P. 40  
0+00 East side Old La Porte Rd. - P. 40



Hole

103.27

92.11

3.22

Nov. 13, 1925

B. M.

10000

42

Sta. 0+00

See Page 43

→ 15%

~~Sto~~  $12 + 08$

$$\begin{array}{r}
 94 \\
 2.32 \overline{) 2.20} \\
 \underline{2.20} \\
 0.00 \\
 1120 \\
 928 \\
 \underline{192}
 \end{array}$$

$$\begin{array}{r}
 95.55 \\
 2.4 \overline{) 95.55} \\
 \underline{95.55} \\
 0.00 \\
 40 \\
 24 \\
 \underline{160}
 \end{array}$$

$$\begin{array}{r}
 91 \\
 32 \overline{) 91} \\
 \underline{182} \\
 273 \\
 \underline{291} \\
 2
 \end{array}$$

H. I. = 100.25 Open Ditch - Poor Farm

Red

|      |   |   |                     |
|------|---|---|---------------------|
| 7.55 | ✓ | 0 | = S. end Open Ditch |
| 7.34 | ✓ | 1 |                     |
| 7.13 | ✓ | 2 |                     |
| 6.92 | ✓ | 3 |                     |
| 6.71 | ✓ | 4 |                     |
| 6.50 | ✓ | 5 |                     |
| 6.29 | ✓ | 6 |                     |
| 6.08 | ✓ | 7 |                     |
| 5.87 | ✓ | 8 |                     |
| 5.66 | ✓ | 9 |                     |

$$\begin{array}{r}
 14+17 \\
 13+90 \\
 13+75 \\
 13+00 \\
 12+40 \\
 12+08 \\
 B.M. 347 \quad 103.47 \\
 100.00
 \end{array}$$

$$\begin{array}{r}
 4.48 \quad 98.99 \quad 95.82 \quad 3.17 \\
 4.51 \quad 98.96 \\
 4.66 \quad 98.81 \\
 5.25 \quad 98.22 \\
 5.44 \quad 98.03 \\
 5.44 \quad 99.03 \quad 92.81 \quad 5.22 \checkmark \\
 100.00
 \end{array}$$



## Poor Farm Tile

See Page 41

|       |      |       |       |      |
|-------|------|-------|-------|------|
| 6     |      | 95.51 | 92.95 | 2.61 |
| 7     | 5.80 | 93.56 | 93.00 | 2.56 |
| 8     | 5.69 | 95.67 | 93.16 | 2.57 |
| 9     | 6.40 | 94.96 | 93.20 | 1.76 |
| 10    | 6.21 | 95.15 | 93.30 | 1.85 |
| 11+00 | 4.95 | 96.41 | 93.50 | 2.91 |
| 11+70 | 3.83 | 97.53 | 93.65 | 3.89 |
| 12+13 | 2.34 | 99.02 | 93.75 | 5.29 |
| 13    | 3.16 | 98.20 | 94.50 | 3.62 |
| 14    | 2.49 | 98.87 | 95.50 | 3.32 |
| 14+42 | 2.10 | 99.26 | 95.90 | 3.31 |

B.M. 136 10/36 100.00

# Revised Profile Raymond Road

Nov. 25, 1925

E. B. Spencer

Paul Turner

|         |     |      |
|---------|-----|------|
| 46      | 2.3 | 95.2 |
| 45      | 4.4 | 93.1 |
| 44      | 5.2 | 92.3 |
| 43 + 46 | 5.4 | 92.1 |
| 43      | 6.3 | 91.2 |
| 42      | 6.3 | 91.2 |

897.5

|         |     |      |
|---------|-----|------|
| 29 + 21 | 4.8 | 81.4 |
| 29      | 5.6 | 80.6 |
| 28      | 4.7 | 81.5 |
| 27      | 3.9 | 82.3 |
| 26      | 4.9 | 81.3 |
| 25      | 5.6 | 80.6 |
| 24      | 7.0 | 79.2 |
| 23      | 7.1 | 79.1 |
| 22      | 6.5 | 79.7 |
| 21 + 46 | 6.1 | 80.1 |

B.M. #2 4.27 886.24

881.97

X on East Headwall 21 + 46



# Revised Profile Raymond Road

Nov. 25, 1925.

|       |                     |        |
|-------|---------------------|--------|
| 51    | 14.9                | 921.8  |
| 52    | 9.7                 | 27.0   |
| 53    | 6.0                 | 30.7   |
| 53+50 | 5.1                 | 31.6   |
| 54    | 5.7                 | 31.0   |
| 55    | 8.2                 | 28.5   |
| 55+50 | 10.4                | 26.3   |
| T.P.  | 11.15 (936.70) 0.25 | 925.55 |
| 56    | 2.0                 | 23.8   |
| 57    | 4.6                 | 21.2   |
| 58    | 5.4                 | 20.4   |
| 59    | 5.8                 | 20.0   |
| 59+13 | 5.7                 | 20.1   |
| 60    | 5.4                 | 20.4   |
| 61    | 3.9                 | 21.9   |

925.8

$$\begin{array}{r} 1225 \\ 903 \\ \hline 2128 \end{array}$$

903.00

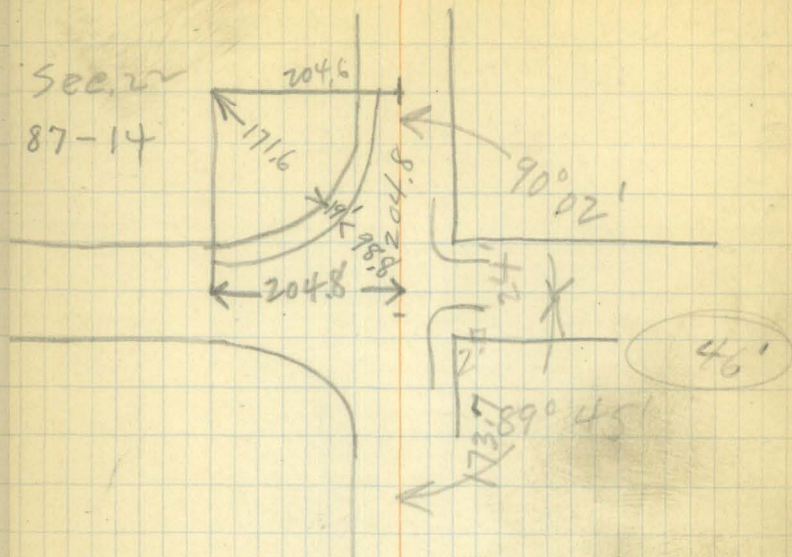
30.05

46.2

35.0

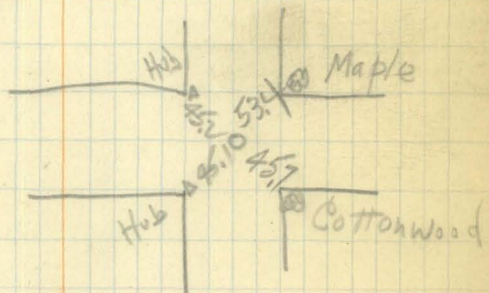
1225

Sec. 2  
87-14



Length = 321.6

Rad. = 204.6



P.I.  
Sta. 320 + 08.4



Waterloo - Raymond Road.  
Secondary System.

Preliminary X-Sections & Profile.

Cloudy J.S.C. 47  
Spitting C.J.C. +  
& Snow. A.H.B. 2 P.M.  
2/8/26

10

4.6  
53.6

9

4.5  
53.7

8

4.38 858.21 5.92 853.83

5.9  
53.9

8

7

5.6  
54.2

6

5.6  
54.2

5

5.3  
54.5

4

5.1  
54.7

3

5.0  
54.8

2

5.5  
54.3

1

6.2  
53.6

0

5.66 Conc. Header at End of  
54.14 Asphalt pavement.

B.M. #1 Sta. 0-40

6.12 853.63

Spk. in tel. pole Rt. 5" above ground

0+00 End of pavement at E. City L. W'oo.

2.82 859.75

856.93

Top of rail WC. Ft N. at E. Maywood Road.

2.83 859.76

856.93

22

$$\begin{array}{r} 5.2 \\ \hline 51.5 \end{array}$$

21

$$\begin{array}{r} 5.4 \\ \hline 51.3 \end{array}$$

20

$$\begin{array}{r} 5.4 \\ \hline 51.3 \end{array}$$

19

BM. #2

↑

4.70

852.09

0

4.50

856.69

6.02

852.19

+54.6

L.Lt.

18

17+78

River Road South

17

16

15

14

13

12

11

858.21

Tel.  
Spk. in pole #117 Left Sta. 19+50

$$\begin{array}{r} 4.7 \\ \hline 52.0 \end{array}$$

$$\begin{array}{r} 6.1 \\ \hline 52.1 \end{array}$$

$$\begin{array}{r} 6.2 \\ \hline 52.0 \end{array}$$

$$\begin{array}{r} 6.2 \\ \hline 100 \end{array}$$

$$\begin{array}{r} 6.7 \\ \hline 51.5 \end{array}$$

$$\begin{array}{r} 6.6 \\ \hline 51.6 \end{array}$$

$$\begin{array}{r} 6.2 \\ \hline 52.0 \end{array}$$

$$\begin{array}{r} 5.5 \\ \hline 52.7 \end{array}$$

$$\begin{array}{r} 5.3 \\ \hline 52.9 \end{array}$$

$$\begin{array}{r} 5.0 \\ \hline 53.2 \end{array}$$

$$\begin{array}{r} 4.0 \\ \hline 53.3 \end{array}$$
 in Ditch



4.30 C.W. at fence  
 3.68 Conc. W. at  
 School steps

B.M. #3 2.36 857.86 3.10 855.50  
 W.C.F. & N. Kails on Evans Road

6K. in pole #5613 Y8 Lt. Sta.  
 858.76  
 3.30 858.61  
 3.45

32+61.8 L at Stone Evans Rd.

5.8 4.8 5.6  
 200 100 53.0  
 52.8 53.8 5.4  
 53.2

32

31

5.3  
 53.3

30

5.0  
 53.6

29

4.9  
 53.7

28

4.9  
 53.7

0

5.37 858.60 3.46 853.23

27

856.69

3.4  
 53.3

26

4.0  
 52.7

25

4.3  
 52.4

24

5.1  
 51.6

23

856.69

5.5  
 51.2

$$\begin{array}{r} 854.87 \\ 108.50 \\ \hline 746.37 \\ 103.36 \\ \hline 849.73 \end{array}$$

Continued on page 57

+543

High rail W.C.F. & N. Cedar Rapids inc

$$\begin{array}{r} 854.87 \\ 3.15 \\ \hline \end{array}$$

37

$$\begin{array}{cccccccccccc} 3.2 & 3.8 & 5.1 & 5.5 & 4.8 & 5.0 & 5.1 & 5.0 & 5.6 & 5.7 & 6.1 \\ 32 & 26 & 22 & 18 & 15 & 12 & 10 & 16 & 16 & 30 & 33 \\ 54.4 & 54.2 & 52.9 & 52.5 & 53.2 & 53.0 & 52.9 & 53.0 & 52.4 & 52.3 & 51.9 \end{array}$$

36

$$\begin{array}{cccccccccccc} 5.9 & 5.9 & 6.5 & 6.7 & 6.2 & 5.7 & 6.3 & 6.5 & 7.2 & 6.7 & 6.1 & 6.1 \\ 33 & 24 & 23 & 22 & 18 & 15 & 18 & 23 & 27 & 30 & 33 \\ 52.1 & 52.1 & 51.5 & 51.3 & 51.8 & 52.3 & 51.7 & 51.2 & 50.8 & 51.3 & 51.9 & 51.9 \end{array}$$

35

$$\begin{array}{cccccccccccc} 6.1 & 6.1 & 6.4 & 6.0 & 5.3 & 6.1 & 7.0 & 6.0 & 5.8 & 5.6 & 5.2 \\ 33 & 29 & 27 & 18 & 16 & 16 & 18 & 21 & 24 & 30 & 33 \\ 51.9 & 51.9 & 51.4 & 52.0 & 52.7 & 51.9 & 51.0 & 51.2 & 52.5 & 52.9 & 52.8 \end{array}$$

34

$$\begin{array}{cccccccccccc} 4.6 & 4.8 & 5.6 & 5.6 & 5.4 & 5.5 & 6.2 & 6.3 & 4.8 & 4.7 & 4.9 \\ 33 & 30 & 23 & 18 & 15 & 18 & 22 & 21 & 30 & 33 \\ 53.2 & 53.2 & 52.2 & 52.4 & 52.6 & 52.5 & 51.8 & 51.8 & 53.2 & 53.3 & 53.1 \end{array}$$

33

85802

$$\begin{array}{cccccccccccc} 3.9 & 4.6 & 4.9 & 5.1 & 5.2 & 4.9 & 4.9 & 5.1 & 4.7 & 4.9 & Level \\ 33 & 27 & 23 & 21 & 18 & 16 & 15 & 9 & 28 & 30 & 33 \\ 53.4 & 53.1 & 52.9 & 52.8 & 53.1 & 53.1 & 52.9 & 52.8 & 53.1 & 53.1 & 53.1 \end{array}$$



# ± Levels + Drain Investigation on Wloo.-Raymond Rd. J.S. Carpenter 51 C.J. Cavanaugh A.H. Beaumont 2/6/26 P.M. Windy + thawing

45 111.73 105.3  
6.4  
105.9  
5.8

44 106.1  
5.6

43 106.4  
5.3

42 106.3  
5.4

41 106.5  
5.2

40 106.9  
4.8

39 107.3  
4.4

38 108.50 High Rail  
W.C.F.V.

37+54.3 3.23 111.73✓

Check Levels Sta. 0+00 - Sta. 32+61.8

B.M. #3 3.15 858.65 855.50

" #2 5.57 857.59 6.63 852.02

0 5.93 859.82 3.70 853.89

~~2.8~~ 6.15 853.67

2.83 856.99

+04 3x3 Cmc Culv. 24 Rdwy.

58

8.30

F.L. Culvert.

57

56

55

Last 5pk.

54

53

52

51

50

49

47+75

0

11.53

109.34

6.92

104.81

48

47

46

111.73

$$\begin{array}{r} 100.7 \\ 8.6 \\ \hline 110 \end{array}$$

101.04

$$\begin{array}{r} 8.30 FL \\ 15.5 \\ \hline \end{array}$$

$$\begin{array}{r} 102.0 \\ 7.3 \\ \hline 33 \end{array}$$

$$\begin{array}{r} 105.0 \\ 4.3 \\ \hline \end{array}$$

104.2

5.1

104.2

5.1

104.3

5.0

$$\begin{array}{r} 101.8 \\ 7.5 \\ \hline 110 \end{array}$$

$$\begin{array}{r} 102.5 \\ 6.8 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 104.3 \\ 5.0 \\ \hline \end{array}$$

$$\begin{array}{r} 101.6 \\ 7.7 \\ \hline 25 \end{array}$$

$$\begin{array}{r} 104.3 \\ 5.0 \\ \hline \end{array}$$

$$\begin{array}{r} 105.0 \\ 4.3 \\ \hline \end{array}$$

$$\begin{array}{r} 105.2 \\ 4.1 \\ \hline \end{array}$$

$$\begin{array}{r} 105.4 \\ 3.9 \\ \hline \end{array}$$

$$\begin{array}{r} 105.1 \\ 4.2 \\ \hline \end{array}$$

$$\begin{array}{r} 102.1 \\ 7.2 \\ \hline 35 \end{array}$$

$$\begin{array}{r} 102.3 \\ 7.0 \\ \hline 35 \end{array}$$

104.8

6.9

104.8

6.9

105.3

6.4

100.48

$$\begin{array}{r} 8.86 \\ 10.5 \\ \hline \end{array}$$

$$\begin{array}{r} 101.4 \\ 7.9 \\ \hline 25 \end{array}$$

$$\begin{array}{r} 101.3 \\ 8.0 \\ \hline 50 \end{array}$$



71

70

69

68

67 Break in Grade

66

65

64

63

62

61

60

59

B.M. #4

5.29

110.14

4.49

104.85

109.34

3.24

106.10

105.9

4.2

105.9

4.2

105.8

4.3

104.7

Ditch  $\frac{5.4}{20}$ 

106.0

4.1

104.4

 $\frac{5.2}{20}$  Ditch

103.2

Ditch  $\frac{6.9}{20}$ 

106.6

3.5

100.9

 $\frac{9.2}{20}$  Ditch

101.4

Ditch  $\frac{8.7}{20}$ 

105.1

5.0

102.4

 $\frac{7.7}{20}$  Ditch

104.3

5.8

104.4

5.7

104.5

5.6

104.8

5.3

105.0

5.1

104.8

4.5

 $\frac{102.4}{2.5}$ 

101.7

2.00

103.9

5.4

x in Center of SW. headwall. Conc. Culv. Sta. 58+04

85

84

83

82

81

80

80

79

78

77

76

75

74

73

72

72

6.97 110.05 ✓ 6.28 103.08 ✓

4.12 109.36 ✓ 4.90 105.24 ✓

170.14 ✓

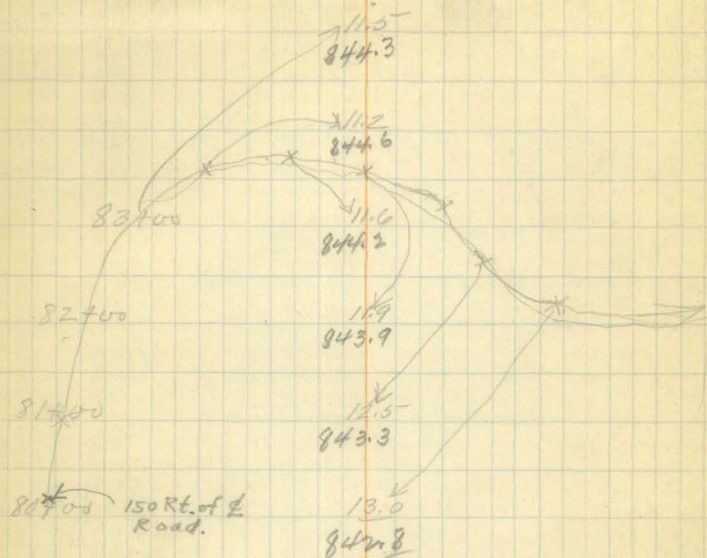
104.4  
5.6104.4  
5.6104.4  
5.6104.5  
5.5103.9  
6.1100.9  
8.5  
Ditch 20103.2  
6.2102.4  
7.0102.2  
7.2102.6  
6.8103.6  
5.8104.9  
4.5105.8  
3.6105.5  
3.9105.2  
4.9100.5  
8.9  
Ditch 20



|    |        |        |      |        |                     |
|----|--------|--------|------|--------|---------------------|
| 99 | 108.59 |        |      |        | 102.9<br><u>5.7</u> |
| 98 |        |        |      |        | 102.5<br><u>6.1</u> |
| 97 |        |        |      |        | 102.3<br><u>6.3</u> |
|    | 6.57   | 108.59 | 5.03 | 102.02 |                     |
| 96 |        | 107.05 |      |        | 102.1<br><u>5.0</u> |
| 95 |        |        |      |        | 102.3<br><u>4.8</u> |
| 94 |        |        |      |        | 102.0<br><u>5.1</u> |
| 93 |        |        |      |        | 101.9<br><u>5.2</u> |
| 92 |        |        |      |        | 102.4<br><u>4.7</u> |
| 91 |        |        |      |        | 103.0<br><u>4.1</u> |
| 90 |        |        |      |        | 103.2<br><u>3.9</u> |
| 89 | 3.98   | 107.05 | 6.98 | 103.07 | 103.4<br><u>6.6</u> |
| 88 |        |        |      |        | 104.6<br><u>5.4</u> |
| 87 |        |        |      |        | 104.8<br><u>5.6</u> |
| 86 |        | 110.05 |      |        | 104.5<br><u>5.5</u> |

| Sta.   | B.S. | I.L.   | F.S. | Elev.  |
|--------|------|--------|------|--------|
| T.B.M. | 5.68 | 855.82 |      | 850.14 |

56  
 Elevs taken in old ditch on R.  
 beginning opposite sta. 83+00 on Rd.  
 Note see sections 80+00 to 82+00 - page 51.  
 laid in tel. pole on Lt. Sta.



