

Transit Survey
Hudson-Cedar Falls Road

FIELD BOOK

361

50

KEUFFEL & ESSER CO.

DRAWING MATERIALS

AND

SURVEYING INSTRUMENTS.

NEW YORK.

CHICAGO. ST. LOUIS. SAN FRANCISCO. MONTREAL.

TABLES FOR EXCAVATIONS AND EMBANKMENTS.

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 18 FEET WIDE. SIDE SLOPES 1 TO 1.

FOR SINGLE TRACK EXCAVATION.

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

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

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

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

50

FINDER RETURN TO-
COUNTY ENGINEER'S
OFFICE -
WATERLOO, IOWA.

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

Transit Notes

Hudson-Cedar Falls Road

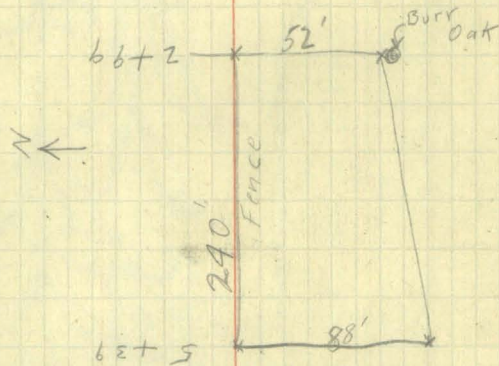
7.09 miles = Length of Proj.

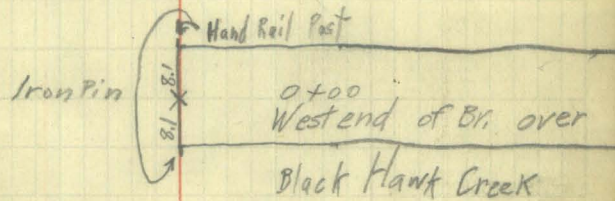
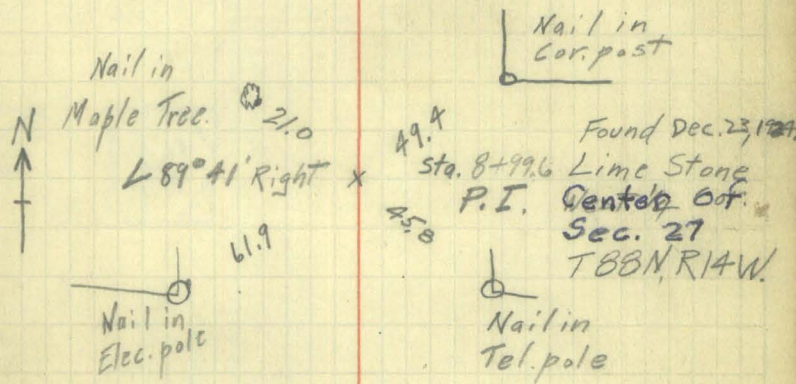
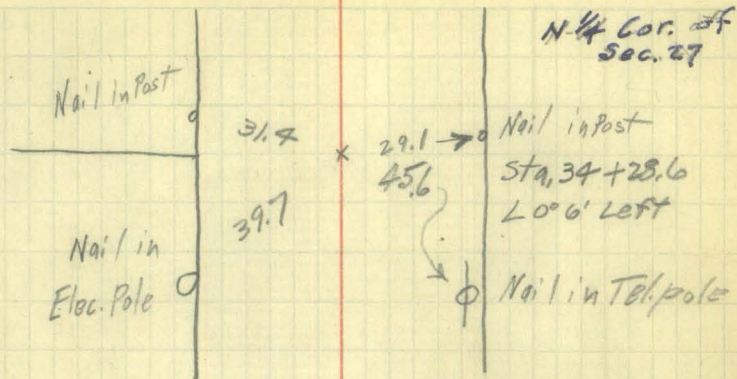
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BLACK HAWK CO.
ENGINEER'S OFFICE
COURT HOUSE
WATERLOO, IOWA 50702

Borrow Pit
on Holmes
Tract





Elec.
Pole

φ

49.0

35.0

Post

Sta. 91+95.3

∠ 0° 2' Left

~~1/4 Sec. 22~~
Tel. pole Sec. 22, T8N, R14W

Elec.
Pole

φ

31.7

27.8

φ

Ever-
greens

Nail in
Post

φ

38.5

42.3

Post

Stone Loc.

Dec. 23, 1924

Sta. 60+83.7

∠ 0° 4' Left

Tel. pole

Center of

Sec. 22, T8N, R14W

N
↑

Nail Elec. pole ϕ

N⁴ Cor. Sec. 15-88-14

Nail Elec. pole ϕ

Nail Tel. pole ϕ

Sta. 140 + 60.15
 $\angle 0^{\circ} 33' \text{ Left}$

48.7
29.4
36.7
33.3



Nail Post

Nail Post

039.4

X 28.0

Top of Knoll

Sta. 132 + 42.65

Cor. post

$\angle 0^{\circ} 2' \text{ Right}$

Nail Elec. pole ϕ

35.0

Tel. pole ϕ

Wind mill

House

Nail in High Elec. pole ϕ

57.2

X 29.9

Post

50.0

50.8

Post

Sta. 111 + 42.1

$\angle 0^{\circ} 17' \text{ Right}$

Post

Cor. Post

Gate

House

Evergreen

Post

37.6

X 37.7

35.2

X 33.1

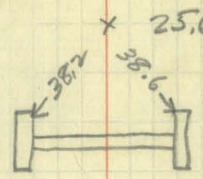
Post

Sta. 98 + 95.3

$\angle 0^{\circ} 2' \text{ Right}$

Tel. pole ϕ

Center
Sec. 10,
T88N, R14W.

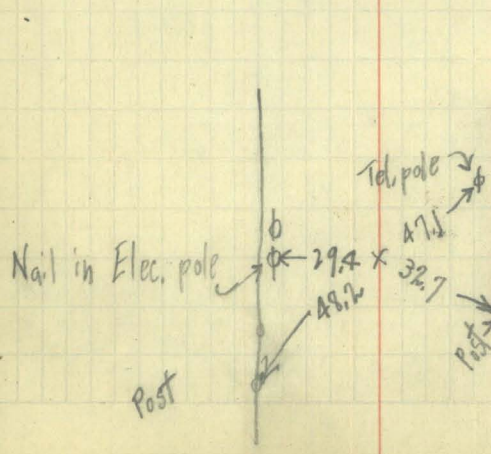


Nail in Cor. Post
stone

Sta. 167+20.15
∠ 0° 8' Right



Sta. 162+11.8
P.O.T.



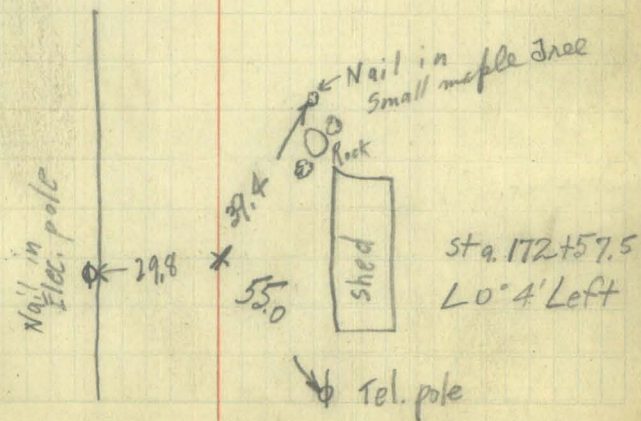
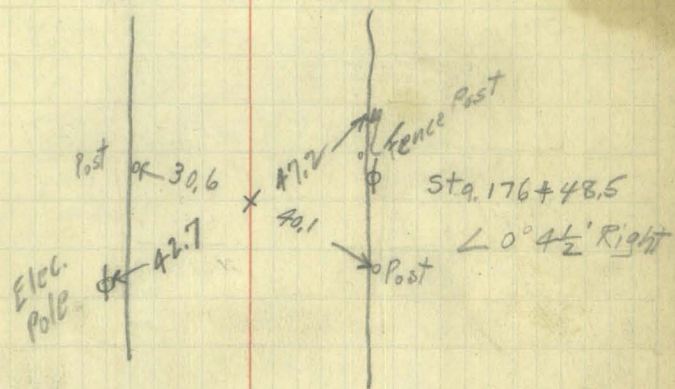
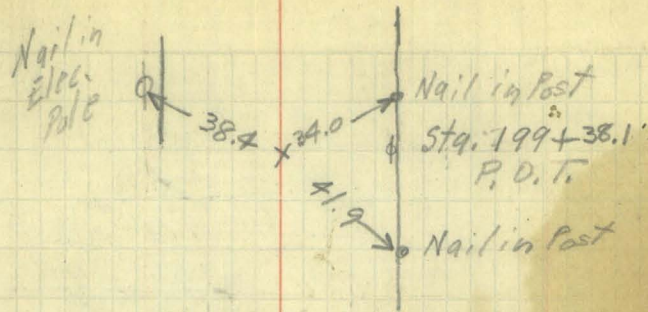
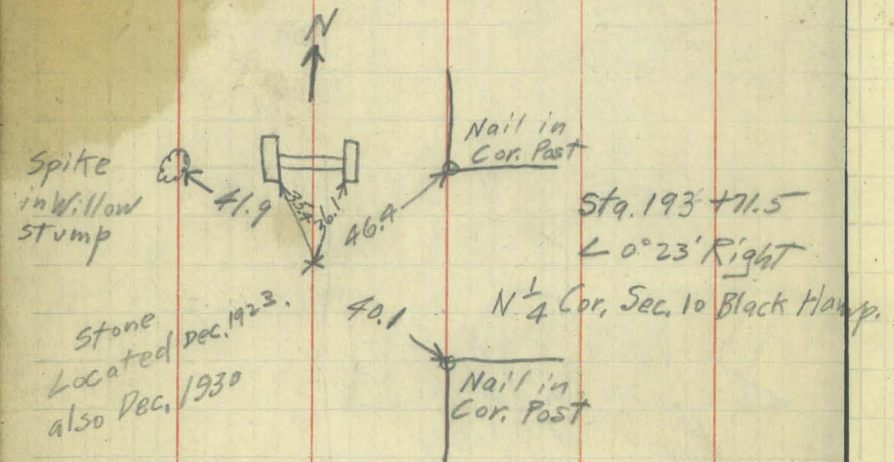
Evergreens