102

+03 End of Guard Rails 108.59

101

+30 B.M. Spk. in Black Tel. pole Lt. 5.23 - 103.3

100

108.59

|       |       |      |
|-------|-------|------|
| 100.3 | 103.9 | 99.8 |
| 8.3   | 4.7   | 8.2  |
|       |       | 2.5  |
|       | 103.4 |      |
|       | 5.2   |      |



50

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

49

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9  
 6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

48

47

4.98 856.14 6.45 851.16

46

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9  
 6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

45

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

44

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

43

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

42

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

41

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

40

4.56 857.61 4.25 853.05

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

39

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9

38

BM 3 180 857.30 855.50

6.0 6.0 6.46.2 5.95.0 4.6 5.2 7.1 7.1 7.4 7.5 5.2 5.2  
 28 29 28 21 14 11 16 21 25 18 10 14 17  
 50.1 50.1 49.7 49.9 50.2 51.1 51.5 50.9 49.0 47.0 48.7 48.3 50.9 50.9



Sta. B.S. H.I. F.I. Elev.

56+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 5.8  | 7.2  | 6.5  | 6.5  | 6.8  | 5.8  | 5.0  | 5.4  | 5.7  | 7.0  | 7.6  | 6.8  | 6.1  | 5.5  |
| 3    | 31   | 27   | 24   | 21   | 17   | 5    | 0    | 8    | 11   | 24   | 27   | 31   | 40   |
| 49.4 | 48.5 | 49.2 | 49.2 | 48.9 | 49.9 | 50.7 | 50.3 | 50.0 | 48.7 | 48.1 | 48.9 | 49.6 | 50.2 |

55+00

|      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 5.9  | 5.9  | 6.7  | 5.9  | 5.3  | 5.0  | 5.3  | 6.9  | 7.4  | 7.4  | 6.0  | 5.3  |
| 36   | 33   | 30   | 21   | 17   | 9    | 10   | 13   | 23   | 31   | 35   | 41   |
| 49.8 | 49.8 | 49.0 | 49.8 | 50.4 | 50.7 | 50.2 | 48.8 | 48.3 | 48.3 | 49.7 | 50.4 |

54+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 6.7  | 6.8  | 6.3  | 5.4  | 5.5  | 5.1  | 5.4  | 5.7  | 7.0  | 7.4  | 7.3  | 5.6  | 7.7  |
| 33   | 30   | 23   | 19   | 15   | 0    | 11   | 18   | 19   | 28   | 33   | 37   | 44   |
| 49.0 | 48.9 | 49.4 | 49.8 | 50.2 | 50.6 | 50.3 | 49.8 | 48.7 | 47.8 | 48.4 | 50.1 | 51.0 |

53+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 6.7  | 6.4  | 7.0  | 7.2  | 6.5  | 5.8  | 5.5  | 5.1  | 5.4  | 7.1  | 7.7  | 7.4  |      |
| 32   | 31   | 28   | 20   | 18   | 13   | 8    | 16   | 17   | 24   | 32   | 41   |      |
| 49.0 | 49.1 | 48.7 | 48.5 | 49.2 | 49.9 | 50.2 | 50.6 | 50.1 | 48.6 | 48.0 | 50.0 | 51.3 |

+43.0 =  $\frac{1}{2}$  of road to right 18" X 34" Cur. Ppt 22' from  $\frac{1}{2}$ 

|      |      |      |
|------|------|------|
| 4.9  | 4.8  | 3.8  |
| 8    | 100  | 210  |
| 50.8 | 50.9 | 51.9 |

52+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 7.0  | 6.4  | 6.6  | 7.3  | 6.3  | 5.0  | 4.6  | 5.1  | 6.5  | 7.6  | 5.8  | 5.7  | 8.7  |
| 33   | 32   | 30   | 24   | 18   | 13   | 5    | 15   | 18   | 24   | 31   | 36   | 40   |
| 48.7 | 49.3 | 49.1 | 48.7 | 48.4 | 50.7 | 51.1 | 50.6 | 49.2 | 48.1 | 49.9 | 50.3 | 51.3 |

B.M. 4 3.42 855.66 852.24

4th. Clond. Cont. Master

2-13-26 Mr. D. Butterfield - C. Caranagh. "Bud" Beaumont. D on S.W. Hbr. Conc. Box Culv. Sta. 58+04

B.M. 4 (See Pg. 53) 3.70 852.24

55

Void from Sta. 52+00 to 53+00 inclusive.

53

52

51

+69.7

856.14

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 4.4  | 7.3  | 6.5  | 5.8  | 5.7  | 5.5  | 7.4  | 7.4  | 7.2  | 6.4  |
| 31   | 27   | 24   | 20   | 16   | 14   | 19   | 24   | 24   | 24   |
| 49.7 | 48.9 | 49.6 | 50.3 | 50.4 | 50.3 | 49.7 | 48.0 | 47.9 | 49.7 |

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 7.3  | 6.4  | 6.1  | 5.8  | 6.0  | 7.4  | 7.4  | 8.3  | 7.7  | 5.8  |
| 34   | 29   | 18   | 15   | 17   | 24   | 30   | 31   | 31   | 31   |
| 48.8 | 49.7 | 50.0 | 50.3 | 50.1 | 48.7 | 48.2 | 47.6 | 48.4 | 50.3 |

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 7.1  | 7.0  | 6.7  | 6.0  | 5.4  | 6.0  | 7.4  | 7.4  | 5.8  |      |
| 34   | 34   | 24   | 19   | 14   | 17   | 24   | 31   | 31   |      |
| 49.0 | 48.4 | 49.4 | 50.1 | 50.5 | 50.0 | 48.5 | 48.0 | 49.8 | 51.1 |

|      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 7.1  | 7.0  | 7.3  | 6.9  | 5.8  | 5.0  | 5.1  | 7.4  | 6.3  | 5.6  |      |      |
| 33   | 32   | 30   | 24   | 18   | 13   | 15   | 24   | 31   | 36   |      |      |
| 48.9 | 49.0 | 48.3 | 48.4 | 49.2 | 50.6 | 51.1 | 50.7 | 48.8 | 48.0 | 49.8 | 50.5 |

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 6.1  | 6.1  | 6.4  | 6.6  | 6.5  | 5.3  | 4.8  | 5.0  | 6.7  | 7.2  | 5.7  | 4.6  | 5.0  |
| 33   | 32   | 30   | 24   | 16   | 12   | 15   | 19   | 24   | 31   | 36   | 40   | 40   |
| 50.0 | 49.9 | 49.2 | 49.5 | 49.6 | 50.9 | 51.3 | 51.1 | 49.4 | 48.3 | 50.4 | 51.5 | 51.8 |



Sta. B.S. H.I. F.S. Elev.

67+00

|     |      |      |      |      |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|------|------|------|------|
| 50  | 51.3 | 8.2  | 8.4  | 7.9  | 5.7  | 5.1  | 5.3  | 14.5 | 10.8 | 4.7  | 8.4  |
| 30  | 31   | 29   | 26   | 22   | 19   | 0    | 12   | 21   | 24   | 35   | 41   |
| 2.7 | 52.4 | 49.5 | 49.3 | 49.8 | 52.0 | 52.6 | 52.4 | 47.2 | 46.9 | 53.0 | 53.3 |

66+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 62   | 64   | 73   | 10.1 | 9.2  | 7.6  | 6.6  | 6.4  | 6.4  | 8.8  | 9.7  | 8.5  | 7.7  | 6.7  | 6.6  |
| 38   | 34   | 29   | 26   | 22   | 18   | 15   | 0    | 10   | 13   | 18   | 23   | 29   | 37   | 41   |
| 51.5 | 51.3 | 48.4 | 47.6 | 48.5 | 50.1 | 51.1 | 51.5 | 13.5 | 11.1 | 48.9 | 48.0 | 49.2 | 50.0 | 51.0 |

65+00

7.41 857.72 5.85 850.31

|      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 8.0  | 8.1  | 9.3  | 9.2  | 7.5  | 7.3  | 7.4  | 8.8  | 9.3  | 8.5  | 8.4  | 8.4  |
| 38   | 32   | 29   | 20   | 15   | 0    | 12   | 15   | 19   | 25   | 31   | 41   |
| 49.7 | 49.6 | 48.4 | 48.5 | 50.2 | 50.4 | 50.1 | 48.9 | 48.4 | 48.5 | 49.3 | 49.3 |

64+00

|      |      |      |      |      |      |      |      |      |      |      |     |
|------|------|------|------|------|------|------|------|------|------|------|-----|
| 6.4  | 6.4  | 8.4  | 8.1  | 5.5  | 5.6  | 5.7  | 7.8  | 8.2  | 5.5  | 5.3  | 4.1 |
| 39   | 32   | 28   | 20   | 14   | 0    | 14   | 19   | 27   | 31   | 41   |     |
| 49.8 | 49.8 | 47.8 | 48.1 | 50.7 | 50.6 | 50.5 | 48.4 | 48.0 | 50.7 | 50.7 |     |

63+00

|      |      |      |      |      |      |      |      |      |      |      |     |
|------|------|------|------|------|------|------|------|------|------|------|-----|
| 5.4  | 6.0  | 7.6  | 7.5  | 5.7  | 5.3  | 6.0  | 7.8  | 8.9  | 6.1  | 5.5  | 4.1 |
| 39   | 33   | 28   | 20   | 14   | 0    | 14   | 19   | 28   | 34   | 40   |     |
| 50.4 | 50.2 | 48.6 | 48.7 | 50.5 | 50.9 | 50.2 | 48.3 | 47.3 | 50.1 | 50.7 |     |

62+00

|      |      |      |      |      |      |      |      |      |      |      |     |
|------|------|------|------|------|------|------|------|------|------|------|-----|
| 4.8  | 5.0  | 7.3  | 6.7  | 5.3  | 5.3  | 5.8  | 6.8  | 7.2  | 5.0  | 5.2  | 4.1 |
| 42   | 33   | 27   | 21   | 16   | 0    | 16   | 20   | 25   | 32   | 40   |     |
| 51.4 | 51.2 | 48.9 | 49.5 | 50.9 | 50.9 | 50.4 | 49.4 | 49.0 | 51.2 | 51.0 |     |

+53.0

|      |      |      |      |      |      |      |      |      |      |      |  |
|------|------|------|------|------|------|------|------|------|------|------|--|
| 4.6  | 4.8  | 5.3  | 5.6  | 5.1  | 5.1  | 5.0  | 5.3  | 5.5  | 7.5  | 5.8  |  |
| 42   | 34   | 30   | 22   | 17   | 0    | 17   | 23   | 33   | 41   | 53   |  |
| 51.6 | 50.3 | 50.9 | 50.6 | 51.1 | 51.1 | 51.2 | 50.9 | 50.7 | 51.7 | 50.8 |  |

61+00

|      |      |      |      |      |      |      |      |      |      |      |      |     |
|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| 5.4  | 6.3  | 7.3  | 7.7  | 6.8  | 5.7  | 5.1  | 5.4  | 7.2  | 7.2  | 7.6  | 6.5  | 5.4 |
| 34   | 30   | 27   | 23   | 17   | 12   | 0    | 15   | 20   | 27   | 32   | 41   | 50  |
| 49.9 | 48.9 | 48.5 | 48.4 | 50.8 | 51.1 | 50.9 | 49.0 | 48.5 | 48.6 | 51.8 | 50.8 |     |

60+00

|      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 6.1  | 7.1  | 7.7  | 7.6  | 5.7  | 5.2  | 5.5  | 7.6  | 8.7  | 8.4  | 7.5  | 6.1  |
| 35   | 32   | 23   | 18   | 13   | 0    | 13   | 18   | 26   | 32   | 38   | 46   |
| 50.1 | 49.1 | 48.5 | 48.6 | 51.0 | 51.0 | 50.7 | 48.6 | 47.5 | 47.8 | 49.7 | 50.1 |

59+00

|      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2.5  | 2.1  | 6.6  | 7.6  | 7.7  | 5.6  | 5.9  | 6.3  | 7.3  | 8.1  | 8.6  | 8.1  |
| 30   | 34   | 29   | 26   | 21   | 15   | 0    | 14   | 19   | 24   | 32   | 41   |
| 48.7 | 47.1 | 49.6 | 48.6 | 48.5 | 50.6 | 50.3 | 49.9 | 48.9 | 48.1 | 47.6 | 47.9 |

B.M. 4 392 856.16 342 8522+

58+04 Conc. Cul. 3x3 Box.

|       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 2.2   | 7.2  | 2.9  | 8.4  | 8.1  | 8.2  | 8.7  | 9.7  | 4.2  | 3.4  | 8.1  | 8.2  | 8.1  | 8.0  | 7.9  |
| 31    | 27   | 20   | 15   | 10   | 12   | 10   | 0    | 12   | 18   | 19   | 21   | 28   | 33   | 30   |
| 148.5 | 48.5 | 47.8 | 47.3 | 52.6 | 52.6 | 51.4 | 51.0 | 51.0 | 51.5 | 51.5 | 46.6 | 47.5 | 47.6 | 47.8 |

58+00

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 7    | 7.4  | 8.0  | 6.8  | 3.1  | 4.4  | 8.2  | 7.8  | 4.8  | 4.1  | 3.4  | 3.4  | 2.2  | 2.8  | 2.9  |
| 1    | 27   | 18   | 15   | 12   | 12   | 10   | 0    | 8    | 12   | 12   | 13   | 13   | 20   | 21   |
| 47.7 | 48.9 | 52.6 | 52.6 | 51.3 | 50.9 | 50.9 | 50.9 | 51.6 | 52.3 | 52.3 | 48.3 | 47.9 | 47.8 | 48.4 |

57+00

|       |      |      |      |      |      |      |      |      |      |      |      |      |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| 7.2   | 6.3  | 6.7  | 7.1  | 5.7  | 5.2  | 5.5  | 6.0  | 7.1  | 8.2  | 7.4  | 7.7  | 7.0  |
| 31    | 26   | 24   | 20   | 17   | 7    | 0    | 8    | 12   | 16   | 23   | 30   | 45   |
| 648.5 | 49.4 | 49.0 | 49.6 | 50.0 | 50.5 | 50.2 | 50.7 | 48.0 | 47.5 | 48.3 | 48.0 | 48.7 |



Sta. B.S. H.I. F.S. Elev.

B.M.#5 5.07 855.21 3.33 850.14

Nail in tel. pole #105 on L.A. Sta. 79+95

79+00

5.2 5.1 6.1 7.9 7.5 4.9 5.0 5.3 6.8 6.9 5.7 5.9 8.3  
34 29 21 17 11 5 0 19 23 26 29 37 137  
48.3 48.4 47.4 45.6 46.0 48.6 48.5 48.2 46.7 46.6 47.8 47.6 45.2

78+00

4.1 4.1 4.0 6.4 6.7 5.3 5.4 5.9 5.1 6.4 6.3 5.9 4.6  
33 31 24 18 11 7 0 9 20 24 26 30 34  
49.4 49.4 49.5 47.1 46.8 48.2 48.1 49.6 48.4 47.1 47.2 48.6 48.9

77+00

3.65 853.47 6.86 849.82

5.3 3.2 5.6 6.1 5.7 5.4 5.0 5.9 5.2 5.3 5.4 4.5 3.9  
33 27 21 16 14 10 9 0 20 23 26 28 36  
50.3 47.9 47.4 47.8 48.1 48.5 48.6 48.5 48.2 48.1 49.0 49.6

76+00

6.9 6.2 6.5 7.1 6.9 7.0 6.6 6.3 6.3  
33 24 18 15 0 14 22 32 35  
49.8 50.5 50.2 49.6 49.8 49.1 50.1 50.4 50.9

75+00

5.2 5.7 5.2 6.2 6.2 5.8 5.6 5.8 6.3 6.4 5.9 5.4 4.0  
34 27 23 20 14 11 0 12 21 23 24 33 39  
5 52.0 51.5 50.5 50.5 50.9 51.1 50.9 50.4 50.3 50.8 51.8 52.7

74+00

4.5 4.5 5.1 6.2 5.8 5.2 4.8 5.0 5.6 5.5 5.1 5.0 4.8 3.8  
32 27 24 22 21 12 0 19 21 23 24 27 30 36  
52.2 52.2 51.6 50.5 50.9 51.5 51.9 51.7 51.1 51.2 51.6 51.7 52.7 53.9

73+00

4.6 5.4 6.4 6.2 5.6 5.1 5.4 5.9 6.0 5.7 5.8 5.4  
34 26 23 22 19 0 22 25 28 30 37  
52.1 51.3 50.3 50.5 51.5 51.6 51.3 50.8 50.7 52.0 52.8

72+00

4.2 4.3 5.4 6.5 6.2 5.4 5.2 5.2 5.6 5.6 4.8 4.6  
34 29 26 23 20 17 0 19 24 27 34 37  
52.5 52.4 51.7 50.2 50.5 51.3 51.6 51.5 51.1 51.1 51.9 52.1

71+00

3.68 856.68 3.68 852.14

5.0 4.1 4.9 5.0 4.7 5.0 5.1 5.5 4.8 4.5  
33 26 24 14 0 19 24 26 29 31  
53.7 52.6 51.8 51.7 52.0 51.7 51.6 51.3 51.9 52.2

70+00

5.9 5.3 7.1 6.3 5.6 5.1 6.6 5.8 5.7  
34 27 24 14 0 21 24 30 36  
53.8 52.4 50.6 51.4 52.1 51.8 51.1 51.8 52.0

69+00

4.6 5.5 6.3 6.3 6.0 5.8 5.9 6.1 6.8 5.9 5.4 5.4  
36 28 25 21 17 0 18 23 28 28 33 37  
53.2 52.2 51.4 51.4 51.7 51.9 51.8 51.6 50.9 51.8 52.3 52.7

68+00

507.72

4.8 5.5 6.8 7.0 5.8 5.6 5.5 6.4 3.1 4.8 5.6 5.4 5.4  
36 28 26 23 14 0 14 21 26 29 31 35 39  
52.9 52.2 50.9 50.7 51.9 52.1 52.2 51.3 50.6 50.9 52.1 52.7 53.4



Sta. B.S. H.I. F.S. Elev.

92+00

$$\begin{array}{r} 45-54 \quad 6.6 \quad 6.2 \quad 6.6 \quad 6.3 \quad 6.5 \quad 6.7 \quad 6.9 \quad 6.1 \\ 33 \quad 22 \quad 19 \quad 16 \quad 15 \quad 8 \quad 16 \quad 19 \quad 29 \quad 34 \\ 50.4 \quad 49.5 \quad 49.3 \quad 48.7 \quad 48.3 \quad 48.6 \quad 48.4 \quad 48.2 \quad 48.0 \quad 48.8 \end{array}$$

91+00

$$\begin{array}{r} 3.9 \quad 3.2 \quad 3.7 \quad 4.8 \quad 5.6 \quad 6.0 \quad 5.7 \quad 5.9 \quad 6.1 \quad 5.9 \quad 5.5 \quad 5.5 \quad 5.2 \\ 35 \quad 29 \quad 24 \quad 19 \quad 17 \quad 13 \quad 8 \quad 16 \quad 18 \quad 24 \quad 29 \quad 30 \quad 33 \\ 51.0 \quad 51.7 \quad 51.2 \quad 50.1 \quad 49.3 \quad 48.9 \quad 49.2 \quad 49.0 \quad 48.8 \quad 49.0 \quad 49.4 \quad 49.4 \quad 49.7 \end{array}$$

90+00

$$\begin{array}{r} 4.3 \quad 4.3 \quad 5.0 \quad 5.3 \quad 5.5 \quad 5.5 \quad 5.6 \quad 5.9 \quad 5.9 \quad 5.3 \quad 5.4 \\ 33 \quad 27 \quad 19 \quad 17 \quad 16 \quad 8 \quad 16 \quad 18 \quad 28 \quad 31 \quad 33 \\ 50.6 \quad 50.6 \quad 49.9 \quad 49.6 \quad 49.4 \quad 49.4 \quad 49.3 \quad 49.0 \quad 49.0 \quad 49.6 \quad 49.5 \end{array}$$

89+00

$$\begin{array}{r} 3.3 \quad 3.0 \quad 3.8 \quad 4.9 \quad 5.2 \quad 5.3 \quad 5.3 \quad 5.2 \quad 4.9 \quad 4.9 \\ 33 \quad 26 \quad 18 \quad 15 \quad 11 \quad 8 \quad 17 \quad 23 \quad 31 \quad 33 \\ 51.6 \quad 51.9 \quad 51.1 \quad 50.0 \quad 49.7 \quad 49.6 \quad 49.6 \quad 49.7 \quad 50.0 \quad 50.0 \end{array}$$

88+00

$$\begin{array}{r} 3.9 \quad 3.7 \quad 4.1 \quad 4.6 \quad 4.8 \quad 5.6 \quad 5.3 \quad 5.0 \quad 5.4 \quad 5.4 \quad 5.3 \quad 4.8 \quad 4.7 \\ 33 \quad 25 \quad 17 \quad 15 \quad 12 \quad 9 \quad 8 \quad 6 \quad 18 \quad 21 \quad 26 \quad 31 \quad 33 \\ 52.2 \quad 52.4 \quad 52.0 \quad 51.5 \quad 51.3 \quad 50.5 \quad 50.8 \quad 51.1 \quad 50.7 \quad 50.5 \quad 50.8 \quad 51.3 \quad 51.4 \end{array}$$

87+00

$$\begin{array}{r} 3.9 \quad 4.1 \quad 4.7 \quad 5.3 \quad 5.3 \quad 5.0 \quad 5.0 \quad 5.3 \quad 5.5 \quad 5.4 \quad 4.9 \quad 4.7 \quad 4.7 \\ 33 \quad 19 \quad 14 \quad 12 \quad 10 \quad 9 \quad 8 \quad 18 \quad 20 \quad 23 \quad 28 \quad 31 \quad 33 \\ 52.2 \quad 52.0 \quad 51.4 \quad 50.8 \quad 50.8 \quad 51.1 \quad 51.1 \quad 50.8 \quad 50.6 \quad 50.7 \quad 51.2 \quad 51.4 \quad 51.4 \end{array}$$

86+00

$$\begin{array}{r} 4.4 \quad 4.5 \quad 5.4 \quad 5.5 \quad 5.2 \quad 5.5 \quad 5.3 \quad 4.6 \quad 4.6 \\ 33 \quad 27 \quad 16 \quad 10 \quad 8 \quad 13 \quad 21 \quad 31 \quad 33 \\ 51.7 \quad 51.6 \quad 50.7 \quad 50.6 \quad 50.9 \quad 50.6 \quad 50.8 \quad 51.5 \quad 52.5 \end{array}$$

85+00

$$\begin{array}{r} 4.6 \quad 4.6 \quad 5.0 \quad 5.3 \quad 5.5 \quad 5.4 \quad 5.3 \quad 5.3 \\ 33 \quad 32 \quad 20 \quad 17 \quad 9 \quad 8 \quad 12 \quad 33 \\ 51.5 \quad 51.5 \quad 51.1 \quad 50.8 \quad 50.6 \quad 50.7 \quad 50.8 \quad 50.8 \end{array}$$

84+00

$$\begin{array}{r} 4.1 \quad 4.4 \quad 5.0 \quad 4.9 \quad 4.5 \quad 4.7 \quad 4.2 \quad 4.2 \quad 4.2 \quad 4.1 \\ 33 \quad 20 \quad 18 \quad 11 \quad 8 \quad 17 \quad 18 \quad 23 \quad 31 \\ 51.1 \quad 50.8 \quad 50.2 \quad 50.3 \quad 50.7 \quad 50.5 \quad 50.3 \quad 50.3 \quad 51.0 \end{array}$$

83+00

$$\begin{array}{r} 4.4 \quad 4.3 \quad 5.0 \quad 5.0 \quad 4.8 \quad 4.5 \quad 4.3 \quad 4.0 \quad 5.0 \quad 4.2 \quad 4.2 \\ 33 \quad 23 \quad 17 \quad 14 \quad 12 \quad 8 \quad 4 \quad 17 \quad 25 \quad 24 \quad 34 \\ 50.8 \quad 50.9 \quad 50.2 \quad 50.2 \quad 50.4 \quad 50.7 \quad 50.9 \quad 50.3 \quad 50.2 \quad 51.0 \quad 51.0 \end{array}$$

82+00

$$\begin{array}{r} 3.9 \quad 4.0 \quad 5.0 \quad 5.0 \quad 4.7 \quad 4.5 \quad 4.2 \quad 5.0 \quad 4.0 \quad 5.1 \quad 4.5 \quad 3.7 \quad 3.0 \\ 33 \quad 23 \quad 18 \quad 13 \quad 11 \quad 8 \quad 4 \quad 18 \quad 22 \quad 24 \quad 27 \quad 31 \quad 35 \\ 51.3 \quad 51.2 \quad 50.2 \quad 50.2 \quad 50.5 \quad 50.7 \quad 51.0 \quad 50.2 \quad 50.3 \quad 50.1 \quad 50.7 \quad 51.5 \quad 51.5 \end{array}$$

81+00

$$\begin{array}{r} 3.8 \quad 3.7 \quad 5.8 \quad 6.3 \quad 5.7 \quad 5.4 \quad 5.2 \quad 5.5 \quad 6.0 \quad 6.0 \quad 5.0 \quad 4.4 \quad 4.4 \quad 10.2 \\ 33 \quad 27 \quad 21 \quad 18 \quad 15 \quad 12 \quad 10 \quad 8 \quad 5 \quad 23 \quad 23 \quad 24 \quad 32 \quad 36 \quad 176 \\ 51.4 \quad 51.5 \quad 49.4 \quad 48.9 \quad 49.5 \quad 50.0 \quad 49.8 \quad 50.0 \quad 49.2 \quad 50.2 \quad 50.8 \quad 50.8 \quad 45.0 \end{array}$$

80+00

$$\begin{array}{r} 5.3 \quad 4.8 \quad 5.7 \quad 7.6 \quad 7.6 \quad 6.5 \quad 6.0 \quad 6.2 \quad 7.1 \quad 7.2 \quad 5.9 \quad 10.1 \\ 34 \quad 25 \quad 21 \quad 16 \quad 14 \quad 11 \quad 8 \quad 14 \quad 23 \quad 27 \quad 32 \quad 160 \\ 49.9 \quad 50.3 \quad 49.5 \quad 47.6 \quad 47.6 \quad 48.7 \quad 49.2 \quad 49.0 \quad 48.1 \quad 48.0 \quad 49.3 \quad 45.1 \end{array}$$

855.21



Sta. B.S. H.L. F.S. Elev. Grade

104+00

0 6.55 857.67 3.70 851.12

6.2  
0  
51.5

103+00

3.7  
0  
51.1

102+00

4.3  
0  
50.5

101+00

4.7

B.M. #6

5.11 849.71 849.73 spike in black feb. pole 50.1 Lt. Sta. 100+40

100+00

4.1 6.0 8.1 7.5 5.2 5.1 5.0 7.6 7.9 8.0 6.8 5.3  
34 29 26 18 12 8 7 21 26 26 32 34  
50.7 48.8 46.7 47.3 49.6 49.7 49.8 47.2 46.9 46.8 48.0 49.5

99+00

4.5 8.2 7.5 7.2 5.8 5.7 5.7 6.6 2.2 7.1 5.5  
34 27 22 17 13 8 19 26 29 33 37  
50.3 46.6 47.3 47.6 49.0 49.1 49.1 48.2 47.6 47.7 49.3

98+00

0 6.01 854.82 4.71 848.81

4.8 5.6 6.8 6.7 6.9 6.1 6.0 6.0 5.9 5.8 7.3 7.5 6.5 6.3  
34 29 27 21 16 11 8 16 17 23 21 28 30 33  
50.0 49.2 48.0 48.1 47.9 48.7 48.8 48.8 48.9 49.0 47.5 47.3 48.3 48.5

97+00

Note - For X-Section Extensions for  
Borrow Pit along N. side rd. Sta. 97+00 to 100+00  
See Book #60 Page 57.

3.8 4.7 5.8 5.8 5.5 5.1 4.9 4.9 5.2 5.7 5.7 5.2 4.9 4.7  
33 29 26 23 20 12 8 15 19 24 27 29 31 33  
49.7 49.1 47.7 47.7 48.0 48.4 48.6 48.6 48.3 47.8 47.8 48.3 48.6 49.2

96+00

4.3 5.5 6.2 5.7 5.2 5.0 5.1 5.4 5.9 5.6 5.6 4.6  
33 26 24 22 12 8 16 19 24 27 32 38  
49.2 48.0 47.3 47.8 48.3 48.5 48.4 48.1 47.6 47.9 47.9 48.9

95+00

4.7 5.6 6.6 6.7 5.7 5.2 5.1 5.4 5.8 5.7 6.3 5.6 4.8  
33 28 25 24 20 17 8 16 26 27 29 33 37  
48.8 47.9 46.9 46.8 47.8 48.3 48.4 48.1 47.7 47.6 47.2 47.9 48.7

94+00

0 5.28 853.52 6.63 848.24

4.7 5.0 6.2 6.6 6.1 5.9 5.9 5.2 5.6 5.8 5.8 6.1 5.6 5.2  
33 30 26 23 20 16 13 8 15 11 26 27 32 36  
48.8 48.5 47.3 46.9 47.4 47.6 48.1 48.3 47.9 47.7 47.7 47.4 47.9 48.3

93+00

854.87

5.6 5.6 7.2 7.5 6.8 6.8 6.6 7.2 2.2 6.3  
33 31 24 20 17 13 8 16 25 33  
47.3 49.3 47.7 47.4 48.1 48.1 48.3 47.7 47.7 48.6



| Sta.    | B.S.         | H.I.                                        | F.S.   | Elev.  |                                                 |
|---------|--------------|---------------------------------------------|--------|--------|-------------------------------------------------|
| 0       | 10.55        | 880.77                                      | 046    | 870.22 |                                                 |
| 115+00  |              |                                             |        |        | $\frac{1.8}{0}$<br>68.9                         |
| 114+00  |              |                                             |        |        | $\frac{5.0}{0}$<br>65.7                         |
| 113+00  |              |                                             |        |        | $\frac{8.1}{0}$<br>62.6                         |
| 0       | 12.57        | 870.68                                      | 1.70   | 858.11 |                                                 |
| 112+00  |              |                                             |        |        | $\frac{3.0}{0}$<br>59.8                         |
| 111+00  |              |                                             |        |        | $\frac{2.6}{0}$<br>57.2                         |
| 110+00  |              |                                             |        |        | $\frac{3.8}{0}$<br>55.4                         |
| 109+00  |              |                                             |        |        | $\frac{8.9}{0}$<br>54.9                         |
| 108+00  |              |                                             |        |        | $\frac{5.0}{0}$<br>54.8                         |
| B.M. #7 | 5.04         | 859.81                                      | 857.77 |        | 7. on N.W. Wing at N. end of bridge Sta. 107+10 |
| 2/15/20 | Clear - cold | 2. Butterfield - C. Caranagh - Bud Beaumont |        |        |                                                 |
| B.M. #7 |              |                                             | 2.90   | 857.77 | 8 on N.W. Wing at N. end of bridge Sta. 107+10  |
| 107+00  |              |                                             |        |        | $\frac{3.2}{0}$<br>54.5                         |
| 106+00  |              |                                             |        |        | $\frac{2.5}{0}$<br>53.2                         |
| 105+00  |              |                                             |        |        | $\frac{5.6}{0}$<br>52.1                         |
|         |              | 857.67                                      |        |        |                                                 |





| Sta.            | B.S. | M.L.   | F.S. | Elev.  |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------|------|--------|------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 138+00          |      |        |      |        | $\begin{array}{r} f. \\ 51 \quad 5.2 \quad 6.0 \quad 6.4 \quad 5.9 \quad 5.2 \quad 4.8 \quad 5.4 \quad 5.9 \quad 5.9 \quad 6.3 \quad 4.2 \quad 3.5 \quad 3.5 \\ 26 \quad 22 \quad 20 \quad 17 \quad 14 \quad 8 \quad 5 \quad 9 \quad 12 \quad 16 \quad 19 \quad 24 \quad 30 \quad 33 \\ 662.5 \quad 624 \quad 61.6 \quad 61.2 \quad 61.7 \quad 62.4 \quad 62.8 \quad 62.2 \quad 61.7 \quad 61.7 \quad 61.3 \quad 63.4 \quad 64.1 \quad 63. \end{array}$     |
| 137+00          |      |        |      |        | $\begin{array}{r} f. \\ 51 \quad 5.4 \quad 5.4 \quad 4.3 \quad 7.0 \quad 6.9 \quad 5.7 \quad 6.2 \quad 6.2 \quad 6.4 \quad 4.6 \quad 3.3 \quad 3.6 \\ 33 \quad 25 \quad 22 \quad 19 \quad 15 \quad 10 \quad 8 \quad 9 \quad 15 \quad 18 \quad 23 \quad 30 \quad 33 \\ 62.5 \quad 62.2 \quad 62.2 \quad 61.3 \quad 60.6 \quad 61.2 \quad 61.9 \quad 61.4 \quad 61.4 \quad 61.2 \quad 63.0 \quad 64.3 \quad 64.0 \end{array}$                                 |
| 136+00          |      |        |      |        | $\begin{array}{r} f. \\ 61 \quad 6.7 \quad 7.0 \quad 7.4 \quad 7.1 \quad 6.4 \quad 6.2 \quad 6.4 \quad 6.4 \quad 7.0 \quad 4.6 \quad 4.2 \quad 4.0 \\ 33 \quad 25 \quad 18 \quad 16 \quad 12 \quad 9 \quad 8 \quad 11 \quad 16 \quad 20 \quad 26 \quad 30 \quad 33 \\ 60.9 \quad 60.9 \quad 60.6 \quad 60.0 \quad 60.5 \quad 61.2 \quad 61.6 \quad 61.2 \quad 61.2 \quad 60.6 \quad 63.0 \quad 63.4 \quad 63.6 \end{array}$                                 |
| 0               | 5.96 | 867.62 | 2.54 | 861.64 |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 135+00          |      |        |      |        | $\begin{array}{r} f. \\ 3.7 \quad 3.4 \quad 3.8 \quad 4.4 \quad 3.4 \quad 2.6 \quad 3.2 \quad 3.2 \quad 3.5 \quad 2.1 \quad 1.8 \quad 1.6 \\ 33 \quad 25 \quad 19 \quad 17 \quad 10 \quad 8 \quad 10 \quad 15 \quad 21 \quad 26 \quad 30 \quad 33 \\ 60.5 \quad 60.8 \quad 60.4 \quad 59.8 \quad 60.8 \quad 61.6 \quad 61.0 \quad 61.0 \quad 60.7 \quad 62.1 \quad 62.4 \quad 62.6 \end{array}$                                                             |
| 134+00          |      |        |      |        | $\begin{array}{r} f. \\ 3.4 \quad 3.4 \quad 3.5 \quad 4.8 \quad 4.6 \quad 4.2 \quad 3.5 \quad 3.7 \quad 4.2 \quad 4.2 \quad 4.3 \quad 2.7 \quad 2.0 \quad 1.5 \\ 33 \quad 24 \quad 20 \quad 17 \quad 13 \quad 10 \quad 8 \quad 10 \quad 14 \quad 17 \quad 19 \quad 25 \quad 30 \quad 33 \\ 60.8 \quad 60.8 \quad 60.7 \quad 59.4 \quad 59.6 \quad 60.0 \quad 60.7 \quad 60.5 \quad 60.0 \quad 60.0 \quad 59.7 \quad 61.5 \quad 62.2 \quad 62.7 \end{array}$ |
| 133+00          |      |        |      |        | $\begin{array}{r} f. \\ 3.6 \quad 3.6 \quad 3.6 \quad 5.5 \quad 5.4 \quad 4.3 \quad 4.5 \quad 5.7 \quad 5.7 \quad 2.4 \quad 1.6 \quad 1.5 \\ 33 \quad 24 \quad 20 \quad 14 \quad 10 \quad 8 \quad 11 \quad 14 \quad 17 \quad 24 \quad 30 \quad 33 \\ 60.6 \quad 60.6 \quad 60.6 \quad 58.7 \quad 58.8 \quad 59.9 \quad 59.7 \quad 58.8 \quad 59.5 \quad 61.8 \quad 62.6 \quad 62.7 \end{array}$                                                             |
| 132+00          |      |        |      |        | $\begin{array}{r} f. \\ 7.8 \quad 7.2 \quad 5.7 \quad 5.3 \quad 5.0 \quad 5.3 \quad 6.2 \quad 6.4 \quad 4.8 \quad 5.1 \quad 2.5 \quad 2.8 \\ 33 \quad 26 \quad 16 \quad 10 \quad 8 \quad 13 \quad 19 \quad 21 \quad 22 \quad 25 \quad 31 \quad 33 \\ 56.8 \quad 57.0 \quad 58.5 \quad 58.9 \quad 59.2 \quad 58.9 \quad 58.0 \quad 57.8 \quad 58.4 \quad 59.1 \quad 61.7 \quad 61.8 \end{array}$                                                             |
| 131+836 to road |      |        |      |        | $\begin{array}{r} f. \\ 5.8 \quad 4.0 \quad 5.8 \quad 5.4 \quad 5.0 \quad 5.2 \quad 5.7 \quad 6.3 \quad 5.7 \quad 5.4 \quad 3.6 \quad 3.1 \\ 100 \quad 50 \quad 38 \quad 28 \quad 17 \quad 13 \quad 17 \quad 23 \quad 23 \quad 24 \quad 30 \quad 31 \\ 58.4 \quad 58.2 \quad 58.3 \quad 58.8 \quad 59.2 \quad 59.0 \quad 58.5 \quad 57.9 \quad 58.5 \quad 58.8 \quad 60.7 \quad 61.1 \end{array}$                                                           |
| 131+00          |      |        |      |        | $\begin{array}{r} f. \\ 7.8 \quad 8.1 \quad 8.4 \quad 7.9 \quad 8.7 \quad 8.4 \quad 6.1 \quad 5.4 \quad 5.6 \quad 6.4 \quad 8.5 \quad 7.1 \quad 6.4 \\ 33 \quad 28 \quad 23 \quad 21 \quad 16 \quad 14 \quad 9 \quad 8 \quad 14 \quad 14 \quad 21 \quad 23 \quad 23 \\ 4 \quad 56.1 \quad 55.8 \quad 55.8 \quad 54.3 \quad 54.5 \quad 55.8 \quad 58.1 \quad 58.8 \quad 58.6 \quad 57.8 \quad 56.0 \quad 55.7 \quad 57.1 \quad 57.8 \end{array}$             |
| 130+00          |      |        |      |        | $\begin{array}{r} f. \\ 7.3 \quad 8.4 \quad 8.4 \quad 10.1 \quad 11.4 \quad 9.7 \quad 9.7 \quad 8.8 \quad 11.3 \quad 10.4 \quad 11.1 \quad 10.6 \quad 8.1 \\ 28 \quad 25 \quad 22 \quad 21 \quad 8 \quad 8 \quad 8 \quad 13 \quad 13 \quad 23 \quad 22 \quad 21 \quad 21 \\ 3 \quad 56.3 \quad 56.0 \quad 55.6 \quad 54.1 \quad 52.8 \quad 57.5 \quad 59.5 \quad 59.4 \quad 52.9 \quad 53.6 \quad 54.1 \quad 54.6 \quad 54.7 \end{array}$                   |
| T.B.M.          | 3.93 | 868.20 | 843  | 860.27 |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| B.M.#9          |      |        |      |        | 856.33 pole in tele pole #205 on Lt. Sta 130+02                                                                                                                                                                                                                                                                                                                                                                                                             |
| 129+00          |      |        |      |        | $\begin{array}{r} f. \\ 12.5 \quad 12.3 \quad 12.4 \quad 12.4 \quad 12.6 \quad 10.2 \quad 9.8 \quad 9.7 \quad 11.7 \quad 12.4 \quad 12.3 \quad 9.6 \\ 33 \quad 26 \quad 20 \quad 17 \quad 12 \quad 6 \quad 8 \quad 14 \quad 19 \quad 23 \quad 22 \quad 32 \\ 6.2 \quad 56.4 \quad 56.3 \quad 55.3 \quad 56.1 \quad 58.5 \quad 58.9 \quad 59.0 \quad 57.0 \quad 56.3 \quad 56.4 \quad 59.1 \end{array}$                                                      |
| 128+00          |      |        |      |        | $\begin{array}{r} f. \\ 10.1 \quad 10.6 \quad 9.4 \quad 11.0 \quad 11.8 \quad 11.9 \quad 9.3 \quad 9.0 \quad 9.0 \quad 10.0 \quad 9.0 \quad 6.9 \quad 6.5 \\ 3 \quad 26 \quad 24 \quad 21 \quad 19 \quad 13 \quad 9 \quad 0 \quad 15 \quad 20 \quad 24 \quad 29 \quad 38 \\ 7.7 \quad 58.1 \quad 58.3 \quad 57.7 \quad 56.9 \quad 56.8 \quad 57.4 \quad 59.7 \quad 59.7 \quad 58.7 \quad 59.7 \quad 61.8 \quad 62.2 \end{array}$                            |
|                 |      | 868.70 |      |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



Sta. B.S. H.I. F.S. Elev.