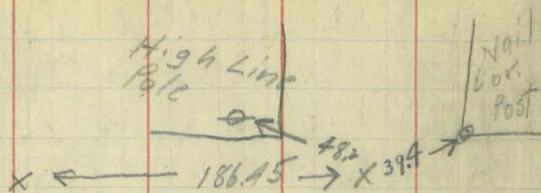
Sta. 145+65.8

∠ 0° 1' Right

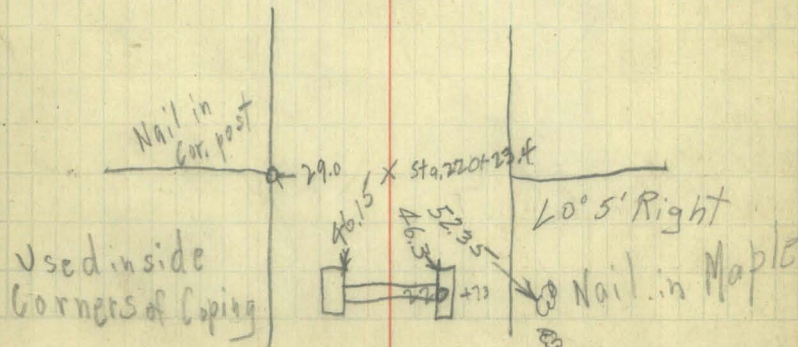
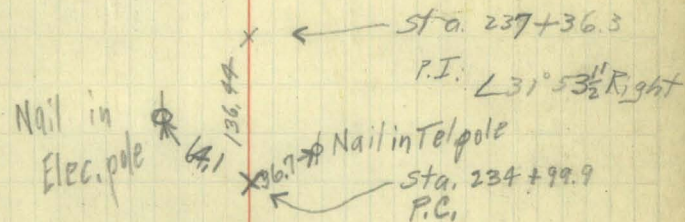
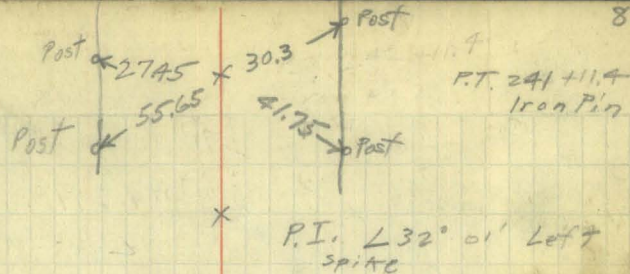
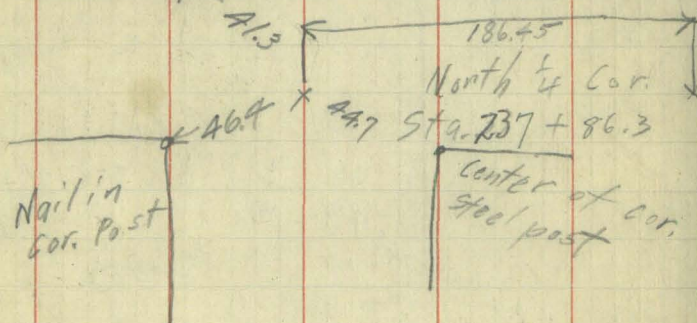
Drive

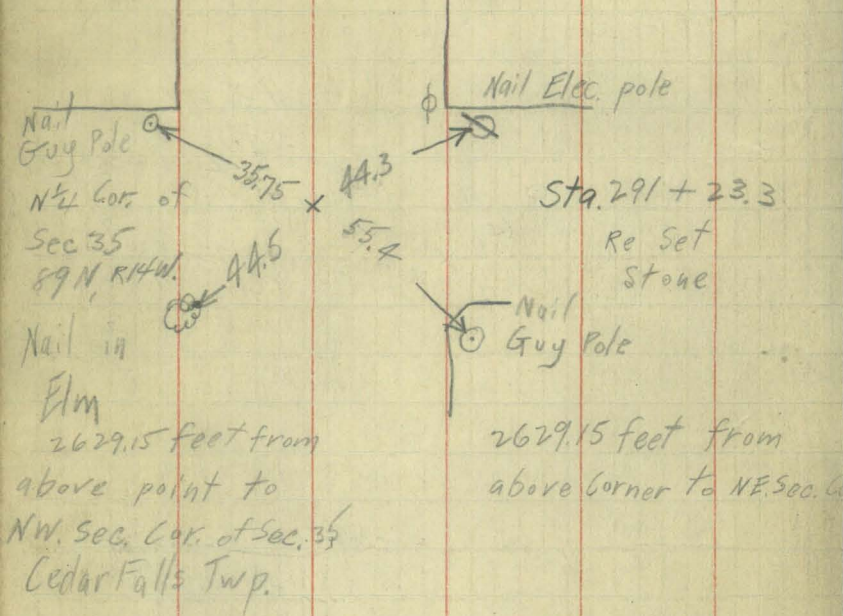
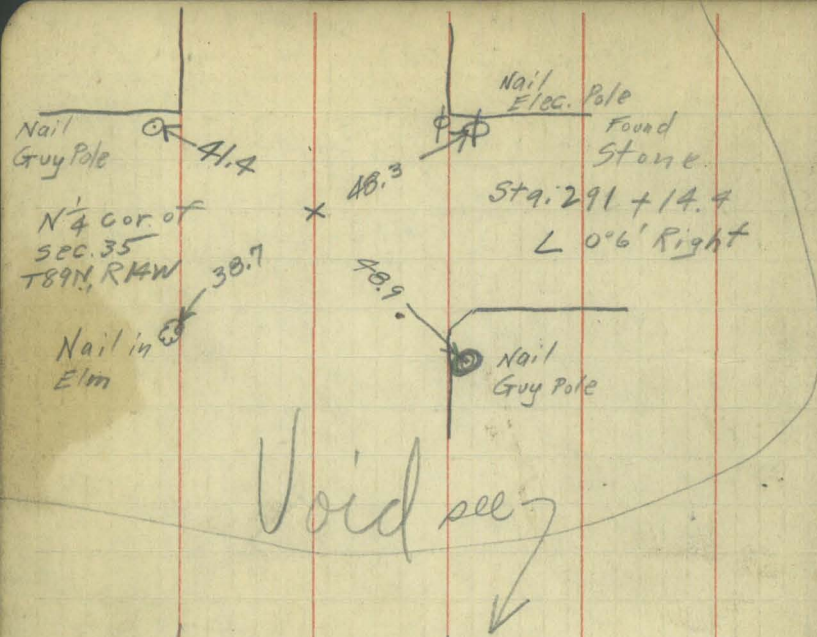




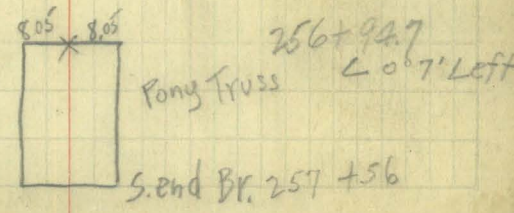
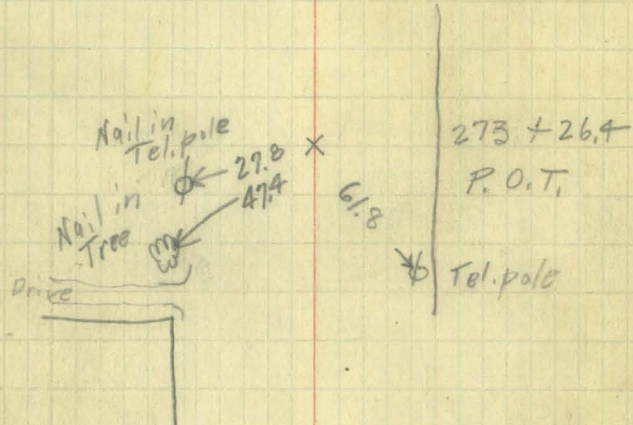
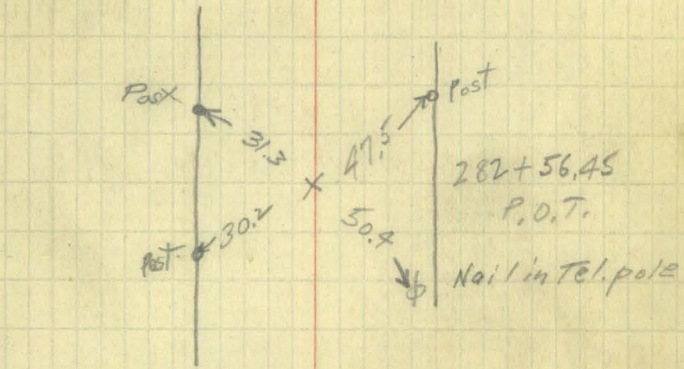


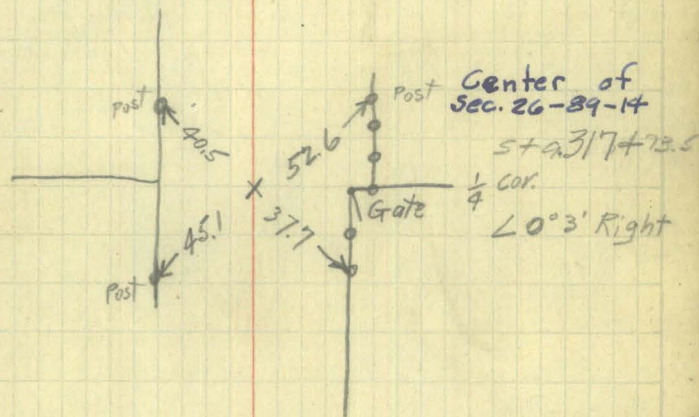
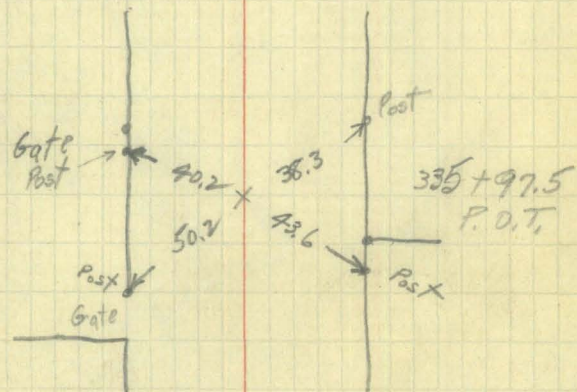
Nail in
Elec. pole



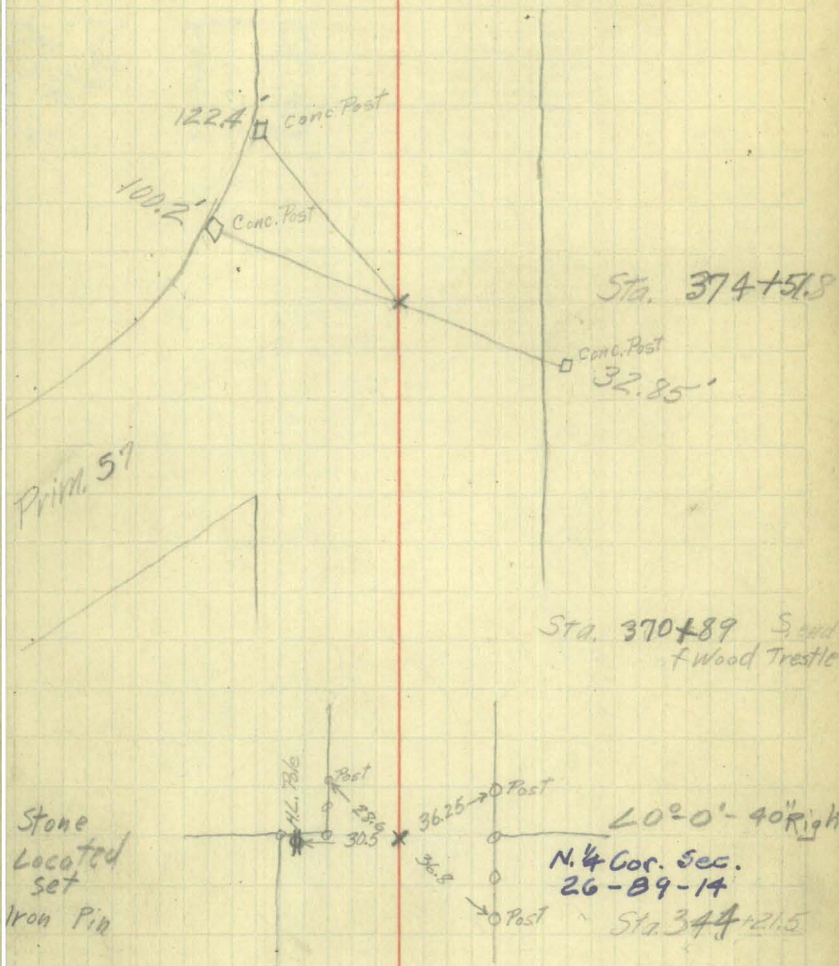


233
1289



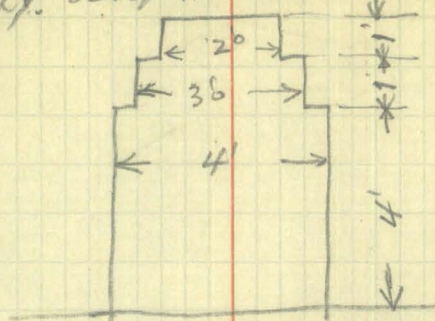


x



12

Cross-section of stone culvert
 C&G W.R.P. so. of Hudson Creamery -



$$\begin{array}{rcl}
 \text{Area} = 2' \times 1' & = & 2.0 \text{ sq ft} \\
 3' \times 1' & = & 3.0 \text{ sq ft} \\
 4' \times 4' & = & 16.0 \text{ sq ft} \\
 \hline
 & = & 21.0 \text{ sq ft}
 \end{array}$$

8+25
8+00
7+75
7+50
7+25
7+00
P.E. 6+96

28 ft.
18°-03'
14°-33'
11°-03'
7°-33'
4° 03'
0° 33'

P.T.
10 + 164
10 + 00
9 + 75
9 + 50
9 + 25
9 + 00
8 + 75
8 + 50

44°-50'
42°-33'
39°-03'
35°-33'
32°-03'
28°-33'
25°-03'
21°-33'

$\Delta + 99.6$ $\angle 89^{\circ} 41'$ Right

+06 Fence

P.C. 6 + 96.1

5

序

+77 ϕ Gate Right

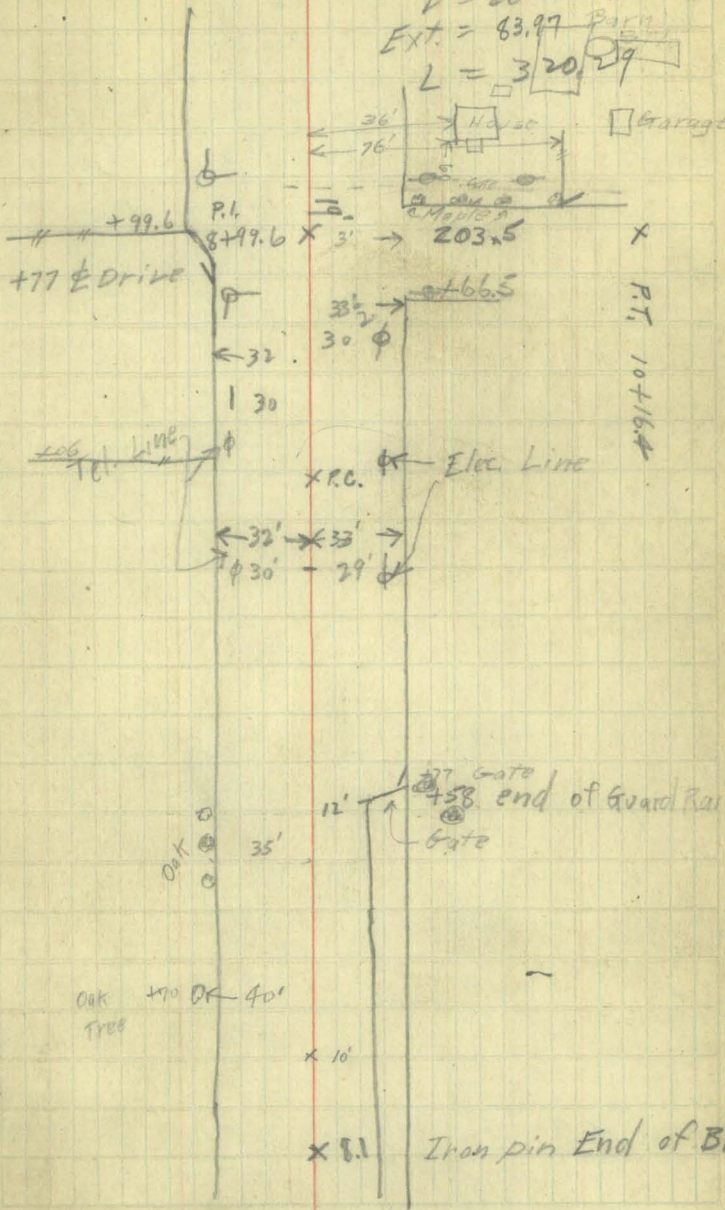
3

2

1

0+00 217' Bridge High Truss

Corner from 'Holmes'


$$\begin{aligned} T &= 203.52 \\ R &= 204.6 \\ \Delta &= 89^\circ - 41 \\ D &= 28^\circ \\ \alpha &= 63.97 \\ L &= 320.2 \end{aligned}$$


✕ 10

× 8.

Iron pin End of Br.