148+00

5.8  
8

71.6

147+00

5.9  
8

71.5

146+00

5.2  
8

72.2

145+00

5.9  
8

71.5

144+31.0 =  $\frac{1}{2}$  L.C. R.R.5.9  
8

71.5

144+00

7.1  
8

70.3

0 9.22 877.44 0.70 868.22

143+00

$$\begin{array}{cccccccccccccccc} 5.1 & 4.2 & 5.1 & 6.8 & 6.3 & 3.1 & 3.2 & 3.0 & 3.9 & 6.1 & 6.1 & 4.3 & 4.2 & 4.4 \\ 30 & 27 & 22 & 18 & 15 & 8 & 8 & 11 & 15 & 18 & 22 & 24 & 27 & 33 \\ 63.8 & 64.7 & 63.8 & 62.2 & 62.6 & 65.8 & 65.7 & 65.9 & 65.0 & 62.8 & 62.8 & 64.6 & 64.7 & 64.5 \end{array}$$

142+00

$$\begin{array}{cccccccccccccccc} 6.6 & 6.6 & 6.6 & 7.5 & 7.4 & 5.4 & 7.8 & 6.5 & 6.9 & 7.0 & 5.7 & 5.7 \\ 33 & 28 & 25 & 22 & 18 & 10 & 13 & 13 & 18 & 21 & 20 & 33 \\ 62.3 & 62.3 & 62.3 & 61.4 & 61.5 & 63.5 & 64.1 & 63.4 & 62.0 & 61.9 & 63.2 & 63.2 \end{array}$$

141+00

$$\begin{array}{cccccccccccccccc} 6.6 & 6.4 & 7.0 & 6.5 & 4.9 & 6.2 & 5.3 & 7.4 & 7.2 & 6.2 & 5.9 & 6.0 & 6.6 \\ 33 & 27 & 20 & 17 & 10 & 8 & 12 & 18 & 22 & 20 & 27 & 30 & 33 \\ 62.3 & 62.5 & 61.4 & 62.4 & 64.0 & 64.2 & 63.6 & 61.5 & 61.7 & 62.7 & 63.0 & 62.9 & 62.3 \end{array}$$
140+87 =  $\frac{1}{2}$  3'x4' Conc. Culv.
$$\begin{array}{cccccccccccccccc} 6.3 & 6.4 & 7.4 & 8.1 & 3.6 & 3.6 & 4.5 & 4.5 & 4.5 & 3.6 & 3.5 & 8.0 & 7.0 & 8.1 & 7.2 & 7.2 & 4.8 \\ 27 & 24 & 22 & 14 & 14 & 13 & 13 & 8 & 13 & 13 & 14 & 14 & 10 & 20 & 24 & 27 & 30 \\ 62.6 & 62.5 & 61.3 & 60.8 & 65.3 & 65.3 & 64.4 & 64.4 & 64.4 & 65.7 & 66.4 & 60.9 & 61.9 & 60.8 & 61.7 & 61.7 & 62.1 \end{array}$$

B.M. #10 3.47 868.92 2.17 865.45

D. on S. Hdwt. Conc. Culv. on Rt. Sta. 140+87

140+00

$$\begin{array}{cccccccccccccccc} 5.8 & 5.4 & 5.6 & 6.1 & 5.7 & 5.1 & 7.8 & 5.1 & 6.0 & 6.8 & 5.3 & 4.6 & 4.8 \\ 33 & 26 & 23 & 20 & 14 & 9 & 8 & 13 & 15 & 19 & 23 & 28 & 33 \\ 61.8 & 62.2 & 62.0 & 61.5 & 61.9 & 62.5 & 62.8 & 62.5 & 61.6 & 60.8 & 62.3 & 63.0 & 62.8 \end{array}$$

139+00

867.62

$$\begin{array}{cccccccccccccccc} 5.1 & 5.1 & 5.7 & 6.8 & 6.7 & 5.6 & 7.7 & 5.3 & 5.8 & 6.1 & 6.2 & 4.7 & 4.1 & 4.5 \\ 33 & 25 & 22 & 18 & 15 & 13 & 8 & 11 & 15 & 18 & 22 & 25 & 29 & 33 \\ 62.5 & 62.5 & 62.2 & 60.8 & 60.9 & 62.0 & 63.2 & 62.3 & 62.2 & 61.5 & 61.4 & 63.2 & 63.5 & 63.4 \end{array}$$



| Sta.      | B.S. | H.I.   | F.S. | Elev.  |
|-----------|------|--------|------|--------|
| 161+00    |      |        |      |        |
| B.M. #11. |      |        | 9.11 | 877.01 |
| 160+00    |      |        |      |        |
| 159+00    |      |        |      |        |
| 158+00    |      |        |      |        |
| 157+00    |      |        |      |        |
| 156+00    |      |        |      |        |
| ①         | 7.24 | 886.12 | 0.82 | 878.88 |
| 155+00    |      |        |      |        |
| 154+00    |      |        |      |        |
| 153+00    |      |        |      |        |
| 152+00    |      |        |      |        |
| 151+00    |      |        |      |        |
| ①         | 5.57 | 879.70 | 3.31 | 874.13 |
| 150+00    |      |        |      |        |
| 149+00    |      | 877.44 |      |        |

|      |         |           |
|------|---------|-----------|
| 10.3 |         |           |
| 75.8 |         |           |
| 74.1 | 160+91. | 3'x3'x16' |
| 9.6  |         |           |
| 76.5 |         |           |
| 7.8  |         |           |
| 78.3 |         |           |
| 4.4  |         |           |
| 81.5 |         |           |
| 3.6  |         |           |
| 82.5 |         |           |
| 6.1  |         |           |
| 80.0 |         |           |
| 2.7  |         |           |
| 77.0 |         |           |
| 4.3  |         |           |
| 75.4 |         |           |
| 5.2  |         |           |
| 74.5 |         |           |
| 5.1  |         |           |
| 74.6 |         |           |
| 3.7  |         |           |
| 76.0 |         |           |
| 3.4  |         |           |
| 74.0 |         |           |
| 5.6  |         |           |
| 71.8 |         |           |

Sta. B.S. H.I. F.S. Elev.

172+00

9.8  
0

79.1

171+00

6.9  
0

77.6

170+00

7.2  
0

76.8

169+00

7.4  
0

76.6

B.M.

7.20

884.03

876.83

on S. Hdwl. Conc. Culv. Sta. 168+19.

H.M. - Clear - Cold - Windy

2-16-26 D. Butterfield - Chas. Hollis.

B.M. #12.

3.93

876.83

on S. Hdwl. Conc. Culv. Sta. 168+19 2'x2'

168+00

4.8  
0

76.0

167+00

5.0  
0

75.8

166+00

4.5  
0

76.3

165+00

4.5  
0

76.3

164+00

5.0  
0

75.8

163+00

5.3  
0

75.5

162+00

5.4  
0

75.4

B.M.

3.75

880.76

9.11

877.01

on S. Hdwl. Conc. Culv. Sta. 160+91 3'x3'x16'

886.12



| Sta.   | B.S.  | I.I.   | F.S. | Elev.  |
|--------|-------|--------|------|--------|
| 185+00 |       |        |      |        |
| 184+00 |       |        |      |        |
| ①      | 6.80  | 913.00 | 0.75 | 906.20 |
| 183+00 |       |        |      |        |
| 182+00 |       |        |      |        |
| 181+00 |       |        |      |        |
| 180+00 |       |        |      |        |
| 179+00 |       |        |      |        |
| ①      | 12.27 | 906.95 | 0.20 | 894.68 |
| 178+00 |       |        |      |        |
| 177+00 |       |        |      |        |
| 176+00 |       |        |      |        |
| 175+00 |       |        |      |        |
| ①      | 11.45 | 894.88 | 0.60 | 883.43 |
| 174+00 |       |        |      |        |
| 173+00 |       | 884.03 |      |        |

$$\begin{array}{r} 512 \\ 5 \end{array}$$

07.8

$$\begin{array}{r} 518 \\ 8 \end{array}$$

07.2

$$\begin{array}{r} 066 \\ 6 \end{array}$$

06.4

$$\begin{array}{r} 18 \\ 8 \end{array}$$

05.2

$$\begin{array}{r} 38 \\ 8 \end{array}$$

03.6

$$\begin{array}{r} 72 \\ 8 \end{array}$$

99.8

$$\begin{array}{r} 10.3 \\ 8 \end{array}$$

96.7

$$\begin{array}{r} 14 \\ 8 \end{array}$$

93.5

$$\begin{array}{r} 46 \\ 8 \end{array}$$

90.3

$$\begin{array}{r} 71 \\ 8 \end{array}$$

87.5

$$\begin{array}{r} 87 \\ 8 \end{array}$$

85.2

$$\begin{array}{r} 14 \\ 8 \end{array}$$

82.9

$$\begin{array}{r} 33 \\ 8 \end{array}$$

80.7

Sta. B.S. H.I. F.S. Elev.

197+00

①

13.09

932.08

3.59

918.99

11.8

20.2

196+00

3.6

19.0

195+00

4.4

18.2

194+00

4.4

18.2

B.M. #13

4.31

918.27

Nail in root of 24" tree on H. Sta. 192+95-

193+00

4.5

18.1

192+00

6.3

16.3

191+00

8.2

14.4

190+00

9.5

①

10.85

922.58

1.27

911.73

13.1

189+00

1.0

12.0

188+00

2.1

10.9

187+00

3.2

09.8

186+00

913.00

4.4

08.6



| Sta.   | B.S. | H.I.   | F.S. | Elev.  |
|--------|------|--------|------|--------|
| 210+00 |      |        |      |        |
| 209+00 |      |        |      |        |
| 208+00 |      |        |      |        |
| 0      | 6.03 | 942.81 | 2.31 | 936.78 |
| 207+00 |      |        |      |        |
| 206+00 |      |        |      |        |
| 205+00 |      |        |      |        |
| 204+00 |      |        |      |        |
| 203+00 |      |        |      |        |
| 0      | 7.73 | 939.09 | 0.72 | 931.36 |
| 202+00 |      |        |      |        |
| 201+00 |      |        |      |        |
| 200+00 |      |        |      |        |
| 199+00 |      |        |      |        |
| 198+00 |      | 932.08 |      |        |

5.8  
0

37.0

5.2  
0

37.6

6.3  
0

36.5

2.8  
0

36.3

3.9  
0

35.2

7.8  
0

34.3

6.0  
0

33.1

6.6  
0

32.5

0.3  
0

31.8

1.2  
0

30.9

2.8  
0

29.3

5.9  
0

26.2

8.9  
0

23.2

Waterloo-Raymond Rd.  
End of Project at Raymond.

80

Level to 4 Road 14.

| Sta.   | B.S.                                                | H.I.   | F.S.  | Elev.  |                        |
|--------|-----------------------------------------------------|--------|-------|--------|------------------------|
| 223+00 | = End of Project = Rwy. Line on W. side of Road 14. |        |       |        | <del>46</del><br>19.2  |
| 222+00 |                                                     |        |       |        | <del>60</del><br>17.8  |
| 221+00 |                                                     |        |       |        | <del>43</del><br>19.5  |
| ○      | 0.45                                                | 923.78 | 10.80 | 923.33 |                        |
| 220+00 |                                                     |        |       |        | <del>130</del><br>22.1 |
| 219+00 |                                                     |        |       |        | <del>80</del><br>26.1  |
| 218+00 |                                                     |        |       |        | <del>35</del><br>30.6  |
| ○      | 1.24                                                | 934.13 | 7.51  | 932.89 |                        |
| 217+00 |                                                     |        |       |        | <del>75</del><br>32.9  |
| 216+00 |                                                     |        |       |        | <del>66</del><br>33.8  |
| 215+00 |                                                     |        |       |        | <del>61</del><br>34.3  |
| 214+00 |                                                     |        |       |        | <del>54</del><br>34.5  |
| ○      | 2.43                                                | 940.40 | 4.84  | 937.97 |                        |
| 213+00 |                                                     |        |       |        | <del>80</del><br>34.8  |
| 212+00 |                                                     |        |       |        | <del>75</del><br>35.3  |
| 211+00 |                                                     | 942.81 |       |        | <del>67</del><br>36.1  |



| Sta. | B.S. | I.I. | F.S. | Elev. |
|------|------|------|------|-------|
|------|------|------|------|-------|

B.M. #8 - Raymond-Dewar Rd  
Book 55 page 6

906.60

Pike in elec. pole (see below) Run from Datum  
Used on F.A.P. No 62.

|         |
|---------|
| 919.37  |
| - 12.77 |
| 906.60  |

|          |
|----------|
| 919.37   |
| - 906.60 |
| 12.77    |

B.M. #14

0

4.25

924.05

4.68

3.98

919.37

919.80

923.78

(Accepted spike in Elec. light Pole on Rt. Sta. 223+30  
From WCF+NRx Datum.

# Drainage Investigation for W 100. - Raymond Road. Near Bangers Greenhouses

W.D.J. 82  
A.M.  
2/20/26 C.J.C. +  
J.S.C. +  
Warm  
Still  
Clear

|      |      |        |
|------|------|--------|
| 9    | 7.9  | 846.4  |
| 8    | 8.5  | 845.8  |
| 7    | 9.6  | 844.7  |
| 6    | 9.5  | 844.8  |
| +62  | 9.5  | 844.8  |
| 5    | 9.4  | 844.9  |
| 4    | 8.9  | 845.4  |
| 3    | 9.0  | 845.3  |
| 2    | 7.8  | 846.5  |
| 1+00 | 6.7  | 847.6  |
| 0+76 | —    | —      |
| 0+44 | 7.4  | 846.9  |
| 0    | 5.8  | 848.5  |
| B.M. | 4.14 | 854.28 |
|      |      | 850.14 |

∠ Rt. 17° 58' to creek.

See page 85

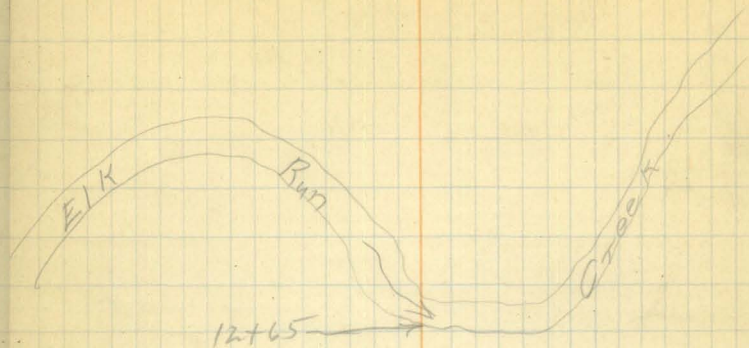
Rd. Fence  
4. Ditch

|     |      |
|-----|------|
| 950 | 1265 |
| 562 | 582  |
| 388 | 703  |

0+00 = Sta. 78+00 - ∠ Rt. 33° 35'

Spike in Tel. Pole #165 on Lt. Sta. 79+95

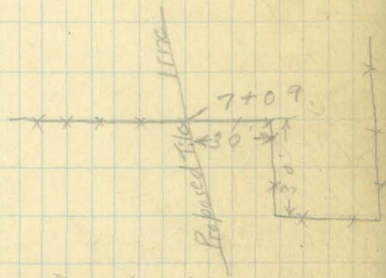




|      |      |        |               |
|------|------|--------|---------------|
| +90  |      |        |               |
| +65  | 11.6 | 837.2  |               |
| +57  | 8.1  | 840.7  |               |
| 12   | 8.6  | 840.2  |               |
| +50  | 5.8  | 843.0  |               |
| +15  | 9.5  | 839.3  |               |
| 11   | 7.0  | 841.8  |               |
| 10   | 7.2  | 841.6  |               |
| 9+35 | 5.9  | 842.9  |               |
| 9+07 |      |        |               |
| 0    | 1.84 | 848.84 | 7.28 847.00 ✓ |
|      |      | 854.28 |               |

Far edge of creek.  
 Edge of Creek. Water Elev.  
 Top of bank at Creek.

High spot.  
 2<sup>nd</sup> Wash



Bottom of bank 1<sup>st</sup> Wash.  
 Fence at top of bank 1<sup>st</sup> Wash.

# Tilo Line Prolim. survey -

SE ly from sta 57 to 1 Wilco-Raymond Rd - 84

|    |             |      |        |   |
|----|-------------|------|--------|---|
| 13 |             | 6-8  | 847.5  | 1 |
| 12 |             | 6.6  | 847.7  |   |
| 11 |             | 7.1  | 847.2  |   |
| 0  | 5.68 854.32 | 5.38 | 848.64 |   |
| 10 |             | 5.3  | 848.7  |   |
| 9  |             | 4.9  | 849.1  |   |
| 8  |             | 5.0  | 848.2  |   |
| 7  |             | 6.2  | 847.8  |   |
| 6  |             | 5.5  | 848.5  |   |
| 5  |             | 6.0  | 848.0  |   |
| 4  |             | 6.1  | 847.9  |   |
| 3  |             | 6.3  | 847.7  |   |
| 2  |             | 6.0  | 848.0  |   |
| 1  |             | 5.7  | 848.2  |   |
| 0  |             | 3.8  | 850.2  |   |

Can lower Ground Elev. 1' by going W. 50'

|              |            |
|--------------|------------|
| 847.8        | 849.0      |
| 3.3          | 847.8      |
| <u>844.5</u> | <u>1.2</u> |

57+00 = 0+00 LRY. 42° 45'

B.M. 1.78 854.02 852.24  
1.50 N.K. 2/27/20 - A.M. Gloat NW. 0-0000  
6.50 B.O. 2/27/20 - A.M. Gloat NW. 0-0000

Top top SW. Headwall / Conc. Cul. 58+00

|      |             |      |        |
|------|-------------|------|--------|
| 1450 |             | 5.8  | 849.0  |
| 900  | distance    | 6.0  | 848.8  |
| 0    | 4.76 854.83 | 5.52 | 850.07 |
| 450  |             | 6.9  | 848.7  |
| 160  |             | 7.8  | 847.8  |
| 0    |             | 4.8  | 850.8  |

Spks in fence post.