0 + 28.6 $\angle 0^\circ$ 6' Left

34

33

32

31

30

29

28

27

26

25

24

23

22

Pasture

+ 29

Pasture

Pasture

24 x 65

x 27

x 30

* + 38 Gate

< 28.5 Tel. Line

cultivated

32 + 55.5

Meadow

27 + 44

+ 36 Gate

No Cult.

< 34' Tel. pole

Pasture

47

46

45

44

43

42

41

40

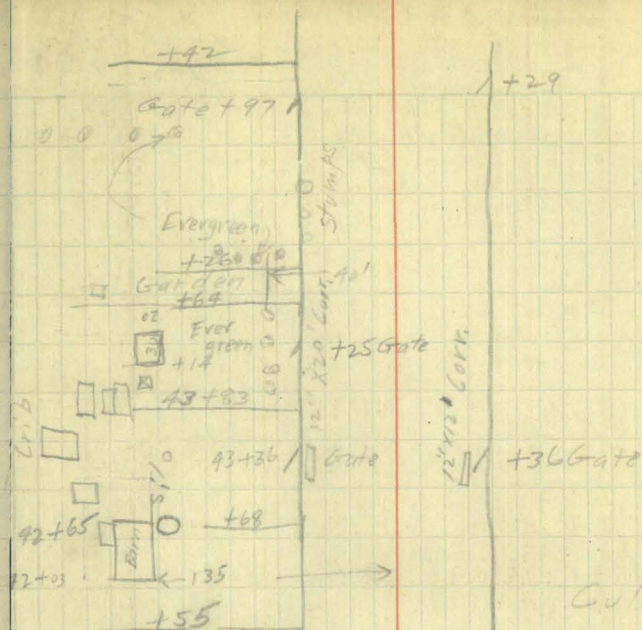
39

38

37

36

35



73

72

71

70

+46 16x16 Wood Br.

69

68

67

66

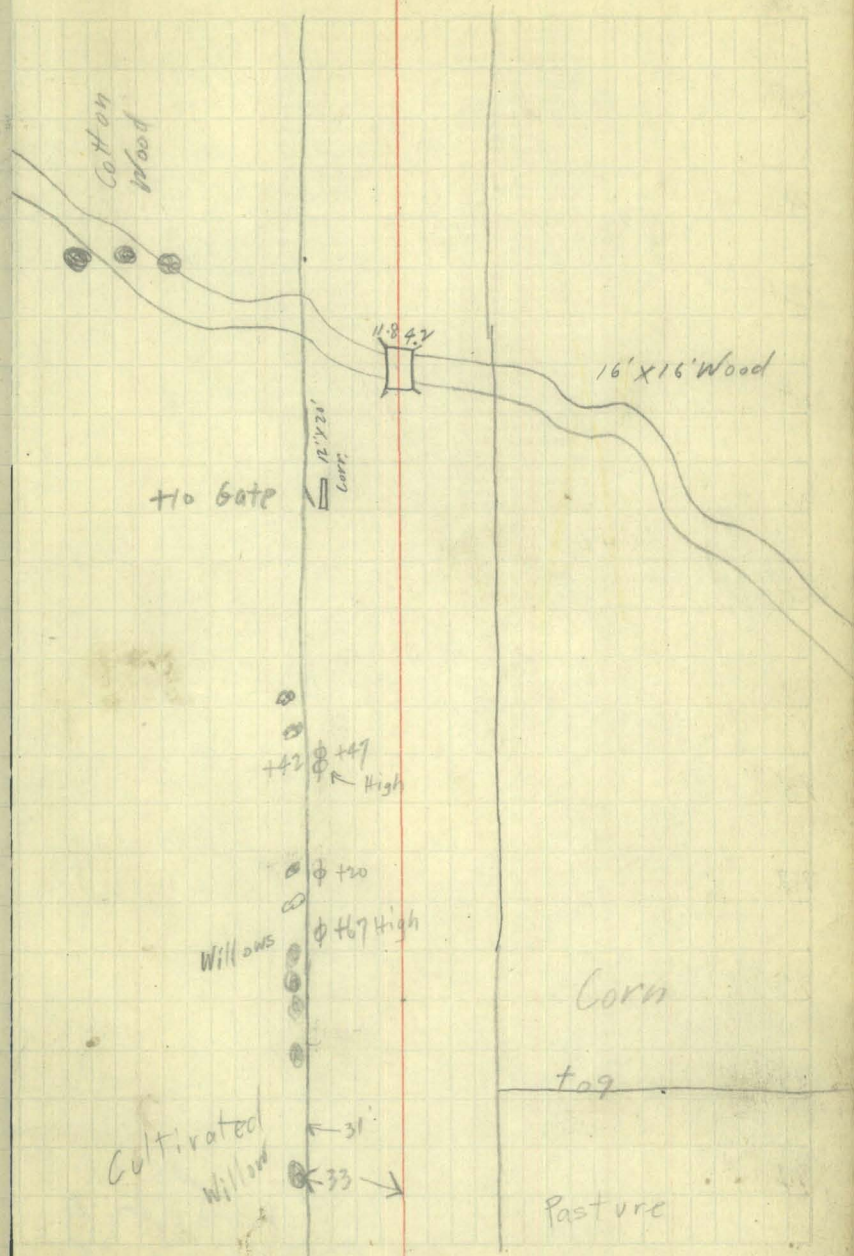
65

64

63

62

61



86

+74 cen. Walk & steps

85

84

83

82

81

80

79

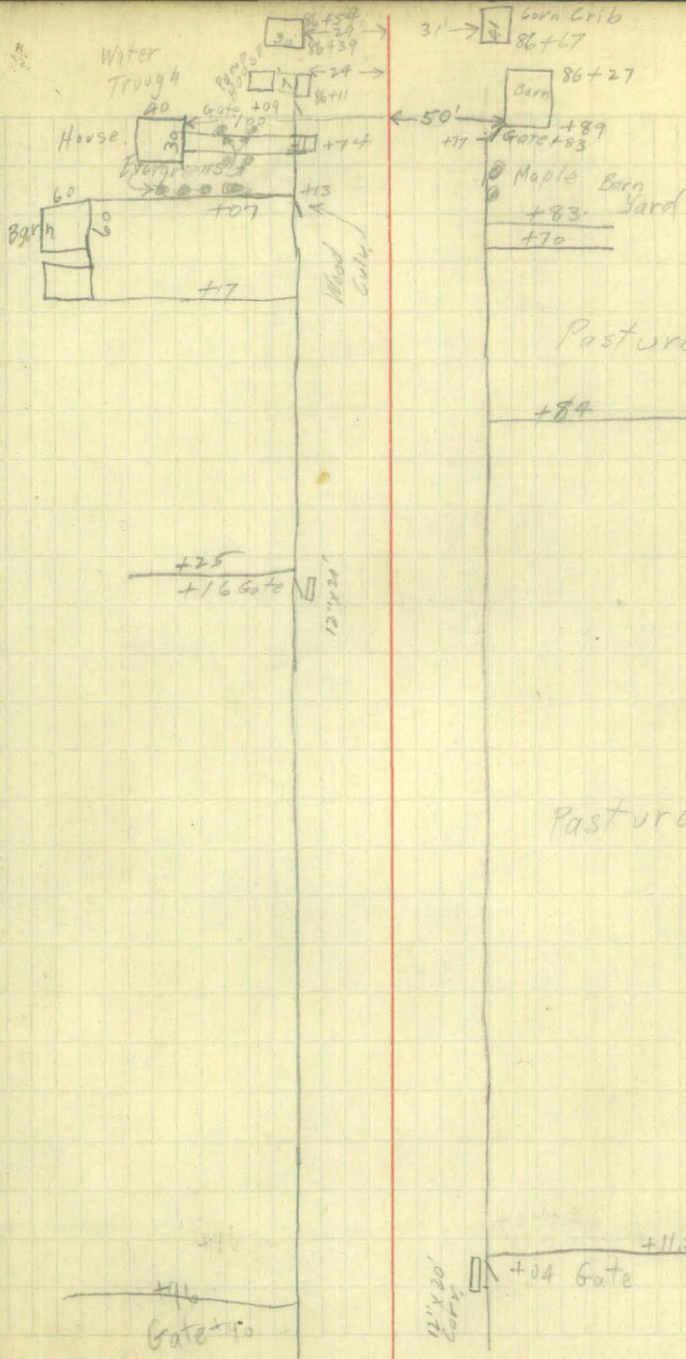
78

77

76

75

74



99

99
① +95.3 P.I. $\angle 0^{\circ} 2'$ Right
House 200 Left

98.