B.M. 3.35 855.59 852.24 ✓

52+43 E of Bl vd. South h. - 0+00

± Lafayette St. Road  
 B.M. + on Hd. Wall conc. Cul. 58+00 f.



|       |     |       |
|-------|-----|-------|
| +59.2 | 4.4 | 847.5 |
| 32    | 6.4 | 845.5 |
| 31    | 6.5 | 845.4 |
| 30    | 6.3 | 845.6 |
| 29    | 6.4 | 845.5 |

+5.09 851.93

+465.02<sup>px</sup>

-5.13

|    |     |        |
|----|-----|--------|
| 29 | 5.6 | 846.84 |
| 27 | 6.0 | 846.0  |
| 26 | 5.3 | 846.7  |
| 25 | 4.9 | 847.1  |
| 24 | 5.2 | 846.8  |
| 23 | 5.0 | 847.0  |
| 22 | 5.5 | 846.5  |

21<sup>px</sup>

+5.69

851.97

6.1

0 -8.04 846.28

20 8.4 845.9

19 7.2 847.1

18 7.4 846.9

17 7.8 846.5

16 7.3 847.0

+41.3 7.3 847.0

15 7.5 846.8

14 7.4 846.9

L RT 60° Approx. = Sta. 2 + 00 on line on pgs 82

Σ

L RT 66° 17'

L Lt 48° 00'

Ground is 57.06' Higher

L Lt. 60° 28'

B.M. - 4.19 851.97

+ 6.06 856.16

① - 5.48 —

— 850.10

13+21

5.5 850.1

13-

7.3 848.3

12"

6.9 848.7

11"

6.8 848.8

10"

6.7 848.9

100' from 8+00 to 10+00

8+60

7.1 848.5

8

7.2 848.4

7

7.3 848.3

6

8.0 847.6

5

8.3 847.3

+ 7.35

855.58

②

- 3.70

848.23

4

4.4 847.5

3

5.1 846.8

2

5.6 846.3

1

5.3 846.6

0

5.1 846.4

852.2

851.97

0.23

 $\angle Rt, 55^{\circ} 55'$   
 = Sta. 64+84.1 on W/leg. to Raymond Rd.

 100' from 8+00 to 10+00  
 $\angle Rt, 66^{\circ} 03'$ 

28+46.5 = 0+00

 $\angle 24. 12.3^{\circ} 43'$



3/8/26 P.M.

Butterfield - Notes  
Cavanaugh - T  
Hollis - PProposed Culv. Notes for  
Waterloo-Raymond Road.

87

Sta. B.S. H.I. F.S. Elev.  
B.M. 5.54 857.63 852.09  
19+00 = Place Conc. Culv.

Spike in Tel. Pole #116 on Lt.

|    |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|
| 49 | 5.3  | 7.1  | 7.7  | 6.3  | 5.6  | 5.5  | 6.2  | 6.2  | 5.5  | 5.6  | 5.6  |
| 3  | 31   | 27   | 23   | 18   | 0    | 13   | 17   | 19   | 23   | 29   | 33   |
| 7  | 52.3 | 50.5 | 49.9 | 51.3 | 52.0 | 52.1 | 51.4 | 51.4 | 52.1 | 52.0 | 52.0 |

58+09 = 3'x3'x24' - Note: - See X-Section on  
Page 59 of this book.

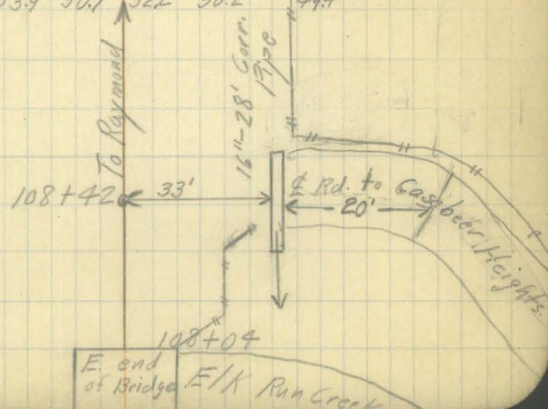
79+00 = This is lowest spot in general -  
See X-Section Page 60 of this book.

108+42 = Right angle at 33' from  $\frac{1}{2}$  on  
Right =  $\frac{1}{2}$  of Road to Casebeer  
Heights is Corr. Pipe 16" x 28' long.

B.M. 5.38 860.15 854.77

on NW Wing at N. end of bridge Sta. 107+10

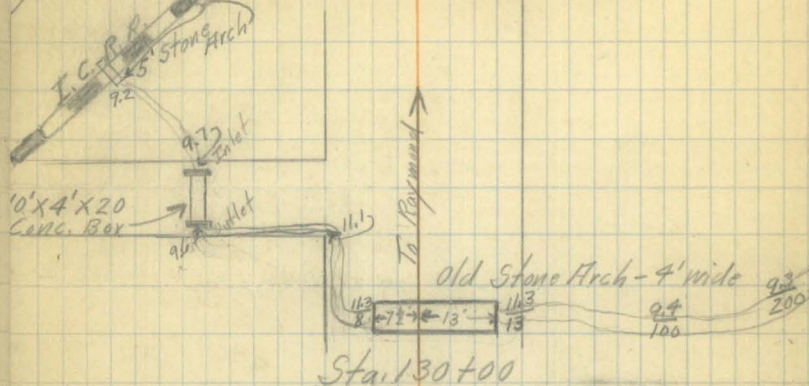
|    |       |      |      |      |        |      |      |      |      |
|----|-------|------|------|------|--------|------|------|------|------|
|    | Inlet |      |      |      | Outlet |      |      |      |      |
| 49 | 8.3   | 8.3  | 6.2  | 6.1  | 6.3    | 2.5  | 8.0  | 10.0 | 10.8 |
| 9  | 20    | 12   | 10   | 0    | 12     | 16   | 19   | 27   | 40   |
| 3  | 51.9  | 51.9 | 54.0 | 54.1 | 53.9   | 50.7 | 52.2 | 50.2 | 49.4 |





| Sta. | B.S. | I.I.   | F.S. | Elev.  |
|------|------|--------|------|--------|
| B.M. | 8.40 | 864.73 |      | 856.33 |

Spike in Tel Pole on Lt. Sta. 130+02



$140+87=4' \times 3' \times 26'$  - Water flows N. - See  
X-Section Page 77 this book.

|      |      |        |        |
|------|------|--------|--------|
| B.M. | 4.65 | 881.66 | 877.01 |
|------|------|--------|--------|

Don S. Hdwt. Conc. Culv. Sta. 160+91

$$160 \div 91 = 3' \times 3' \times 16'$$

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 12.0 | 11.2 | 9.5  | 8.9  | 8"   | 7.7  | 5.8  | 5.6  | 5.6  | 4.6  | 8"   | 9.0  | 8.8  | 7.8  | 7.1  |
| 50   | 20   | 15   | 7    | Hdwl | 6    | 6    | 0    | 10   | 10   | Hdwl | 11   | 18   | 22   | 30   |
| 69.7 | 70.5 | 72.2 | 72.8 |      | 77.0 | 76.3 | 76.1 | 76.1 | 77.1 |      | 72.7 | 72.9 | 73.9 | 74.6 |

|      |      |        |        |
|------|------|--------|--------|
| B.M. | 4.11 | 880.94 | 876.83 |
|------|------|--------|--------|

8 on S. Hdwb. Conc. Culr. Sta. 168 + 19

$$168 \div 19 = 2' \times 2' \times 20'$$

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 11.0 | 9.3  | 9.2  | 8.9  | 9.3  | 9.3  | 9.8  | 9.5  | 9.8  | 9.1  | 9.1  | 8.9  | 7.2  | 6.9  | 6.3  | 7.0  |
| 75   | 23   | 18   | 11   | 10   | 10   | 10   | 0    | 10   | 10   | 10   | 11   | 18   | 22   | 25   | 33   |
| 69.9 | 71.6 | 71.7 | 72.0 | 71.6 | 71.6 | 71.7 | 71.7 | 71.6 | 71.8 | 71.8 | 72.0 | 73.7 | 74.0 | 74.6 | 76.9 |
| F.L. |      |      |      |      |      |      |      |      |      | F.L. |      |      |      |      |      |



| Rod               | stadia                                            |                    |        | Page                             |
|-------------------|---------------------------------------------------|--------------------|--------|----------------------------------|
| Interepts.        | Distance                                          | H.I.               | B.S.   | F.S.                             |
| Sta.              |                                                   |                    |        | Grade                            |
| B.M.              | 400 <sup>0+00</sup> <del>ft.</del> at 856.34 4/10 |                    |        | 852.24 SW Adm. Conc. Culv.       |
| 4.00              | 95° Δ N.W. of Culv.                               | 5.2 = Average H.I. |        |                                  |
| 2.09              | 191'                                              |                    | - 8.6  | 847.7                            |
| <del>1.22</del>   | 450'                                              |                    | - 8.2  | 848.1                            |
| 1.50              | 700'                                              | 854.21             | - 6.15 | - 8.28 848.06                    |
| B.M.              | 850'                                              |                    | - 4.01 | 850.20 <i>pile in fence post</i> |
| 1.80              | 880'                                              |                    | - 4.80 | 849.4                            |
| 2.00              | 1080                                              | 854.79             | - 5.38 | 849.59                           |
| 2.55              | 1335                                              |                    | - 4.21 | 849.98                           |
| 2.28              | 1563                                              | 855.28             | + 5.30 | 850.10                           |
| 2.73              | 1836                                              |                    | - 6.01 | 849.27                           |
| 2.18              | 2044                                              | 855.07             | + 5.80 | 849.9                            |
| 2.49              | 2293                                              |                    | - 5.29 | 849.78                           |
| 2.34              | 2527                                              | 855.14             | + 5.36 | 849.9                            |
| 1.68              | 2695                                              |                    | - 5.70 | 849.44                           |
|                   | 3405                                              |                    |        |                                  |
| 710 to fence from |                                                   |                    |        |                                  |

## IMPROVED TABLES AND INFORMATION

3 NKS # of 50c 22-89-12 -



### DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope  $1\frac{1}{2}$  to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

TABLE No. 9.

To find Tangent and External for curve of any other degree, divide by degree of curve and add correction found in column of corrections.

Degree of curve with a given  $I$  may be found by dividing tangent, (or external), opposite  $I$  by given tangent, (or external).

The distance from a point on the tangent to the curve is very nearly the square of the tangent length divided by twice the radius.

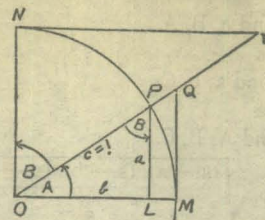


TABLE II  
TRIGONOMETRIC FORMULÆ

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

$$R = OB = c = 1$$

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

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

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

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

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

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

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

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

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

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

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

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

Law of Lines  $\frac{\sin A}{a} = \frac{\sin B}{B} = \frac{\sin C^1}{C}$

Law of Cosines  $c^2 = a^2 + b^2 - 2ab \cos C$

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



TABLE II—Continued  
TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Lines.

Given A, B, c; to find a, b, C.

Use Law of Lines.

Given a, b, c; to find A, B, C.

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

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

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

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

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

Area of a triangle:

$$\text{Area} = \frac{1}{2} ab \sin C$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

PRISMOIDAL FORMULA.

$$\text{Vol.} = \frac{h}{6} (B + b + 4M)$$

h = altitude; b, B = bases; M = midsection

TABLE III  
INCHES AND FRACTIONS OF AN INCH IN DECIMALS OF A FOOT

|                 | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |                 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|
| $\frac{1}{16}$  | .0052 | .0885 | .1719 | .2552 | .3385 | .4219 | .5052 | .5885 | .6719 | .7552 | .8385 | .9219 | $\frac{1}{16}$  |
| $\frac{1}{8}$   | .0104 | .0938 | .1771 | .2604 | .3438 | .4271 | .5104 | .5938 | .6771 | .7604 | .8438 | .9271 | $\frac{1}{8}$   |
| $\frac{3}{16}$  | .0156 | .0990 | .1823 | .2656 | .3490 | .4323 | .5156 | .5990 | .6823 | .7656 | .8490 | .9323 | $\frac{3}{16}$  |
| $\frac{1}{4}$   | .0208 | .1042 | .1875 | .2708 | .3542 | .4375 | .5208 | .6042 | .6875 | .7708 | .8542 | .9375 | $\frac{1}{4}$   |
| $\frac{5}{16}$  | .0260 | .1094 | .1927 | .2760 | .3594 | .4427 | .5260 | .6094 | .6927 | .7760 | .8594 | .9427 | $\frac{5}{16}$  |
| $\frac{3}{8}$   | .0313 | .1146 | .1979 | .2813 | .3646 | .4479 | .5313 | .6146 | .6979 | .7813 | .8646 | .9479 | $\frac{3}{8}$   |
| $\frac{7}{16}$  | .0365 | .1198 | .2031 | .2865 | .3698 | .4531 | .5365 | .6198 | .7031 | .7865 | .8698 | .9531 | $\frac{7}{16}$  |
| $\frac{1}{2}$   | .0417 | .1250 | .2083 | .2917 | .3750 | .4583 | .5417 | .6250 | .7083 | .7917 | .8750 | .9583 | $\frac{1}{2}$   |
| $\frac{9}{16}$  | .0469 | .1302 | .2135 | .2969 | .3803 | .4635 | .5469 | .6302 | .7135 | .7969 | .8802 | .9635 | $\frac{9}{16}$  |
| $\frac{5}{8}$   | .0521 | .1354 | .2188 | .3021 | .3854 | .4688 | .5521 | .6354 | .7188 | .8021 | .8854 | .9688 | $\frac{5}{8}$   |
| $\frac{11}{16}$ | .0573 | .1406 | .2240 | .3073 | .3906 | .4740 | .5573 | .6406 | .7240 | .8073 | .8906 | .9740 | $\frac{11}{16}$ |
| $\frac{3}{4}$   | .0625 | .1458 | .2292 | .3125 | .3958 | .4792 | .5625 | .6458 | .7292 | .8125 | .8958 | .9792 | $\frac{3}{4}$   |
| $\frac{7}{8}$   | .0677 | .1510 | .2344 | .3177 | .4010 | .4844 | .5677 | .6510 | .7344 | .8177 | .9010 | .9844 | $\frac{7}{8}$   |
| $\frac{15}{16}$ | .0729 | .1563 | .2396 | .3229 | .4063 | .4896 | .5729 | .6563 | .7396 | .8229 | .9063 | .9896 | $\frac{15}{16}$ |
| 1               | .0781 | .1615 | .2448 | .3281 | .4115 | .4948 | .5781 | .6615 | .7448 | .8281 | .9115 | .9948 | 1               |
|                 | .0833 | .1667 | .2500 | .3333 | .4167 | .5000 | .5833 | .6667 | .7500 | .8333 | .9167 | 1.000 |                 |
|                 | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |                 |

TABLE IV  
USEFUL RELATIONS.

|               |                      |                |
|---------------|----------------------|----------------|
| Lineal feet   | ×.00019              | = miles        |
| Lineal yards  | ×.0006               | = miles        |
| Square inches | ×.007                | = square feet  |
| Square feet   | ×.111                | = square yards |
| Square yards  | ×.0002067            | = acres        |
| Acres         | ×4840                | = square yards |
| Cubic inches  | ×.00058              | = cubic feet   |
| Cubic feet    | ×.03704              | = cubic yards  |
| Links         | ×.22                 | = yards        |
| Links         | ×.66                 | = feet         |
| Feet          | ×1.5                 | = links        |
| 360°          | = 21600'             | = 1296000"     |
| Radius        | = arc of 57.2957790° |                |
| Arc of 1°     | (radius = 1)         | = .017453292   |
| Arc of 1'     | (radius = 1)         | = .000290888   |
| Arc of 1"     | (radius = 1)         | = .000004848   |

$$\pi = 3.141592654$$

$$\frac{\pi}{4} = 0.785398163$$

$$\frac{\pi}{6} = 0.523598776$$

$$\sqrt{\frac{4}{\pi}} = 1.128379167$$

$$\frac{\pi}{6} = 0.523598776$$

$$\frac{4\pi}{3} = 4.188790205$$

Curvature of Earth's surface = about 0.7 feet in 1 mile

Curvature in feet = 0.667 (Dist. in miles)<sup>2</sup>

Difference between arc and chord length, 0.05 feet in 11½ miles

$$\text{Probable error of a single observation} = 0.6754 \sqrt{\frac{M v^2}{n-1}}$$

Error in chaining of 0.01 feet in 100 feet:

Due to—

1. Length of tape error of 0.01 feet
2. Alignment. One end 1.4 feet out of line
3. Sag of tape at centre of 0.61 feet.
4. Temperature difference of 15°
5. Difference of pull of 15 lbs.

#### STADIA REDUCTION FORMULAE.

Horizontal Distance =  $R - R \sin^2 a + C \cos a$

Vertical Distance =  $R \frac{1}{2} \sin 2a + C \sin a$

$R = \text{Reading} \times \frac{\text{distance from Object glass to cross hairs}}{\text{distance between cross hairs}}$

C = distance from Object glass to cross hairs + distance from Object glass to center of instrument.

a = angle of elevation for mid Reading







TABLE VI (continued)  
SINES, COSINES, TANGENTS, COTANGENTS (continued)

| °   | sin  | tan    | sin  | tan    | sin  | tan    | sin  | tan    | sin   | tan    | sin   | tan    | °   |
|-----|------|--------|------|--------|------|--------|------|--------|-------|--------|-------|--------|-----|
| 0'  | 0'   | 10'    | 10'  | 20'    | 20'  | 30'    | 30'  | 40'    | 40'   | 50'    | 50'   | 60'    | 0'  |
| 46  | 7193 | 1.0355 | 7214 | 1.0416 | 7234 | 1.0477 | 7254 | 1.0533 | 7274  | 1.0599 | 7294  | 1.0661 | 43  |
| 47  | 314  | .0724  | 333  | .0786  | 353  | .0850  | 373  | .0913  | 392   | .0977  | 412   | .1041  | 42  |
| 48  | 431  | .1106  | 451  | .1171  | 470  | .1237  | 490  | .1303  | 509   | .1369  | 528   | .1436  | 41  |
| 49  | 547  | .1504  | 566  | .1571  | 585  | .1640  | 604  | .1708  | 623   | .1778  | 642   | .1847  | 40  |
| 50  | 660  | 1.1918 | 7679 | 1.1988 | 7698 | 1.2059 | 7716 | 1.2131 | 7735  | 1.2203 | 7753  | 1.2276 | 39  |
| 51  | 771  | .2349  | 790  | .2423  | 808  | .2497  | 826  | .2572  | 844   | .2647  | 862   | .2723  | 38  |
| 52  | 880  | .2799  | 898  | .2876  | 916  | .2954  | 934  | .3032  | 951   | .3111  | 969   | .3190  | 37  |
| 53  | 986  | .3270  | 8004 | .3351  | 8021 | .3452  | 8039 | .3514  | 8056  | .3597  | 8073  | .3680  | 36  |
| 54  | 8090 | .3764  | 107  | .3848  | 124  | .3934  | 141  | .4019  | 158   | .4106  | 175   | .4193  | 35  |
| 55  | 192  | .4281  | 208  | .4370  | 225  | .4460  | 241  | .4550  | 258   | .4641  | 274   | .4733  | 34  |
| 56  | 290  | .4826  | 307  | .4919  | 323  | .5013  | 339  | .5108  | 355   | .5204  | 371   | .5301  | 33  |
| 57  | 387  | .5399  | 403  | .5497  | 418  | .5597  | 434  | .5697  | 450   | .5798  | 465   | .5900  | 32  |
| 58  | 480  | .6003  | 496  | .6107  | 511  | .6212  | 526  | .6319  | 542   | .6426  | 557   | .6534  | 31  |
| 59  | 572  | .6643  | 587  | .6753  | 601  | .6864  | 616  | .6977  | 631   | .7090  | 646   | .7205  | 30  |
| 60  | 660  | 1.7321 | 8675 | 1.7437 | 8689 | 1.7556 | 8704 | 1.7675 | 8718  | 1.7797 | 8732  | 1.7917 | 29  |
| 61  | 746  | .8040  | 760  | .8165  | 774  | .8291  | 788  | .8418  | 802   | .8546  | 816   | .8676  | 28  |
| 62  | 829  | .8807  | 843  | .8940  | 857  | .9074  | 870  | .9210  | 884   | .9347  | 897   | .9486  | 27  |
| 63  | 910  | .9626  | 923  | .9768  | 936  | .9912  | 949  | 2.0057 | 962   | 2.0204 | 975   | 2.0353 | 26  |
| 64  | 988  | 2.0503 | 9001 | 2.0655 | 9013 | 2.0809 | 9026 | .0965  | 9038  | .1123  | 9051  | .1283  | 25  |
| 65  | 9063 | 1.445  | 075  | 1.609  | 088  | .1775  | 100  | .1943  | 112   | .2113  | 124   | .2286  | 24  |
| 66  | 135  | .2460  | 147  | .2637  | 159  | .2817  | 171  | .2998  | 182   | .3183  | 194   | .3369  | 23  |
| 67  | 205  | .3559  | 216  | .3750  | 228  | .3945  | 239  | .4142  | 250   | .4342  | 261   | .4545  | 22  |
| 68  | 272  | .4751  | 283  | .4960  | 293  | .5172  | 304  | .5386  | 315   | .5605  | 325   | .5826  | 21  |
| 69  | 336  | .6051  | 346  | .6279  | 356  | .6511  | 367  | .6746  | 377   | .6985  | 387   | .7228  | 20  |
| 70  | 397  | 2.7475 | 9407 | 2.7725 | 9417 | 2.7980 | 9426 | 2.8239 | 9436  | 2.8502 | 9446  | 2.8770 | 19  |
| 71  | 455  | .9042  | 465  | .9319  | 474  | .9600  | 483  | .9887  | 492   | 3.0178 | 502   | 3.0475 | 18  |
| 72  | 511  | 3.0777 | 520  | 3.1084 | 528  | 3.1397 | 537  | 3.1716 | 546   | .2041  | 555   | .2371  | 17  |
| 73  | 563  | .2709  | 572  | .3052  | 580  | .3402  | 588  | .3759  | 596   | .4124  | 605   | .4495  | 16  |
| 74  | 613  | .4874  | 621  | .5261  | 628  | .5656  | 636  | .6059  | 644   | .6470  | 652   | .6891  | 15  |
| 75  | 659  | .7321  | 667  | .7760  | 674  | .8208  | 681  | .8657  | 689   | .9136  | 696   | .9617  | 14  |
| 76  | 703  | 4.0108 | 710  | 4.0611 | 717  | 4.1126 | 724  | 4.1653 | 730   | 4.2193 | 737   | 4.2747 | 13  |
| 77  | 744  | .3315  | 750  | .3897  | 757  | .4494  | 763  | .5107  | 769   | .5736  | 775   | .6382  | 12  |
| 78  | 781  | .7046  | 787  | .7729  | 793  | .8430  | 799  | .9152  | 805   | .9894  | 811   | 5.0658 | 11  |
| 79  | 816  | .1446  | 822  | 5.2257 | 827  | 5.3093 | 833  | 5.3955 | 838   | 5.4845 | 843   | .5764  | 10  |
| 80  | 9848 | 5.6713 | 9853 | 5.7694 | 9858 | 5.8708 | 9863 | 5.9758 | 9868  | 6.0844 | 9872  | 6.1970 | 9   |
| 81  | 877  | 6.3138 | 881  | 6.4348 | 886  | 6.5606 | 890  | 6.6912 | 894   | .8269  | 899   | .9682  | 8   |
| 82  | 903  | 7.1154 | 907  | 7.2687 | 911  | 7.4287 | 914  | 7.5958 | 918   | 7.7704 | 922   | 7.9530 | 7   |
| 83  | 925  | 8.1443 | 929  | 8.3450 | 932  | 8.5555 | 936  | 8.7769 | 939   | 9.0098 | 942   | 9.2553 | 6   |
| 84  | 945  | 9.5144 | 948  | 9.7882 | 951  | 10.078 | 954  | 10.385 | 957   | 10.711 | 959   | 11.059 | 5   |
| 85  | 962  | 11.430 | 964  | 11.826 | 967  | 12.250 | 969  | 12.706 | 971   | 13.187 | 974   | 13.727 | 4   |
| 86  | 976  | 14.300 | 978  | 14.924 | 980  | 15.605 | 981  | 16.350 | 983   | 17.169 | 985   | 18.075 | 3   |
| 87  | 986  | 19.081 | 988  | 20.206 | 989  | 21.470 | 990  | 22.903 | 992   | 24.542 | 993   | 26.432 | 2   |
| 88  | 994  | 28.636 | 9995 | 31.242 | 9996 | 34.368 | 9997 | 38.189 | 997   | 42.964 | 9998  | 49.104 | 1   |
| 89  | 9998 | 57.290 | 9999 | 68.750 | 9999 | 85.940 | 9999 | 114.58 | 1.000 | 171.88 | 1.000 | 343.77 | 0   |
| 60' | 60'  | 50'    | 50'  | 40'    | 40'  | 30'    | 30'  | 20'    | 30'   | 10'    | 10'   | 60'    | 60' |
| cos | cot  | cos    | cot  | cos    | cot  | cos    | cot  | cos    | cot   | cos    | cot   | cos    | cot |

TABLE VII  
RODS IN FEET AND INCHES

| Rods | Feet Inches | Rods | Feet Inches | Rods | Feet Inches | Rods | Feet Inches | Rods | Feet Inches |
|------|-------------|------|-------------|------|-------------|------|-------------|------|-------------|
| 1    | 16-6        | 21   | 346-6       | 41   | 676-6       | 61   | 1006-6      | 81   | 1336-6      |
| 2    | 33-0        | 22   | 363-0       | 42   | 693-0       | 62   | 1023-0      | 82   | 1353-0      |
| 3    | 49-6        | 23   | 379-6       | 43   | 709-6       | 63   | 1039-6      | 83   | 1369-6      |
| 4    | 66-0        | 24   | 396-0       | 44   | 726-0       | 64   | 1056-0      | 84   | 1386-0      |
| 5    | 82-6        | 25   | 412-6       | 45   | 742-6       | 65   | 1072-6      | 85   | 1402-6      |
| 6    | 99-0        | 26   | 429-0       | 46   | 759-0       | 66   | 1089-0      | 86   | 1419-0      |
| 7    | 115-6       | 27   | 445-6       | 47   | 775-6       | 67   | 1105-6      | 87   | 1435-6      |
| 8    | 132-0       | 28   | 462-0       | 48   | 792-0       | 68   | 1122-0      | 88   | 1452-0      |
| 9    | 148-6       | 29   | 478-6       | 49   | 808-6       | 69   | 1138-6      | 89   | 1468-6      |
| 10   | 165-0       | 30   | 495-0       | 50   | 825-0       | 70   | 1155-0      | 90   | 1485-0      |
| 11   | 181-6       | 31   | 511-6       | 51   | 841-6       | 71   | 1171-6      | 91   | 1501-6      |
| 12   | 198-0       | 32   | 528-0       | 52   | 858-0       | 72   | 1188-0      | 92   | 1518-0      |
| 13   | 214-6       | 33   | 544-6       | 53   | 874-6       | 73   | 1204-6      | 93   | 1534-6      |
| 14   | 231-0       | 34   | 561-0       | 54   | 891-0       | 74   | 1221-0      | 94   | 1551-0      |
| 15   | 247-6       | 35   | 577-6       | 55   | 907-6       | 75   | 1237-6      | 95   | 1567-6      |
| 16   | 264-0       | 36   | 594-0       | 56   | 924-0       | 76   | 1254-0      | 96   | 1584-0      |
| 17   | 280-6       | 37   | 610-6       | 57   | 940-6       | 77   | 1270-6      | 97   | 1600-6      |
| 18   | 297-0       | 38   | 627-0       | 58   | 957-0       | 78   | 1287-0      | 98   | 1617-0      |
| 19   | 313-6       | 39   | 643-6       | 59   | 973-6       | 79   | 1303-6      | 99   | 1633-6      |
| 20   | 330-0       | 40   | 660-0       | 60   | 990-0       | 80   | 1320-0      | 100  | 1650-0      |

TABLE VIII  
LINKS IN FEET AND INCHES

| Links | Feet Inches | Links | Feet Inches | Links | Feet Inches | Links | Feet Inches | Links | Feet Inches | Links | Feet Inches |
|-------|-------------|-------|-------------|-------|-------------|-------|-------------|-------|-------------|-------|-------------|
| 1     | 0-7.92      | 18    | 11-10.56    | 35    | 23-1.20     | 52    | 34-3.84     | 69    | 45-6.48     | 86    | 56-9.12     |
| 2     | 1-3.84      | 19    | 12-6.48     | 36    | 23-9.12     | 53    | 34-11.76    | 70    | 46-2.40     | 87    | 57-5.04     |
| 3     | 1-11.76     | 20    | 13-2.40     | 37    | 24-5.04     | 54    | 35-7.68     | 71    | 46-10.32    | 88    | 58-0.96     |
| 4     | 2-7.68      | 21    | 13-10.32    | 38    | 25-0.96     | 55    | 36-3.60     | 72    | 47-6.24     | 89    | 58-8.88     |
| 5     | 3-3.60      | 22    | 14-6.24     | 39    | 25-8.88     | 56    | 36-11.52    | 73    | 48-2.16     | 90    | 59-4.80     |
| 6     | 3-11.52     | 23    | 15-2.16     | 40    | 26-4.80     | 57    | 37-7.44     | 74    | 48-10.08    | 91    | 60-0.72     |
| 7     | 4-7.44      | 24    | 15-10.08    | 41    | 27-0.72     | 58    | 38-3.36     | 75    | 49-6.00     | 92    | 60-8.64     |
| 8     | 5-3.36      | 25    | 16-6.00     | 42    | 27-8.64     | 59    | 38-11.28    | 76    | 50-1.92     | 93    | 61-4.56     |
| 9     | 5-11.28     | 26    | 17-1.92     | 43    | 28-4.56     | 60    | 39-7.20     | 77    | 50-9.84     | 94    | 62-0.48     |
| 10    | 6-7.20      | 27    | 17-9.84     | 44    | 29-0.48     | 61    | 40-3.12     | 78    | 51-5.76     | 95    | 62-8.40     |
| 11    | 7-3.12      | 28    | 18-5.76     | 45    | 29-8.40     | 62    | 40-11.04    | 79    | 52-1.68     | 96    | 63-4.32     |
| 12    | 7-11.04     | 29    | 19-1.68     | 46    | 30-4.32     | 63    | 41-6.96     | 80    | 52-9.60     | 97    | 64-0.24     |
| 13    | 8-6.96      | 30    | 19-9.60     | 47    | 31-0.24     | 64    | 42-2.88     | 81    | 53-5.52     | 98    | 64-8.16     |
| 14    | 9-2.88      | 31    | 20-5.52     | 48    | 31-8.16     | 65    | 42-10.80    | 82    | 54-1.44     | 99    | 65-4.08     |
| 15    | 9-10.80     | 32    | 21-1.44     | 49    | 32-4.08     | 66    | 43-6.72     | 83    | 54-9.36     | 100   | 66-0.00     |
| 16    | 10-6.72     | 33    | 21-9.36     | 50    | 33-0.00     | 67    | 44-2.64     | 84    | 55-5.28     | 101   | 66-7.92     |
| 17    | 11-2.64     | 34    | 22-5.28     | 51    | 33-7.92     | 68    | 44-10.56    | 85    | 56-1.20     | 102   | 67-3.84     |



TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

| I   | T      | E      | I=10°  | I   | T      | E      | I=20°  | I   | T      | E      | I=30°  |
|-----|--------|--------|--------|-----|--------|--------|--------|-----|--------|--------|--------|
| 1°  | 50.00  | .218   | +      | 11° | 551.70 | 26.500 | +      | 21° | 1061.9 | 97.577 | +      |
| 10' | 58.34  | .297   | 5° C.  | 10' | 560.11 | 27.313 | 5° C.  | 10' | 1070.8 | 99.155 | 5° C.  |
| 20' | 66.67  | .358   | T      | 20' | 568.53 | 28.137 | T      | 20' | 1079.2 | 100.75 | T      |
| 30' | 75.01  | .491   | T      | 30' | 576.95 | 28.974 | T      | 30' | 1087.8 | 102.35 | T      |
| 40' | 83.34  | .606   | .03    | 40' | 585.36 | 29.824 | .06    | 40' | 1096.4 | 103.97 | .10    |
| 50' | 91.68  | .733   | E      | 50' | 593.79 | 30.686 | E      | 50' | 1105.1 | 105.60 | E      |
| 2°  | 100.01 | .873   | .001   | 12° | 602.21 | 31.561 | .006   | 22° | 1113.7 | 107.24 | .013   |
| 10' | 108.35 | 1.024  |        | 10' | 610.64 | 32.447 |        | 10' | 1122.4 | 108.90 |        |
| 20' | 116.68 | 1.188  |        | 20' | 619.07 | 33.347 |        | 20' | 1131.0 | 110.57 |        |
| 30' | 125.02 | 1.364  |        | 30' | 627.50 | 34.259 |        | 30' | 1139.7 | 112.25 |        |
| 40' | 133.36 | 1.552  |        | 40' | 635.93 | 35.183 |        | 40' | 1148.4 | 113.95 |        |
| 50' | 141.70 | 1.752  |        | 50' | 644.37 | 36.120 |        | 50' | 1157.0 | 115.66 |        |
| 3°  | 150.04 | 1.964  | 10° C. | 13° | 652.81 | 37.070 | 10° C. | 23° | 1165.7 | 117.38 | 10° C. |
| 10' | 158.38 | 2.188  | T      | 10' | 661.25 | 38.031 | T      | 10' | 1174.4 | 119.12 | T      |
| 20' | 166.72 | 2.425  | .06    | 20' | 669.70 | 39.006 | .13    | 20' | 1183.1 | 120.87 | .19    |
| 30' | 175.06 | 2.674  | E      | 30' | 678.15 | 39.993 | E      | 30' | 1191.8 | 122.63 | E      |
| 40' | 183.40 | 2.934  | .003   | 40' | 686.60 | 40.992 | .011   | 40' | 1200.5 | 124.41 | .025   |
| 50' | 191.74 | 3.207  |        | 50' | 695.06 | 42.004 |        | 50' | 1209.2 | 126.20 |        |
| 4°  | 200.08 | 3.492  |        | 14° | 703.51 | 43.029 |        | 24° | 1217.9 | 128.00 |        |
| 10' | 208.43 | 3.790  |        | 10' | 711.97 | 44.066 |        | 10' | 1226.6 | 129.82 |        |
| 20' | 216.77 | 4.099  |        | 20' | 720.44 | 45.116 |        | 20' | 1235.3 | 131.65 |        |
| 30' | 225.12 | 4.421  |        | 30' | 728.90 | 46.178 |        | 30' | 1244.0 | 133.50 |        |
| 40' | 233.47 | 4.755  |        | 40' | 737.37 | 47.253 |        | 40' | 1252.8 | 135.35 |        |
| 50' | 241.81 | 5.100  | 15° C. | 50' | 745.85 | 48.341 | 15° C. | 50' | 1261.5 | 137.23 | 15° C. |
| 5°  | 250.16 | 5.459  | T      | 15° | 754.32 | 49.441 | T      | 25° | 1270.2 | 139.11 | T      |
| 10' | 258.51 | 5.829  | .09    | 10' | 762.80 | 50.554 | .19    | 10' | 1279.0 | 141.01 | .29    |
| 20' | 266.86 | 6.211  | E      | 20' | 771.29 | 51.679 | E      | 20' | 1287.7 | 142.93 | E      |
| 30' | 275.21 | 6.606  | .004   | 30' | 779.77 | 52.818 | .017   | 30' | 1296.5 | 144.85 | .038   |
| 40' | 283.57 | 7.013  |        | 40' | 788.26 | 53.969 |        | 40' | 1305.3 | 146.75 |        |
| 50' | 291.92 | 7.432  |        | 50' | 796.75 | 55.132 |        | 50' | 1314.0 | 148.75 |        |
| 6°  | 300.28 | 7.863  |        | 16° | 805.25 | 56.309 |        | 26° | 1322.8 | 150.71 |        |
| 10' | 308.64 | 8.307  |        | 10' | 813.75 | 57.498 |        | 10' | 1331.6 | 152.69 |        |
| 20' | 316.99 | 8.762  |        | 20' | 822.25 | 58.699 |        | 20' | 1340.4 | 154.69 |        |
| 30' | 325.35 | 9.230  |        | 30' | 830.76 | 59.914 |        | 30' | 1349.2 | 156.70 |        |
| 40' | 333.71 | 9.710  | 20° C. | 40' | 839.27 | 61.141 | 20° C. | 40' | 1358.0 | 158.72 | 20° C. |
| 50' | 342.08 | 10.202 | T      | 50' | 847.78 | 62.381 | T      | 50' | 1366.8 | 160.76 | T      |
| 7°  | 350.44 | 10.707 | .13    | 17° | 856.30 | 63.634 | .26    | 27° | 1375.6 | 162.81 | .39    |
| 10' | 358.81 | 11.224 | E      | 10' | 864.82 | 64.900 | E      | 10' | 1384.4 | 164.86 | E      |
| 20' | 367.17 | 11.753 | .006   | 20' | 873.35 | 66.178 | .022   | 20' | 1393.2 | 166.95 | .051   |
| 30' | 375.54 | 12.294 |        | 30' | 881.88 | 67.470 |        | 30' | 1402.0 | 169.04 |        |
| 40' | 383.91 | 12.847 |        | 40' | 890.41 | 68.774 |        | 40' | 1410.9 | 171.15 |        |
| 50' | 392.28 | 13.413 |        | 50' | 898.95 | 70.091 |        | 50' | 1419.7 | 173.27 |        |
| 8°  | 400.66 | 13.991 |        | 18° | 907.49 | 71.421 |        | 28° | 1428.6 | 175.41 |        |
| 10' | 409.03 | 14.582 | 25° C. | 10' | 916.03 | 72.764 | 25° C. | 10' | 1437.4 | 177.55 | 25° C. |
| 20' | 417.41 | 15.184 | T      | 20' | 924.58 | 74.119 | T      | 20' | 1446.3 | 179.72 | T      |
| 30' | 425.79 | 15.799 | .16    | 30' | 933.13 | 75.488 | .32    | 30' | 1455.1 | 181.89 | .49    |
| 40' | 434.17 | 16.426 | E      | 40' | 941.69 | 76.869 | E      | 40' | 1464.0 | 184.08 | E      |
| 50' | 442.55 | 17.065 |        | 50' | 950.25 | 78.264 |        | 50' | 1472.9 | 186.29 |        |
| 9°  | 450.93 | 17.717 | .007   | 19° | 958.81 | 79.671 | .028   | 29° | 1481.8 | 188.51 | .065   |
| 10' | 459.32 | 18.381 |        | 10' | 967.38 | 81.092 |        | 10' | 1490.7 | 190.74 |        |
| 20' | 467.71 | 19.058 |        | 20' | 975.96 | 82.525 |        | 20' | 1499.6 | 192.99 |        |
| 30' | 476.10 | 19.746 |        | 30' | 984.53 | 83.972 |        | 30' | 1508.5 | 195.25 |        |
| 40' | 484.49 | 20.447 |        | 40' | 993.12 | 85.431 |        | 40' | 1517.4 | 197.53 |        |
| 50' | 492.88 | 21.161 |        | 50' | 1001.7 | 86.904 |        | 50' | 1526.3 | 199.82 |        |
| 10° | 501.28 | 21.887 | 30° C. | 20° | 1010.3 | 88.389 | 30° C. | 30° | 1535.3 | 202.12 | 30° C. |
| 10' | 509.68 | 22.624 | T      | 10' | 1018.9 | 89.888 | T      | 10' | 1544.2 | 204.44 | T      |
| 20' | 518.08 | 23.375 | .19    | 20' | 1027.5 | 91.399 | .39    | 20' | 1553.1 | 206.77 | .59    |
| 30' | 526.48 | 24.138 | E      | 30' | 1036.1 | 92.924 | E      | 30' | 1562.1 | 209.12 | E      |
| 40' | 534.89 | 24.913 |        | 40' | 1044.7 | 94.462 |        | 40' | 1571.0 | 211.48 |        |
| 50' | 543.29 | 25.700 | .008   | 50' | 1053.3 | 96.013 | .034   | 50' | 1580.0 | 213.86 | .078   |