97

96

95⁷⁰¹ 2x2 x18,6 RCB

94

93

92

92
① +95.3 P.I. $\angle 0^{\circ} 2'$ Left

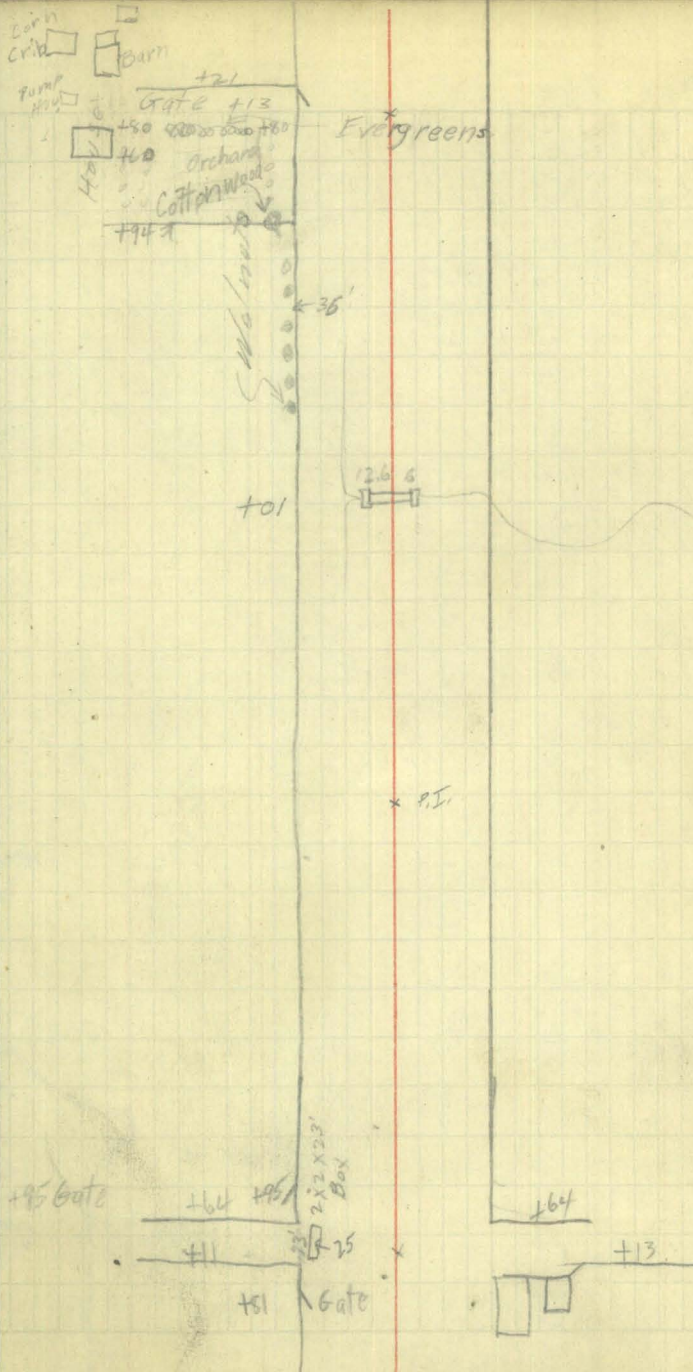
91

90

89

88

on +38 E Twp. Road



26-74 Tel.

112

111 +42.1 $\angle 0^{\circ}17'$ Right

110

109

108

107

106

105 +23 Culv. 3x3x24 R.C.B.