T = R tan ½ I

E = R exsec ½ I

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

| I   | T      | E     | I=40°  | I   | T      | E     | I=50°  | I   | T      | E     | I=60°  |
|-----|--------|-------|--------|-----|--------|-------|--------|-----|--------|-------|--------|
| 31° | 1589.0 | 216.3 | +      | 41° | 2142.2 | 387.4 | +      | 51° | 2732.9 | 618.4 | +      |
| 10' | 1598.0 | 218.7 | 5° C.  | 10' | 2151.7 | 390.7 | 5° C.  | 10' | 2743.1 | 622.8 | 5° C.  |
| 20' | 1606.9 | 221.1 | T      | 20' | 2161.2 | 394.1 | T      | 20' | 2753.4 | 627.2 | T      |
| 30' | 1615.9 | 223.5 | .13    | 30' | 2170.8 | 397.4 | .17    | 30' | 2763.7 | 631.7 | .21    |
| 40' | 1624.9 | 226.0 | E      | 40' | 2180.3 | 400.8 | E      | 40' | 2773.9 | 636.2 | E      |
| 50' | 1633.9 | 228.4 | .023   | 50' | 2189.9 | 404.2 | .037   | 50' | 2784.2 | 640.7 | .056   |
| 32° | 1643.0 | 230.9 |        | 42° | 2199.4 | 407.6 |        | 52° | 2794.6 | 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 | 10° C. | 50' | 2247.3 | 425.0 | 10° C. | 50' | 2846.3 | 668.0 | 10° C. |
| 33° | 1697.2 | 246.1 | T      | 43° | 2257.0 | 428.5 | T      | 53° | 2856.7 | 672.7 | T      |
| 10' | 1706.3 | 248.7 | .26    | 10' | 2266.6 | 432.0 | .34    | 10' | 2867.1 | 677.3 | .42    |
| 20' | 1715.3 | 251.3 | E      | 20' | 2276.2 | 435.6 | E      | 20' | 2877.5 | 682.0 | E      |
| 30' | 1724.4 | 253.9 | .046   | 30' | 2285.9 | 439.2 | .075   | 30' | 2888.0 | 686.7 | .112   |
| 40' | 1733.5 | 256.5 |        | 40' | 2295.6 | 442.8 |        | 40' | 2898.4 | 691.4 |        |
| 50' | 1742.6 | 259.1 | 15° C. | 50' | 2305.2 | 446.4 | 15° C. | 50' | 2908.9 | 696.1 | 15° C. |
| 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 | 15° C. | 50' | 2363.5 | 468.4 | 15° C. | 50' | 2972.1 | 725.0 | 15° C. |
| 35° | 1806.6 | 278.1 | T      | 45° | 2373.3 | 472.1 | T      | 55° | 2982.7 | 729.9 | T      |
| 10' | 1815.7 | 280.8 | .40    | 10' | 2383.1 | 475.8 | .51    | 10' | 2993.3 | 734.8 | .63    |
| 20' | 1824.9 | 283.6 | E      | 20' | 2392.8 | 479.6 | E      | 20' | 3003.9 | 739.7 | E      |
| 30' | 1834.1 | 286.4 | .070   | 30' | 2402.6 | 483.4 | .116   | 30' | 3014.5 | 744.6 | .168   |
| 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 | 20° C. | 30' | 2461.7 | 506.4 | 20° C. | 30' | 3078.7 | 774.7 | 20° C. |
| 40' | 1898.6 | 306.4 | T      | 40' | 2471.5 | 510.3 | T      | 40' | 3089.4 | 779.8 | T      |
| 50' | 1907.9 | 309.3 | .53    | 50' | 2481.4 | 514.3 | .68    | 50' | 3100.2 | 784.9 | .84    |
| 37° | 1917.1 | 312.2 | E      | 47° | 2491.3 | 518.2 | E      | 57° | 3110.9 | 790.1 | E      |
| 10' | 1926.4 | 315.2 | .093   | 10' | 2501.2 | 522.2 | .151   | 10' | 3121.7 | 795.2 | .225   |
| 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 | 25° C. | 10' | 2561.0 | 546.3 | 25° C. | 10' | 3186.9 | 826.7 | 25° C. |
| 20' | 1991.5 | 336.3 | T      | 20' | 2571.0 | 550.4 | T      | 20' | 3197.8 | 832.0 | T      |
| 30' | 2000.9 | 339.3 | .67    | 30' | 2581.0 | 554.5 | .85    | 30' | 3208.8 | 837.3 | .105   |
| 40' | 2010.2 | 342.4 | E      | 40' | 2591.0 | 558.6 | E      | 40' | 3219.7 | 842.7 | E      |
| 50' | 2019.6 | 345.5 | .117   | 50' | 2601.1 | 562.8 | .189   | 50' | 3230.7 | 848.1 | .283   |
| 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 | 30° C. | 50' | 2661.6 | 588.0 | 30° C. | 50' | 3296.9 | 880.8 | 30° C. |
| 40° | 2085.4 | 367.7 | T      | 50° | 2671.8 | 592.3 | T      | 60° | 3308.0 | 886.4 | T      |
| 10' | 2094.9 | 371.0 | .80    | 10' | 2681.9 | 596.6 | 1.02   | 10' | 3319.1 | 892.0 | .127   |
| 20' | 2104.3 | 374.2 | E      | 20' | 2692.1 | 600.9 | E      | 20' | 3330.3 | 897.5 | E      |
| 30' | 2113.8 | 377.5 | .141   | 30' | 2702.3 | 605.3 | .227   | 30' | 3341.4 | 903.2 | .346   |
| 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 IX. TANGENTS AND EXTERNALS TO A 1° CURVE

| I   | T      | E      | I=70°  | I   | T      | E      | I=80°  | I   | T      | E      | I=90°  |
|-----|--------|--------|--------|-----|--------|--------|--------|-----|--------|--------|--------|
| 61° | 3375.0 | 920.2  | +      | 71° | 4086.9 | 1308.2 | +      | 81° | 4893.6 | 1805.3 | +      |
| 10° | 3386.3 | 925.9  | 5° C.  | 10° | 4099.5 | 1315.6 | 5° C.  | 10° | 4908.0 | 1814.7 | 5° C.  |
| 20° | 3397.5 | 931.6  | T      | 20° | 4112.1 | 1322.9 | T      | 20° | 4922.5 | 1824.1 | T      |
| 30° | 3408.8 | 937.3  | .25    | 30° | 4124.8 | 1330.3 | .30    | 30° | 4937.0 | 1833.6 | .30    |
| 40° | 3420.1 | 943.1  | E      | 40° | 4137.4 | 1337.7 | E      | 40° | 4951.5 | 1843.1 | E      |
| 50° | 3431.4 | 948.9  | .080   | 50° | 4150.1 | 1345.1 | .110   | 50° | 4966.1 | 1852.6 | .140   |
| 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  | 10° C. | 73° | 4239.7 | 1398.0 | 10° C. | 83° | 5069.2 | 1920.5 | 10° C. |
| 10° | 3522.6 | 996.2  | T      | 10° | 4252.6 | 1405.7 | T      | 10° | 5084.0 | 1930.4 | T      |
| 20° | 3534.1 | 1002.3 | .51    | 20° | 4265.6 | 1413.5 | .61    | 20° | 5099.0 | 1940.3 | .72    |
| 30° | 3545.6 | 1008.3 | E      | 30° | 4278.5 | 1421.2 | E      | 30° | 5113.9 | 1950.3 | E      |
| 40° | 3557.2 | 1014.4 | .159   | 40° | 4291.5 | 1429.0 | .220   | 40° | 5128.9 | 1960.2 | .299   |
| 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 | 15° C. | 50° | 4383.3 | 1484.4 | 15° C. | 50° | 5234.9 | 2031.4 | 15° C. |
| 65° | 3650.2 | 1063.9 | T      | 75° | 4396.5 | 1492.4 | T      | 85° | 5250.3 | 2041.7 | T      |
| 10° | 3661.9 | 1070.2 | .76    | 10° | 4409.8 | 1500.5 | .91    | 10° | 5265.6 | 2052.1 | 1.09   |
| 20° | 3673.7 | 1076.6 | E      | 20° | 4423.1 | 1508.6 | E      | 20° | 5281.0 | 2062.5 | E      |
| 30° | 3685.4 | 1082.9 | .240   | 30° | 4436.4 | 1516.7 | .332   | 30° | 5296.4 | 2073.0 | .450   |
| 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 | 20° C. | 40° | 4530.4 | 1574.7 | 20° C. | 40° | 5405.6 | 2147.5 | 20° C. |
| 50° | 3780.4 | 1134.8 | T      | 50° | 4544.0 | 1583.1 | T      | 50° | 5421.4 | 2158.4 | T      |
| 67° | 3792.4 | 1141.4 | 1.02   | 77° | 4557.6 | 1591.6 | 1.22   | 87° | 5437.2 | 2169.2 | 1.45   |
| 10° | 3804.4 | 1148.0 | E      | 10° | 4571.2 | 1600.1 | E      | 10° | 5453.1 | 2180.2 | E      |
| 20° | 3816.4 | 1154.7 | .321   | 20° | 4584.8 | 1608.6 | .445   | 20° | 5469.0 | 2191.1 | .603   |
| 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 | 25° C. | 20° | 4667.4 | 1660.5 | 25° C. | 20° | 5565.4 | 2258.0 | 25° C. |
| 30° | 3901.2 | 1202.0 | T      | 30° | 4681.3 | 1669.2 | T      | 30° | 5581.6 | 2269.3 | T      |
| 40° | 3913.4 | 1208.9 | 1.28   | 40° | 4695.2 | 1678.1 | 1.53   | 40° | 5597.8 | 2280.6 | 1.83   |
| 50° | 3925.6 | 1215.8 | E      | 50° | 4709.2 | 1686.9 | E      | 50° | 5614.2 | 2292.0 | E      |
| 69° | 3937.9 | 1222.7 | .403   | 79° | 4723.2 | 1695.8 | .558   | 89° | 5630.5 | 2303.5 | .756   |
| 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 | 30° C. | 80° | 4807.7 | 1749.9 | 30° C. | 90° | 5729.7 | 2373.3 | 30° C. |
| 10° | 4024.4 | 1272.1 | T      | 10° | 4822.0 | 1759.0 | T      | 10° | 5746.3 | 2385.1 | T      |
| 20° | 4036.8 | 1279.3 | 1.54   | 20° | 4836.2 | 1768.2 | 1.84   | 20° | 5763.1 | 2397.0 | 2.20   |
| 30° | 4049.3 | 1286.5 | E      | 30° | 4850.5 | 1777.4 | E      | 30° | 5779.9 | 2408.9 | E      |
| 40° | 4061.8 | 1293.6 | .485   | 40° | 4864.8 | 1786.7 | .671   | 40° | 5796.7 | 2420.9 | .910   |
| 50° | 4074.4 | 1300.9 |        | 50° | 4879.2 | 1796.0 |        | 50° | 5813.6 | 2432.9 |        |

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

$$E = R \operatorname{exsec} \frac{1}{2} I$$

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

| I    | T      | E      | I=100° | I    | T      | E      | I=110° | I    | T       | E      | I=120° |
|------|--------|--------|--------|------|--------|--------|--------|------|---------|--------|--------|
| 91°  | 5830.5 | 2444.9 | +      | 101° | 6950.6 | 3278.1 | +      | 111° | 8336.7  | 4386.1 | +      |
| 10°  | 5847.5 | 2457.1 | 5° C.  | 10°  | 6971.3 | 3294.1 | 5° C.  | 10°  | 8362.7  | 4407.6 | 5° C.  |
| 20°  | 5864.6 | 2469.3 | T      | 20°  | 6992.0 | 3310.1 | T      | 20°  | 8388.9  | 4429.2 | T      |
| 30°  | 5881.7 | 2481.5 | .43    | 30°  | 7012.7 | 3326.1 | .51    | 30°  | 8415.1  | 4450.9 | .62    |
| 40°  | 5898.8 | 2493.8 | E      | 40°  | 7033.6 | 3342.3 | E      | 40°  | 8441.5  | 4472.7 | E      |
| 50°  | 5916.0 | 2506.1 | .200   | 50°  | 7054.5 | 3358.5 | .268   | 50°  | 8468.0  | 4494.6 | .360   |
| 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 | 10° C. | 50°  | 7181.7 | 3457.6 | 10° C. | 50°  | 8629.3  | 4628.6 | 10° C. |
| 93°  | 6037.8 | 2594.0 | T      | 103° | 7203.2 | 3474.4 | T      | 113° | 8656.6  | 4651.3 | T      |
| 10°  | 6055.4 | 2606.8 | .86    | 10°  | 7224.7 | 3491.3 | .103   | 10°  | 8684.0  | 4674.2 | .125   |
| 20°  | 6073.1 | 2619.7 | E      | 20°  | 7246.3 | 3508.2 | F      | 20°  | 8711.5  | 4697.2 | E      |
| 30°  | 6090.8 | 2632.6 | .401   | 30°  | 7268.0 | 3525.2 | .536   | 30°  | 8739.2  | 4720.3 | .721   |
| 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°  | 6162.2 | 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 | 15° C. | 50°  | 7444.6 | 3664.5 | 15° C. | 50°  | 8965.0  | 4909.9 | 15° C. |
| 95°  | 6252.8 | 2751.3 | T      | 105° | 7467.0 | 3682.3 | T      | 115° | 8993.8  | 4934.1 | T      |
| 10°  | 6271.1 | 2764.8 | 1.30   | 10°  | 7489.6 | 3700.2 | 1.56   | 10°  | 9022.7  | 4958.6 | 1.93   |
| 20°  | 6289.4 | 2778.3 | E      | 20°  | 7512.2 | 3718.2 | E      | 20°  | 9051.7  | 4983.1 | E      |
| 30°  | 6307.9 | 2792.0 | .604   | 30°  | 7534.9 | 3736.2 | .806   | 30°  | 9080.9  | 5007.8 | 1.09   |
| 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 | 20° C. | 40°  | 7696.3 | 3865.2 | 20° C. | 40°  | 9289.2  | 5184.5 | 20° C. |
| 50°  | 6457.3 | 2903.1 | T      | 50°  | 7719.7 | 3884.0 | T      | 50°  | 9319.5  | 5210.3 | T      |
| 97°  | 6476.2 | 2917.3 | 1.74   | 107° | 7743.2 | 3902.9 | 2.08   | 117° | 9349.9  | 5236.2 | 2.52   |
| 10°  | 6495.2 | 2931.6 | E      | 10°  | 7766.8 | 3921.9 | E      | 10°  | 9380.5  | 5262.3 | E      |
| 20°  | 6514.3 | 2945.9 | .809   | 20°  | 7790.5 | 3940.9 | 1.08   | 20°  | 9411.3  | 5288.6 | 1.46   |
| 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 | 25° C. | 10°  | 7910.4 | 4037.8 | 25° C. | 10°  | 9567.2  | 5422.1 | 25° C. |
| 20°  | 6630.1 | 3033.1 | T      | 20°  | 7934.6 | 4057.4 | T      | 20°  | 9598.9  | 5449.2 | T      |
| 30°  | 6649.6 | 3047.9 | 1.18   | 30°  | 7959.0 | 4077.2 | 2.61   | 30°  | 9630.7  | 5476.5 | 3.16   |
| 40°  | 6669.2 | 3062.8 | E      | 40°  | 7983.5 | 4097.1 | E      | 40°  | 9662.6  | 5504.0 | E      |
| 50°  | 6688.8 | 3077.7 |        | 50°  | 8008.0 | 4117.0 |        | 50°  | 9694.7  | 5531.7 |        |
| 99°  | 6708.6 | 3092.7 | 1.02   | 109° | 8032.7 | 4137.1 | 1.36   | 119° | 9727.0  | 5559.4 | 1.83   |
| 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 | 30° C. | 110° | 8182.8 | 4259.7 | 30° C. | 120° | 9924.0  | 5729.7 | 30° C. |
| 10°  | 6848.5 | 3199.6 | T      | 10°  | 8208.2 | 4280.5 | T      | 10°  | 9957.5  | 5758.6 | T      |
| 20°  | 6868.8 | 3215.1 | 2.62   | 20°  | 8233.7 | 4301.4 | 3.14   | 20°  | 9991.0  | 5787.7 | 3.81   |
| 30°  | 6889.2 | 3230.8 | E      | 30°  | 8259.3 | 4322.4 | E      | 30°  | 10025.0 | 5817.0 | E      |
| 40°  | 6909.6 | 3246.5 |        | 40°  | 8285.0 | 4343.6 |        | 40°  | 10059.0 | 5846.5 |        |
| 50°  | 6930.1 | 3262.3 | 1.22   | 50°  | 8310.8 | 4364.8 | 1.63   | 50°  | 10093.0 | 5876.1 | 2.20   |



TABLE X.  
MIDDLE ORDINATES OF RAILS  
Length of Rail (feet)

| C<br>o / | R<br>Feet | 30<br>Inch | 28<br>Inch | 26<br>Inch | 24<br>Inch | 22<br>Inch | 20<br>Inch | C<br>o | R<br>Feet | 30<br>Inch | 28<br>Inch | 26<br>Inch | 24<br>Inch | 22<br>Inch | 20<br>Inch |
|----------|-----------|------------|------------|------------|------------|------------|------------|--------|-----------|------------|------------|------------|------------|------------|------------|
| 0-20     | 17189     | .08        | .07        | .06        | .05        | .04        | .03        | 8      | 716.8     | 1.88       | 1.64       | 1.42       | 1.20       | 1.01       | .84        |
| 0-40     | 8594      | .16        | .14        | .12        | .10        | .08        | .07        | 9      | 637.3     | 2.12       | 1.84       | 1.60       | 1.35       | 1.14       | .94        |
| 1-0      | 5730      | .24        | .20        | .18        | .15        | .13        | .10        | 10     | 573.7     | 2.36       | 2.05       | 1.78       | 1.50       | 1.27       | 1.04       |
| 1-20     | 4297      | .31        | .27        | .23        | .20        | .17        | .13        | 11     | 521.7     | 2.59       | 2.26       | 1.95       | 1.65       | 1.39       | 1.15       |
| 1-40     | 3438      | .39        | .34        | .29        | .25        | .21        | .17        | 12     | 478.3     | 3.83       | 2.47       | 2.15       | 1.81       | 1.54       | 1.26       |
| 2-0      | 2865      | .47        | .41        | .35        | .30        | .25        | .20        | 13     | 441.7     | 3.05       | 2.66       | 2.30       | 1.96       | 1.66       | 1.36       |
| 2-20     | 2456      | .55        | .48        | .41        | .35        | .29        | .23        | 14     | 410.3     | 3.30       | 2.87       | 2.48       | 2.10       | 1.78       | 1.46       |
| 2-40     | 2149      | .63        | .55        | .47        | .40        | .33        | .27        | 15     | 383.1     | 3.54       | 3.08       | 2.68       | 2.26       | 1.91       | 1.57       |
| 3-0      | 1910      | .71        | .62        | .53        | .45        | .38        | .31        | 16     | 359.3     | 3.76       | 3.28       | 2.83       | 2.40       | 2.04       | 1.67       |
| 3-20     | 1719      | .78        | .68        | .59        | .50        | .42        | .35        | 17     | 338.3     | 4.00       | 3.48       | 3.02       | 2.57       | 2.16       | 1.78       |
| 3-40     | 1563      | .86        | .75        | .65        | .55        | .46        | .38        | 18     | 319.6     | 4.21       | 3.67       | 3.18       | 2.70       | 2.28       | 1.87       |
| 4-0      | 1433      | .94        | .82        | .71        | .60        | .50        | .42        | 19     | 302.9     | 4.45       | 3.89       | 3.36       | 2.86       | 2.41       | 1.98       |
| 4-20     | 1323      | 1.02       | .89        | .77        | .65        | .55        | .45        | 20     | 287.9     | 4.70       | 4.09       | 3.55       | 3.00       | 2.54       | 2.09       |
| 4-40     | 1228      | 1.10       | .96        | .83        | .70        | .59        | .48        | 22     | 262.0     | 5.16       | 4.44       | 3.84       | 3.30       | 2.80       | 2.29       |
| 5        | 1146      | 1.18       | 1.03       | .89        | .75        | .63        | .52        | 24     | 240.5     | 5.64       | 4.92       | 4.20       | 3.59       | 3.04       | 2.50       |
| 6        | 955.3     | 1.41       | 1.23       | 1.06       | .90        | .76        | .62        | 26     | 222.3     | 6.07       | 5.29       | 4.58       | 3.88       | 3.29       | 2.70       |
| 7        | 819.0     | 1.65       | 1.44       | 1.24       | 1.05       | .89        | .73        |        |           |            |            |            |            |            |            |