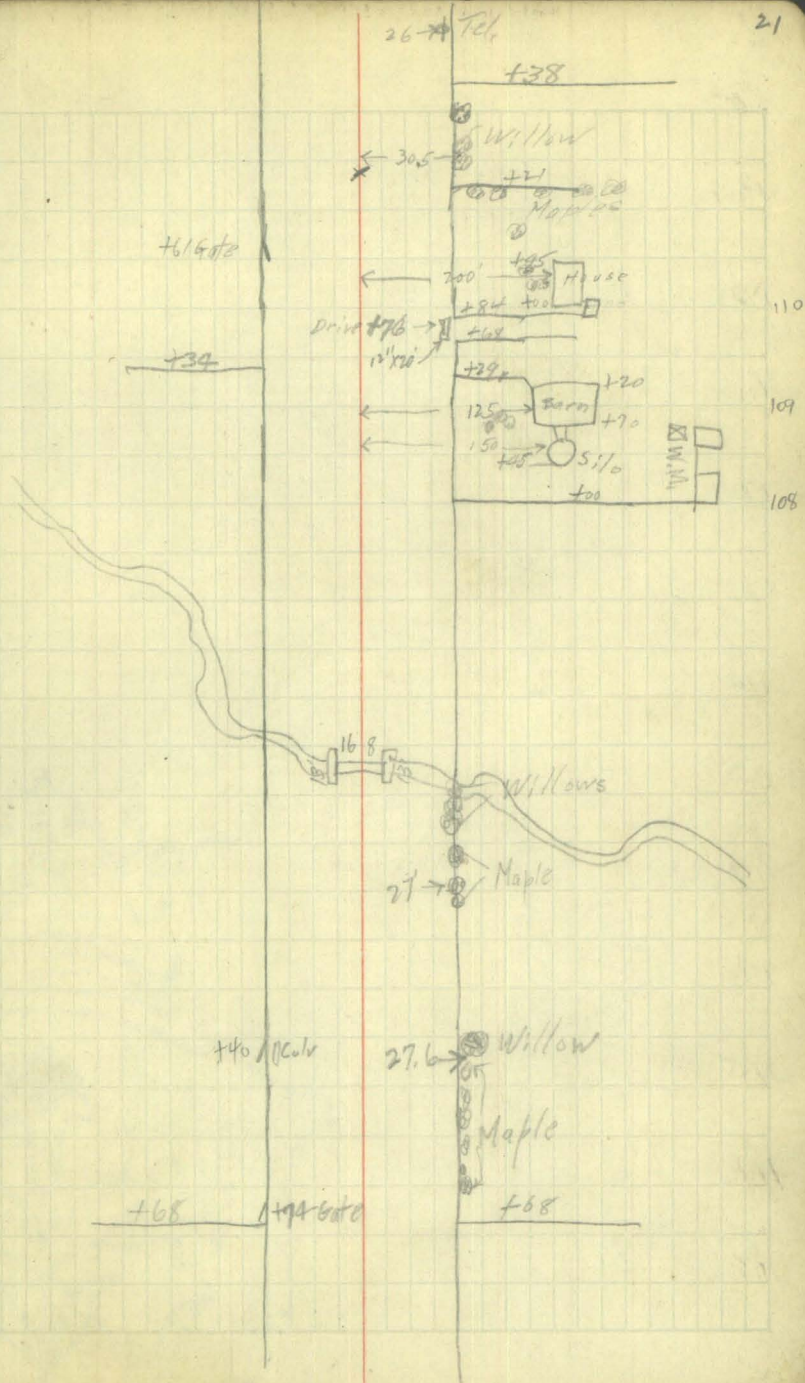
104

103

102 +40 Gate Left

101

100



125

124 + 36

6.4 X 3 X 1/8 R.C.B

123

122

121

120

119

118

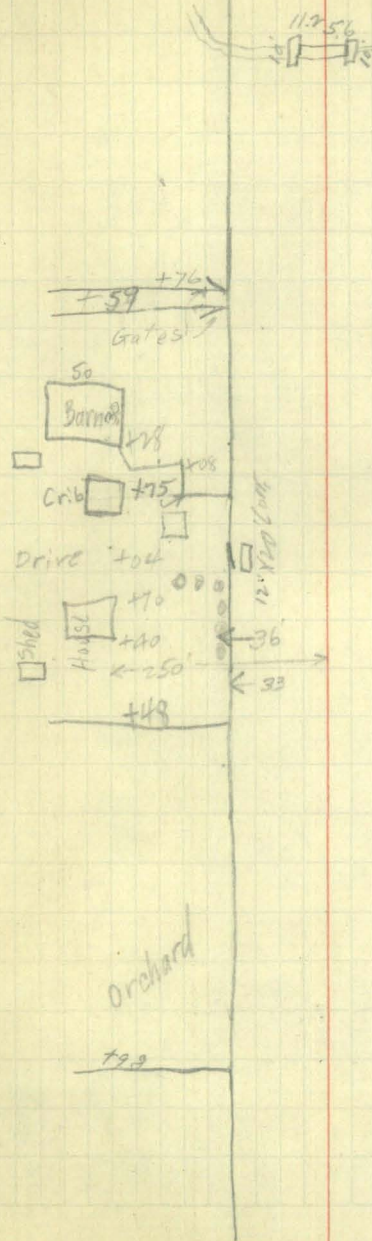
117

116

115

114

113



138

137

136

135

134

133

① +42.65 $\angle$ 0° 2' Right
132

131

130

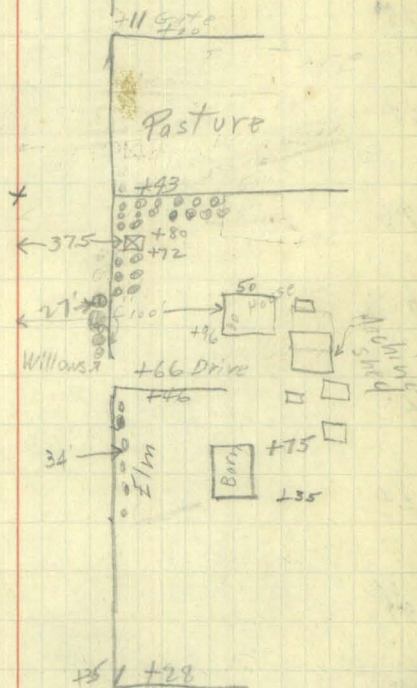
129

128

127 +35 Gate Right + Left

126

Cultivated



151

150

149

148

147

146

① +65.8 $\angle 0^\circ 1' \text{ Right}$

145

144

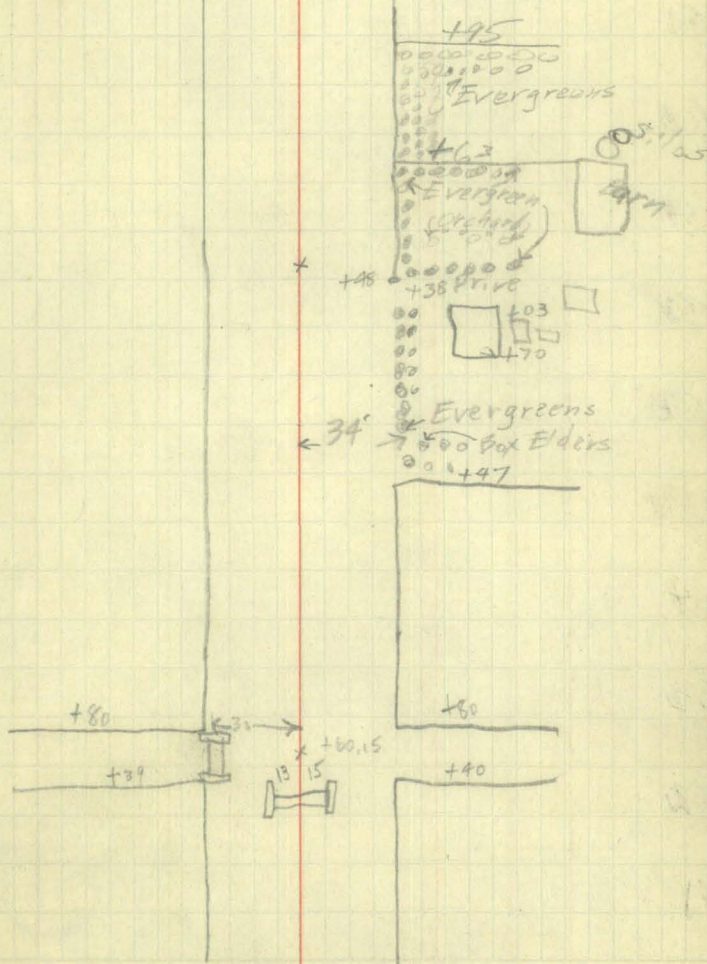
143

142

① 141 +60.54 TWP. Rd. $\angle 0^\circ 33' \text{ Left}$
+08 $\frac{1}{2}$ 3" $\times$ 28 R.C.B.

140

139



164

163

162 ^{+11.8} L P.O.T.

161 ⁺¹⁷ Drive Left

160

159 ⁺⁷¹ 2x2x24 R.C.B.

158

157

156
155

154 ⁺⁷² 2x2x24.3 R.C.B.

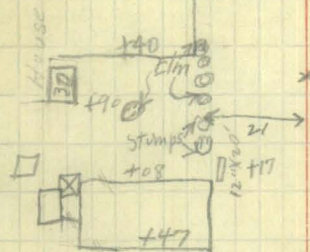
153

152

151

150

Willow
Stumps



Stumps

Pasture

Cultivated

Pasture

① +48.5 $\angle 0^\circ - 4\frac{1}{2}'$ Right

176

175

174

173

+57.5 $\angle 0^\circ - 4'$ Left

172

171

170

169

168

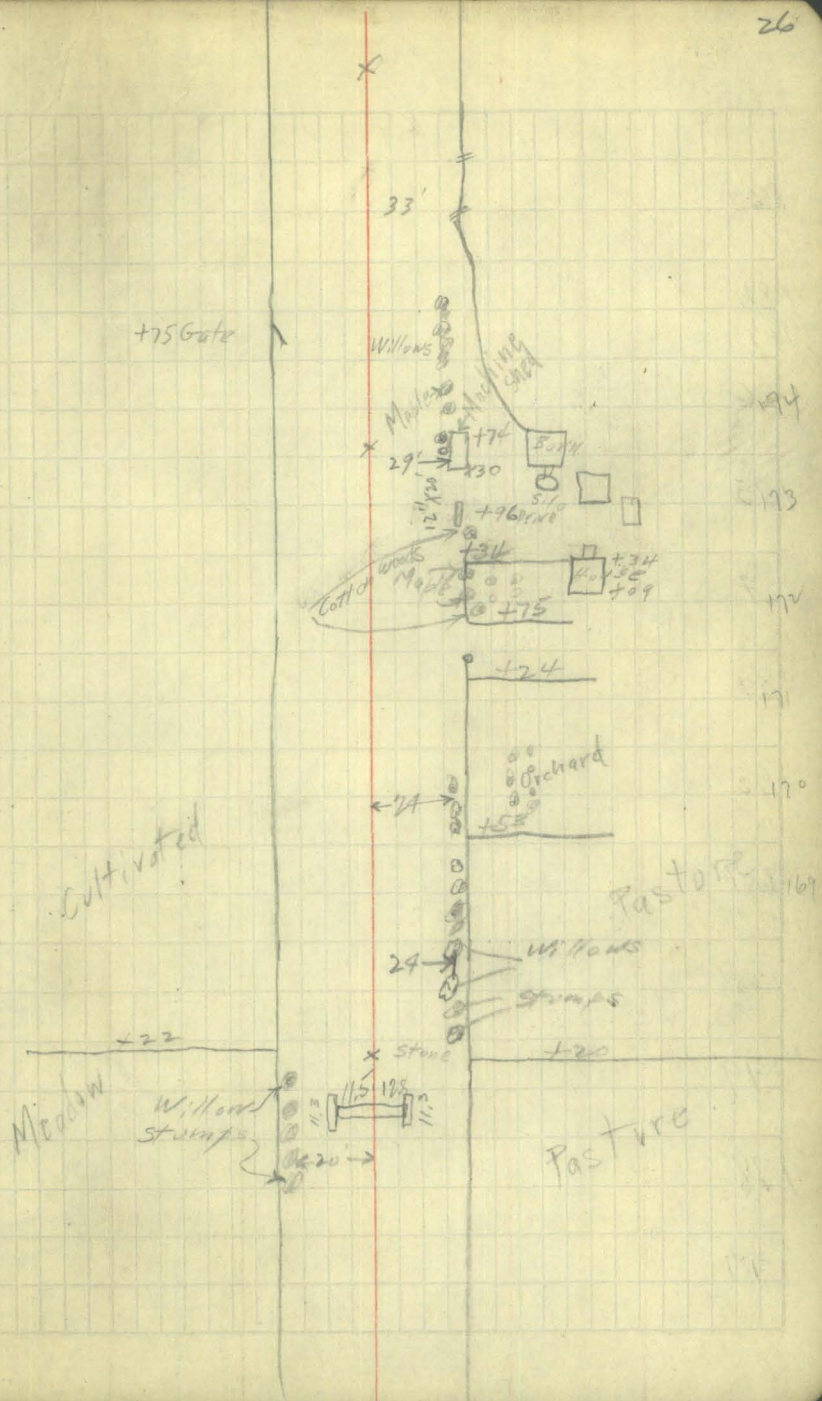
① +20.15 $\angle 0^\circ 8'$ Right

167

+78 Culv. $V \times V \times 24.3$ R.C.B.

166

165



203

202

201

200

199 +38.1 P.O.T.
+34 Drive Left

198

197

196

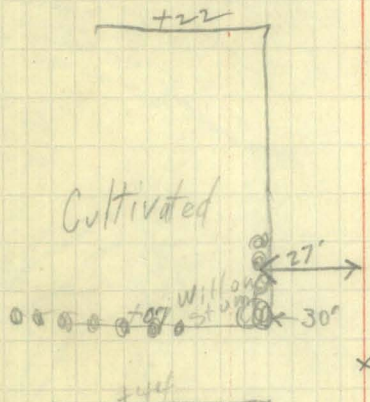
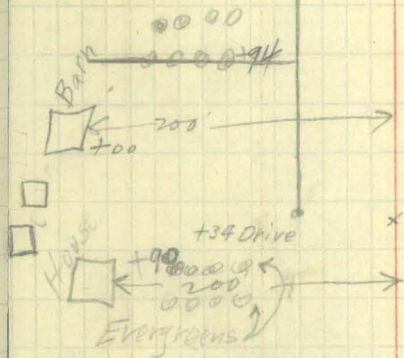
195

194
+71.5 stone & Twp. Road $\angle 0^{\circ} 23'$ Right

193

192

191



216

215

214

213

212

211

210

209

208

207

206

205

204

Culv. 2 x 2 x 24.3 R.C.B.

12" x 20' Corr. pipe

Stumps

Willow
Stumps

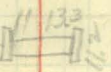


12" x 20' Corr.

Gate

High
Tension

\$ 305



7 1/2

+53

+88

Maples

Pasture

+94

229

228

227

226

225

224

223

222

221

① +23.4 L 0°-5' Right
 220
 +73 2x2x26 R.C.B.

219

218

217

Meadow

Cultivated

+23

Meadow

+25

Willows
 Maples
 Willows

+57

Caring
Crib

250'

Gate +46'

+30

House

Darn

← 34 →

Maples

P.T. 237+65.67 15°-57'

237 12°-00

236+50 9°-00

236 6°-00

235+50 3°-00

Len. = 265.77

$\Delta = 31^{\circ}53\frac{1}{2}'$

D = 12°

Tan = 136.44

Ext. = 19.10

Rad. = 477.5

235
 Δ P.C. 234+99.9

P.C. 234+99.9

234

233

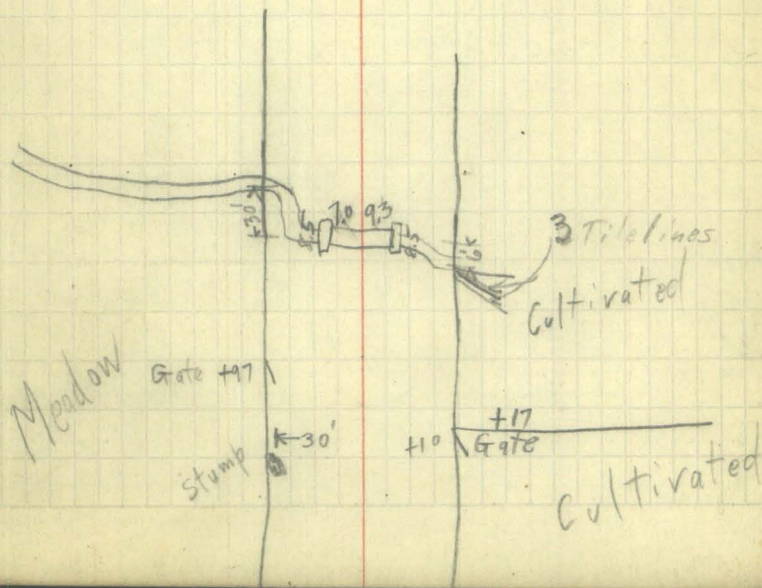
+25
232 6x3 x163 R.C.B. No Floor

231

230

P.T. 236+36.3 *

P.C. *



$V-10^\circ$ Curves will fit without changing the P.I. points

P.T. 241+11.4 $16^\circ-0\frac{1}{2}'$

$Lea_1 = 266.8$

240+50 $12^\circ 19\frac{1}{2}'$

$\Delta = 32^\circ-01'$

240 $9^\circ 19\frac{1}{2}'$

$Tan = 136.93$

239+50 $6^\circ 19\frac{1}{2}'$

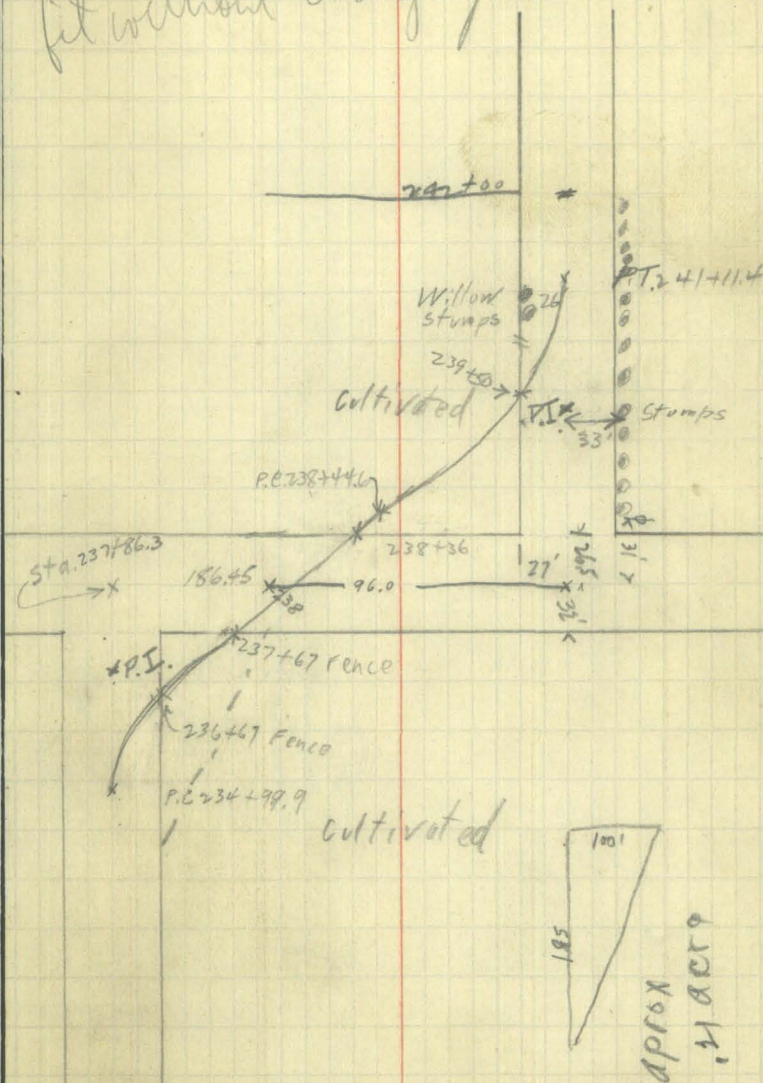
$Ext_1 = 19.26$

239 $3^\circ 19\frac{1}{2}'$

$D = 12^\circ-01'$

P.C. 238+44.6

$Rad. = 477.5$



255
254
253
252
251
250
249
248
247
246
245
244
243

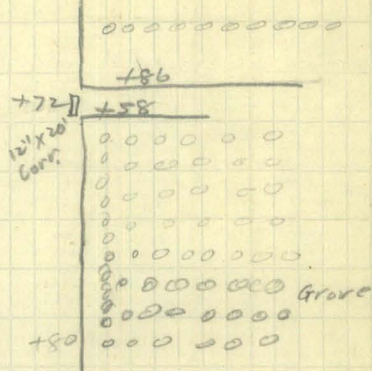
Check this

+53

original +83
+70

Pasture

citronwood
+120



Meadow

268

267

266

265

+74.1

Set stake for Center Sec. 35
2° 0' 10" Right2636' to
West Sec. Line

x

2636' to
East Sec. Line

264

263

262

261

260

259

258

257

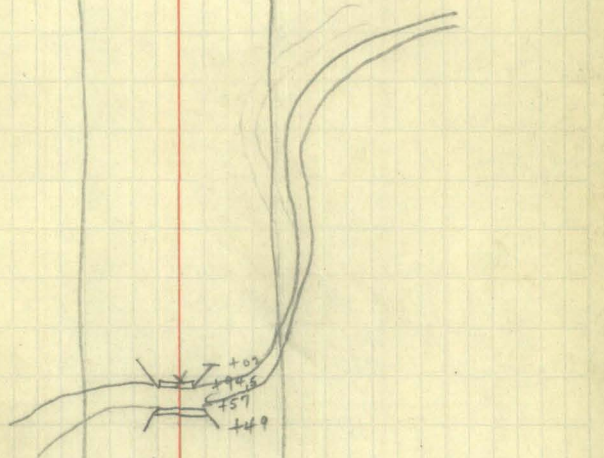
+94.7

+76

2° 0' 11" Left

35' X 16' Pony Truss

256



281

280

279

278

277⁺³³ $3 \times 2\frac{1}{2} \times 24\frac{1}{3}$ Box West end Arch Eastern

v. 76

275

274

① $+26.4$
273

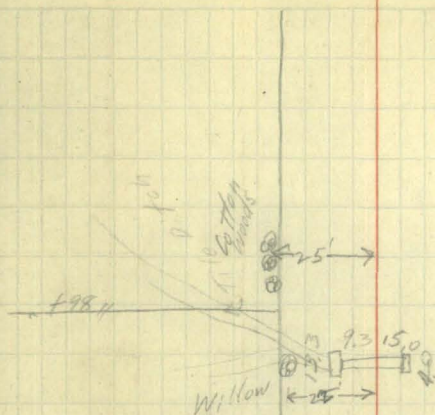
50. $40^{\circ} 4'$ left

272

271

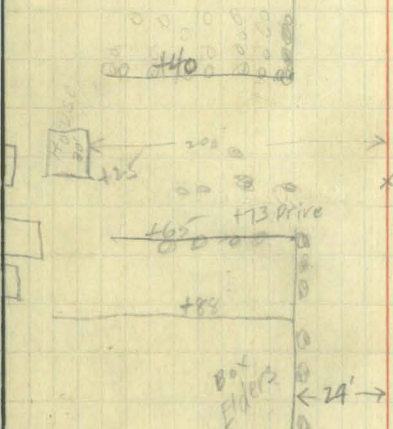
270

269


$$D.A. = 41 A_c$$

(Ext. East-end 'V')?

459



294

293

292

291 +23.3 $\angle 0^\circ$ 6' Right

290

289

288

287

286 +40
2852x2 x 6' Ext. West End.
20" x 20" Cir. Conc. Eastern

285

+60

284

283

© +56.45 P.O.T.

282

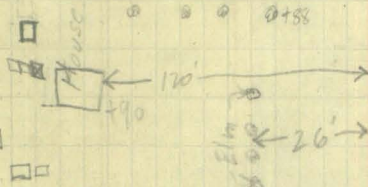
Pumps

28

+45
2629.15 to Sec. Con.

+52

2629.15 to Sec. Con.

+72
Gate

+26 +33 Drive

Cotton
Woods

25'

Meadow

19'

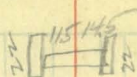
Cultivated
D.A. = 5 Ac.

16' Gate

307

+88

6x4x26 R.C.P. D.A. = 160 AC.



306

305

304

303

302

301

300

299

298

297

296

+15

2x2x26

D.A. = 14 AC.

295

Cultiv.

Meadow

+40

+32

Stumps

Cultivated

Meadow

+94 Gate



320

319

318

① +73.5 40° - 3' Right

317

316

315

314

313

312

311

310

309

308

Pasture
 Orchard
 High Line
 +75
 30'

Pasture
 Tel.
 28 →
 33 →
 460
 28 →
 12' 20' 60"

Cultivated

Meadow

+117

+134

333

332

331

330

329

+75

2X2X25

D.A. = 7 AC,

328

327

326

325

324

323

322

Hb2

2X2X27

D.A. = 10 AC

321

Culti.