TABLE XI.  
SHORT RADIUS CURVES

| Radius<br>Feet | Chord<br>Feet | Central<br>Angle | Deflection<br>Angle | Deflection<br>for 1 Foot |
|----------------|---------------|------------------|---------------------|--------------------------|
| 35             | 10            | 16-26            | 8-13                | 49.3                     |
| 45             | 10            | 12-46            | 6-23                | 38.3                     |
| 50             | 15            | 17-16            | 8-38                | 34.5                     |
| 60             | 15            | 14-22            | 7-11                | 28.8                     |
| 75             | 15            | 11-30            | 5-45                | 23.0                     |
| 100            | 20            | 11-30            | 5-45                | 17.3                     |
| 120            | 20            | 9-34             | 4-47                | 14.3                     |
| 150            | 20            | 7-39             | 3-49                | 11.5                     |
| 190            | 25            | 7-32             | 3-46                | 9.15                     |
| 200            | 25            | 7-10             | 3-35                | 8.6                      |
| 225            | 25            | 6-25             | 3-12                | 7.7                      |
| 240            | 25            | 5-58             | 2-59                | 7.2                      |
| 250            | 25            | 5-44             | 2-52                | 6.9                      |
| 275            | 25            | 5-12             | 2-36                | 6.2                      |
| 288            | 50            | 9-58             | 4-59                | 6.0                      |
| 300            | 50            | 9-32             | 4-46                | 5.7                      |
| 350            | 50            | 8-12             | 4-06                | 4.9                      |
| 376            | 50            | 7-40             | 3-50                | 4.6                      |
| 400            | 50            | 7-10             | 3-35                | 4.3                      |
| 410            | 50            | 7-00             | 3-30                | 4.2                      |

To find length of curve divide angle from P. C. to P. T. by central angle of chord, and multiply by length of chord.

TABLE XII.  
INCLINED DISTANCE OF 100 FT. REDUCED TO HORIZONTAL

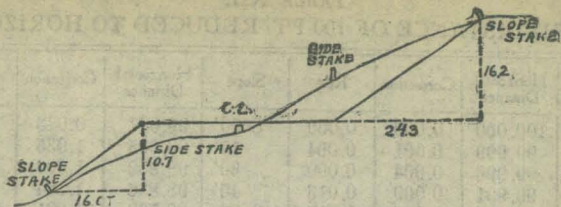
| Slope | Horizontal<br>Distance | Correction | Rise  | Slope | Horizontal<br>Distance | Correction | Rise  |
|-------|------------------------|------------|-------|-------|------------------------|------------|-------|
| 0°00' | 100.000                | 0.000      | 0.000 | 8°00' | 99.027                 | 0.973      | 0.139 |
| 15'   | 99.999                 | 0.001      | 0.004 | 15'   | 98.965                 | 1.035      | 0.143 |
| 30'   | 99.996                 | 0.004      | 0.009 | 30'   | 98.902                 | 1.098      | 0.148 |
| 45'   | 99.991                 | 0.009      | 0.013 | 45'   | 98.836                 | 1.164      | 0.152 |
| 1 00  | 99.985                 | 0.015      | 0.017 | 9 00  | 98.769                 | 1.231      | 0.156 |
| 15    | 99.976                 | 0.024      | 0.022 | 15    | 98.700                 | 1.300      | 0.161 |
| 30    | 99.966                 | 0.034      | 0.026 | 30    | 98.629                 | 1.371      | 0.165 |
| 45    | 99.953                 | 0.047      | 0.031 | 45    | 98.556                 | 1.444      | 0.169 |
| 2 00  | 99.939                 | 0.061      | 0.035 | 10 00 | 98.481                 | 1.519      | 0.174 |
| 15    | 99.923                 | 0.077      | 0.039 | 15    | 98.404                 | 1.596      | 0.178 |
| 30    | 99.905                 | 0.095      | 0.044 | 30    | 98.325                 | 1.675      | 0.182 |
| 45    | 99.885                 | 0.115      | 0.048 | 45    | 98.245                 | 1.755      | 0.187 |
| 3 00  | 99.863                 | 0.137      | 0.052 | 11 00 | 98.163                 | 1.837      | 0.191 |
| 15    | 99.839                 | 0.161      | 0.057 | 15    | 98.079                 | 1.921      | 0.195 |
| 30    | 99.813                 | 0.187      | 0.061 | 30    | 97.992                 | 2.008      | 0.199 |
| 45    | 99.786                 | 0.214      | 0.065 | 45    | 97.905                 | 2.095      | 0.204 |
| 4 00  | 99.756                 | 0.244      | 0.070 | 12 00 | 97.815                 | 2.185      | 0.208 |
| 15    | 99.725                 | 0.275      | 0.074 | 15    | 97.723                 | 2.277      | 0.212 |
| 30    | 99.692                 | 0.308      | 0.078 | 30    | 97.630                 | 2.370      | 0.216 |
| 45    | 99.657                 | 0.343      | 0.083 | 45    | 97.534                 | 2.466      | 0.221 |
| 5 00  | 99.619                 | 0.381      | 0.087 | 13 00 | 97.437                 | 2.563      | 0.225 |
| 15    | 99.580                 | 0.420      | 0.092 | 15    | 97.338                 | 2.662      | 0.229 |
| 30    | 99.540                 | 0.460      | 0.096 | 30    | 97.237                 | 2.763      | 0.233 |
| 45    | 99.497                 | 0.503      | 0.100 | 45    | 97.134                 | 2.866      | 0.238 |
| 6 00  | 99.452                 | 0.548      | 0.105 | 14 00 | 97.030                 | 2.970      | 0.242 |
| 15    | 99.406                 | 0.594      | 0.109 | 15    | 96.923                 | 3.077      | 0.246 |
| 30    | 99.357                 | 0.643      | 0.113 | 30    | 96.815                 | 3.185      | 0.250 |
| 45    | 99.307                 | 0.693      | 0.118 | 45    | 96.705                 | 3.295      | 0.255 |
| 7 00  | 99.255                 | 0.745      | 0.122 | 15 00 | 96.593                 | 3.407      | 0.259 |
| 15    | 99.200                 | 0.800      | 0.126 | 15    | 96.479                 | 3.521      | 0.263 |
| 30    | 99.144                 | 0.856      | 0.131 | 30    | 96.363                 | 3.637      | 0.267 |
| 45    | 99.087                 | 0.913      | 0.135 | 45    | 96.246                 | 3.754      | 0.271 |

For each foot take one one-hundredth of each reading.

TABLE XIII.  
MINUTES IN DECIMALS OF A DEGREE.

|       |        |         |        |         |        |         |        |         |        |         |         |
|-------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|---------|
| 0 30" | .00833 | 10' 30" | .17500 | 20' 30" | .34167 | 30' 10" | .50833 | 40' 30" | .67500 | 50' 10" | .84167  |
| 1 00  | .01667 | 11 00   | .18333 | 21 00   | .35000 | 31 00   | .51667 | 41 00   | .68333 | 51 00   | .85000  |
| 30    | .02500 | 30      | .19167 | 30      | .35833 | 30      | .52500 | 30      | .69167 | 30      | .85833  |
| 2 00  | .03333 | 12 00   | .20000 | 22 00   | .36667 | 32 00   | .53333 | 42 00   | .70000 | 52 00   | .86667  |
| 30    | .04167 | 30      | .20833 | 30      | .37500 | 30      | .54167 | 30      | .70833 | 30      | .87500  |
| 3 00  | .05000 | 13 00   | .21667 | 23 00   | .38333 | 33 00   | .55000 | 43 00   | .71667 | 53 00   | .88333  |
| 30    | .05833 | 30      | .22500 | 30      | .39167 | 30      | .55833 | 30      | .72500 | 30      | .89167  |
| 4 00  | .06667 | 14 00   | .23333 | 24 00   | .40000 | 34 00   | .56667 | 44 00   | .73333 | 54 00   | .90000  |
| 30    | .07500 | 30      | .24167 | 30      | .40833 | 30      | .57500 | 30      | .74167 | 30      | .90833  |
| 5 00  | .08333 | 15 00   | .25000 | 25 00   | .41667 | 35 00   | .58333 | 45 00   | .75000 | 55 00   | .91667  |
| 30    | .09167 | 30      | .25833 | 30      | .42500 | 30      | .59167 | 30      | .75833 | 30      | .92500  |
| 6 00  | .10000 | 16 00   | .26667 | 26 00   | .43333 | 36 00   | .60000 | 46 00   | .76667 | 56 00   | .93333  |
| 30    | .10833 | 30      | .27500 | 30      | .44167 | 30      | .60833 | 30      | .77500 | 30      | .94167  |
| 7 00  | .11667 | 17 00   | .28333 | 27 00   | .45000 | 37 00   | .61667 | 47 00   | .78333 | 57 00   | .95000  |
| 30    | .12500 | 30      | .29167 | 30      | .45833 | 30      | .62500 | 30      | .79167 | 30      | .95833  |
| 8 00  | .13333 | 18 00   | .30000 | 28 00   | .46667 | 38 00   | .63333 | 48 00   | .80000 | 58 00   | .96667  |
| 30    | .14167 | 30      | .30833 | 30      | .47500 | 30      | .64167 | 30      | .80833 | 30      | .97500  |
| 9 00  | .15000 | 19 00   | .31667 | 29 00   | .48333 | 39 00   | .65000 | 49 00   | .81667 | 59 00   | .98333  |
| 30    | .15833 | 30      | .32500 | 30      | .49167 | 30      | .65833 | 30      | .82500 | 30      | .99167  |
| 10 00 | .16667 | 20 00   | .33333 | 30 00   | .50000 | 40 00   | .66667 | 50 00   | .83333 | 60 00   | 1.00000 |





# DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING;

SLOPE  $1\frac{1}{2}$  TO 1. ROADWAY OF ANY WIDTH.

|    | 0     | .1    | .2    | .3    | .4    | .5    | .6    | .7    | .8    | .9    |    |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| 0  | 0.00  | 0.15  | 0.30  | 0.45  | 0.60  | 0.75  | 0.90  | 1.05  | 1.20  | 1.35  | 0  |
| 1  | 1.50  | 1.65  | 1.80  | 1.95  | 2.10  | 2.25  | 2.40  | 2.55  | 2.70  | 2.85  | 1  |
| 2  | 3.00  | 3.15  | 3.30  | 3.45  | 3.60  | 3.75  | 3.90  | 4.05  | 4.20  | 4.35  | 2  |
| 3  | 4.50  | 4.65  | 4.80  | 4.95  | 5.10  | 5.25  | 5.40  | 5.55  | 5.70  | 5.85  | 3  |
| 4  | 6.00  | 6.15  | 6.30  | 6.45  | 6.60  | 6.75  | 6.90  | 7.05  | 7.20  | 7.35  | 4  |
| 5  | 7.50  | 7.65  | 7.80  | 7.95  | 8.10  | 8.25  | 8.40  | 8.55  | 8.70  | 8.85  | 5  |
| 6  | 9.00  | 9.15  | 9.30  | 9.45  | 9.60  | 9.75  | 9.90  | 10.05 | 10.20 | 10.35 | 6  |
| 7  | 10.50 | 10.65 | 10.80 | 10.95 | 11.10 | 11.25 | 11.40 | 11.55 | 11.70 | 11.85 | 7  |
| 8  | 12.00 | 12.15 | 12.30 | 12.45 | 12.60 | 12.75 | 12.90 | 13.05 | 13.20 | 13.35 | 8  |
| 9  | 13.50 | 13.65 | 13.80 | 13.95 | 14.10 | 14.25 | 14.40 | 14.55 | 14.70 | 14.85 | 9  |
| 10 | 15.00 | 15.15 | 15.30 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 10 |
| 11 | 16.50 | 16.65 | 16.80 | 16.95 | 17.10 | 17.25 | 17.40 | 17.55 | 17.70 | 17.85 | 11 |
| 12 | 18.00 | 18.15 | 18.30 | 18.45 | 18.60 | 18.75 | 18.90 | 19.05 | 19.20 | 19.35 | 12 |
| 13 | 19.50 | 19.65 | 19.80 | 19.95 | 20.10 | 20.25 | 20.40 | 20.55 | 20.70 | 20.85 | 13 |
| 14 | 21.00 | 21.15 | 21.30 | 21.45 | 21.60 | 21.75 | 21.90 | 22.05 | 22.20 | 22.35 | 14 |
| 15 | 22.50 | 22.65 | 22.80 | 22.95 | 23.10 | 23.25 | 23.40 | 23.55 | 23.70 | 23.85 | 15 |
| 16 | 24.00 | 24.15 | 24.30 | 24.45 | 24.60 | 24.75 | 24.90 | 25.05 | 25.20 | 25.35 | 16 |
| 17 | 25.50 | 25.65 | 25.80 | 25.95 | 26.10 | 26.25 | 26.40 | 26.55 | 26.70 | 26.85 | 17 |
| 18 | 27.00 | 27.15 | 27.30 | 27.45 | 27.60 | 27.75 | 27.90 | 28.05 | 28.20 | 28.35 | 18 |
| 19 | 28.50 | 28.65 | 28.80 | 28.95 | 29.10 | 29.25 | 29.40 | 29.55 | 29.70 | 29.85 | 19 |
| 20 | 30.00 | 30.15 | 30.30 | 30.45 | 30.60 | 30.75 | 30.90 | 31.05 | 31.20 | 31.35 | 20 |
| 21 | 31.50 | 31.65 | 31.80 | 31.95 | 32.10 | 32.25 | 32.40 | 32.55 | 32.70 | 32.85 | 21 |
| 22 | 33.00 | 33.15 | 33.30 | 33.45 | 33.60 | 33.75 | 33.90 | 34.05 | 34.20 | 34.35 | 22 |
| 23 | 34.50 | 34.65 | 34.80 | 34.95 | 35.10 | 35.25 | 35.40 | 35.55 | 35.70 | 35.85 | 23 |
| 24 | 36.00 | 36.15 | 36.30 | 36.45 | 36.60 | 36.75 | 36.90 | 37.05 | 37.20 | 37.35 | 24 |
| 25 | 37.50 | 37.65 | 37.80 | 37.95 | 38.10 | 38.25 | 38.40 | 38.55 | 38.70 | 38.85 | 25 |
| 26 | 39.00 | 39.15 | 39.30 | 39.45 | 39.60 | 39.75 | 39.90 | 40.05 | 40.20 | 40.35 | 26 |
| 27 | 40.50 | 40.65 | 40.80 | 40.95 | 41.10 | 41.25 | 41.40 | 41.55 | 41.70 | 41.85 | 27 |
| 28 | 42.00 | 42.15 | 42.30 | 42.45 | 42.60 | 42.75 | 42.90 | 43.05 | 43.20 | 43.35 | 28 |
| 29 | 43.50 | 43.65 | 43.80 | 43.95 | 44.10 | 44.25 | 44.40 | 44.55 | 44.70 | 44.85 | 29 |
| 30 | 45.00 | 45.15 | 45.30 | 45.45 | 45.60 | 45.75 | 45.90 | 46.05 | 46.20 | 46.35 | 30 |
| 31 | 46.50 | 46.65 | 46.80 | 46.95 | 47.10 | 47.25 | 47.40 | 47.55 | 47.70 | 47.85 | 31 |
| 32 | 48.00 | 48.15 | 48.30 | 48.45 | 48.60 | 48.75 | 48.90 | 49.05 | 49.20 | 49.35 | 32 |
| 33 | 49.50 | 49.65 | 49.80 | 49.95 | 50.10 | 50.25 | 50.40 | 50.55 | 50.70 | 50.85 | 33 |
| 34 | 51.00 | 51.15 | 51.30 | 51.45 | 51.60 | 51.75 | 51.90 | 52.05 | 52.20 | 52.35 | 34 |
| 35 | 52.50 | 52.65 | 52.80 | 52.95 | 53.10 | 53.25 | 53.40 | 53.55 | 53.70 | 53.85 | 35 |
| 36 | 54.00 | 54.15 | 54.30 | 54.45 | 54.60 | 54.75 | 54.90 | 55.05 | 55.20 | 55.35 | 36 |
| 37 | 55.50 | 55.65 | 55.80 | 55.95 | 56.10 | 56.25 | 56.40 | 56.55 | 56.70 | 56.85 | 37 |
| 38 | 57.00 | 57.15 | 57.30 | 57.45 | 57.60 | 57.75 | 57.90 | 58.05 | 58.20 | 58.35 | 38 |
| 39 | 58.50 | 58.65 | 58.80 | 58.95 | 59.10 | 59.25 | 59.40 | 59.55 | 59.70 | 59.85 | 39 |
| 40 | 60.00 | 60.15 | 60.30 | 60.45 | 60.60 | 60.75 | 60.90 | 61.05 | 61.20 | 61.35 | 40 |
| 41 | 61.50 | 61.65 | 61.80 | 61.95 | 62.10 | 62.25 | 62.40 | 62.55 | 62.70 | 62.85 | 41 |
| 42 | 63.00 | 63.15 | 63.30 | 63.45 | 63.60 | 63.75 | 63.90 | 64.05 | 64.20 | 64.35 | 42 |
| 43 | 64.50 | 64.65 | 64.80 | 64.95 | 65.10 | 65.25 | 65.40 | 65.55 | 65.70 | 65.85 | 43 |
| 44 | 66.00 | 66.15 | 66.30 | 66.45 | 66.60 | 66.75 | 66.90 | 67.05 | 67.20 | 67.35 | 44 |
| 45 | 67.50 | 67.65 | 67.80 | 67.95 | 68.10 | 68.25 | 68.40 | 68.55 | 68.70 | 68.85 | 45 |
| 46 | 69.00 | 69.15 | 69.30 | 69.45 | 69.60 | 69.75 | 69.90 | 70.05 | 70.20 | 70.35 | 46 |
| 47 | 70.50 | 70.65 | 70.80 | 70.95 | 71.10 | 71.25 | 71.40 | 71.55 | 71.70 | 71.85 | 47 |
| 48 | 72.00 | 72.15 | 72.30 | 72.45 | 72.60 | 72.75 | 72.90 | 73.05 | 73.20 | 73.35 | 48 |
| 49 | 73.50 | 73.65 | 73.80 | 73.95 | 74.10 | 74.25 | 74.40 | 74.55 | 74.70 | 74.85 | 49 |
| 50 | 75.00 | 75.15 | 75.30 | 75.45 | 75.60 | 75.75 | 75.90 | 76.05 | 76.20 | 76.35 | 50 |

Computed by L. Leland Locke.



8.59

1.83

3.98

.06

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13.46

8  
134  

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74

3.98  
1.83  

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5.81  
3.98  

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9.79

172  
9.45  

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6.17