+96

Meadow

+93

Orchard

+990

H0 USC

+90

+88

+97

+97

+97

+97

+97

+97

+97

+97

+97

+97

+97

+97

+97

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+20

35' Cottonwood

Meadow

+28

11 14

29'

11 16

346

345

344 $+21.5$ $\angle 0^\circ-0'-40''$ Right

343

342

341

340

339

338

337

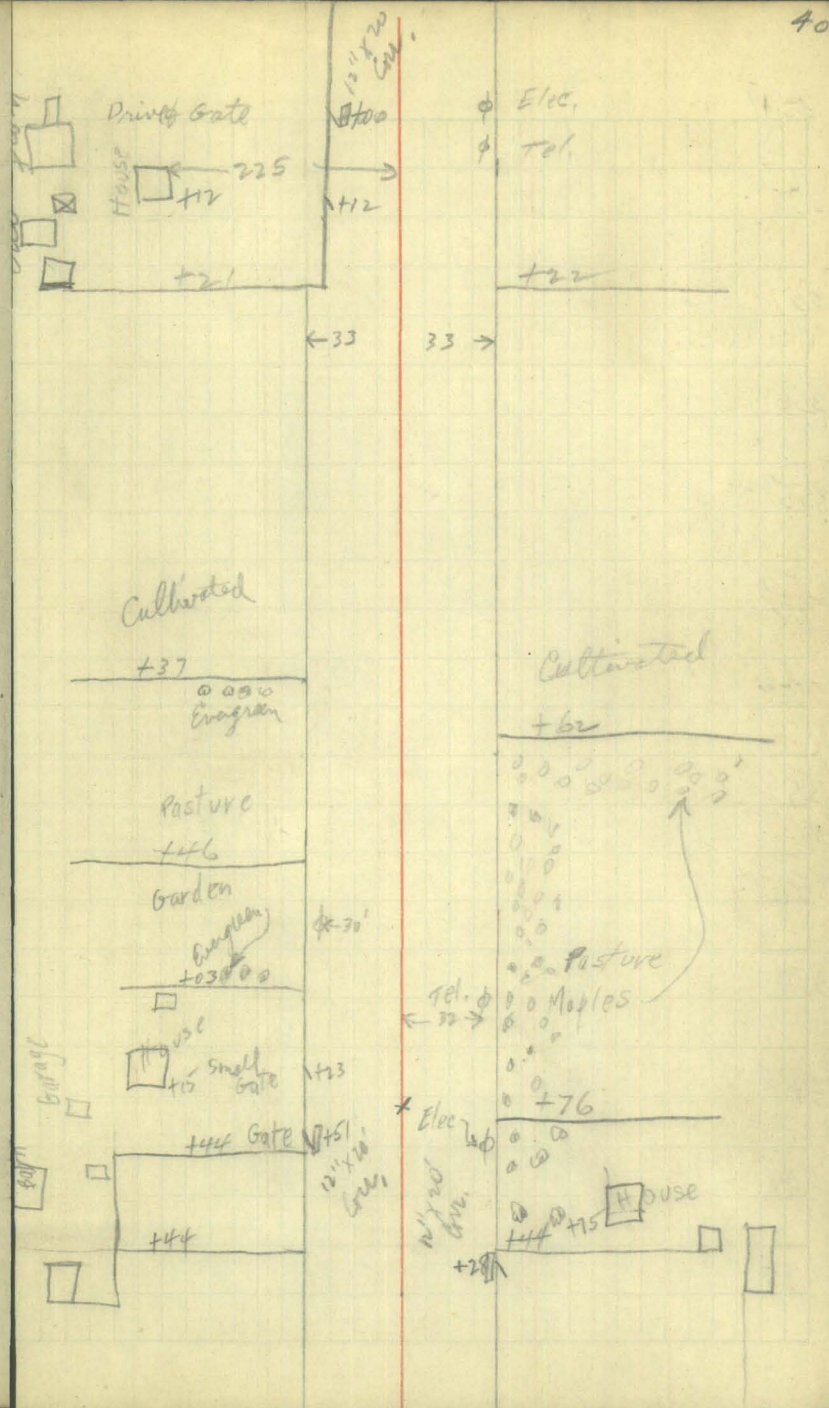
336

335 $+97.5$

335

334

P.O.T.



359

358

357

+89

conc. drive culv. 2x2 20 Arch

356

355

354

353

352

351

350

349

348

347

Cultivated

+63

Gate

+69

Cultivated

41

+21 Evergreens
+75 Maples○○○○○ ○○○○
○○○○○ ○○○○
○○○○○ ○○○○

+89 Drive

700

700

House +90

+85

+53

Pasture

+92

F22

←20

Cultivated

372

371 +48 N. end Br.
+89 S. end Br.

60 x 16 Wood Br.

370

369

368

367

366

365

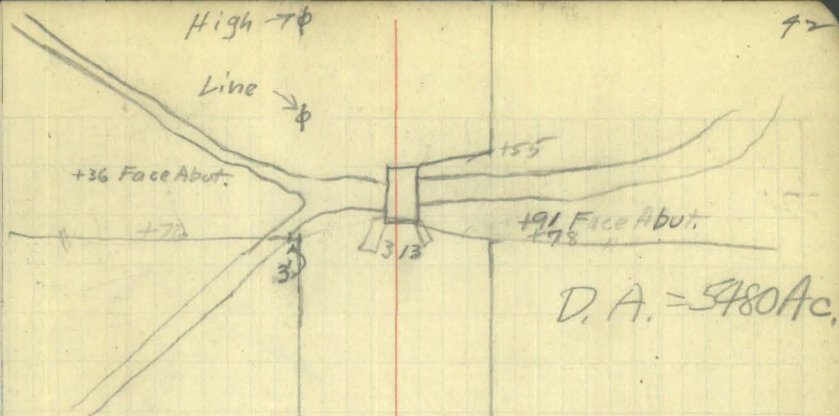
364

363

362

361

360



Pasture

Cultivated

Culti

374 + 51.8

P.I. End of Project

374

373

Handwritten mathematical calculations, likely a ledger or account book, featuring numerous entries with numbers and symbols. The entries are organized into columns and rows, with some entries marked with checkmarks. The calculations involve various numbers, including integers, decimals, and fractions, and are often accompanied by symbols like 'f' and 'L'. The overall layout is dense and appears to be a record of financial or accounting transactions.

+48

37/

370

367

366

5.15

892.17

887.02

895.50

Handwritten mathematical calculations, likely a ledger or account book, featuring numerous entries with numbers and symbols. The entries are organized into columns and rows, with some entries marked with checkmarks (✓) indicating completion or verification. The calculations involve various numbers, including integers, decimals, and fractions, and are often accompanied by descriptive text or symbols.

B.M. #1

3.72 888.45 888.45

374 + 51.8

+ 25

+ 19

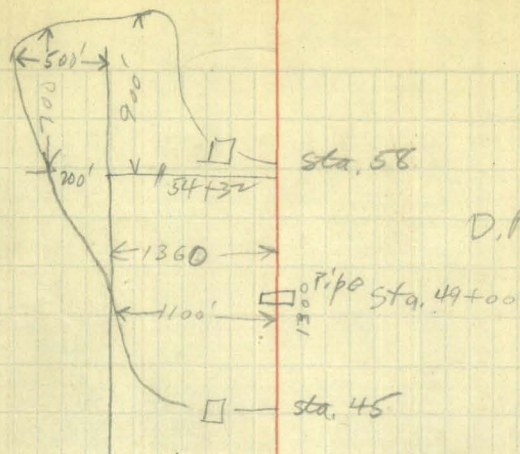
374

373

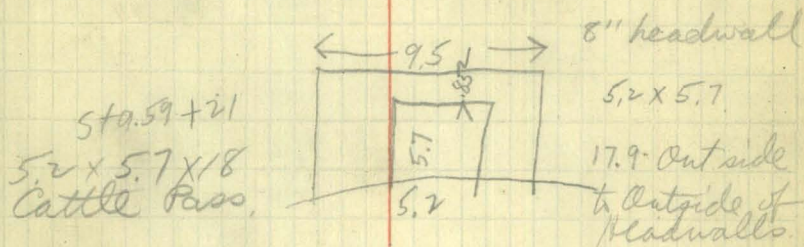
372

892.17

888.2 887.9 887.7 88.0 887.8 885.8 885.7 886.1 ✓
 4.0 4.3 4.5 4.2 4.4 6.4 6.5 6.1 ✓
 37 33 19 15 19 21 28 ✓
 887.9 886.5 886.2 887.3 887.6 885.8 885.7 886.1 885.9 ✓
 4.3 5.7 6.0 4.9 4.4 6.4 6.5 6.1 6.3 ✓
 35 29 21 17 15 19 21 28 33 ✓
 886.3 886.8 886.1 885.8 886.3 887.6 887.6 885.5 886.1 885.5 ✓
 5.2 5.4 6.1 6.4 4.9 4.6 6.7 6.1 6.7 ✓
 33 24 20 12 15 20 30 33 ✓
 884.7 884.7 883.8 883.9 886.9 887.3 887.5 84.8 884.6 884.3 ✓
 7.5 7.5 8.4 8.3 5.3 4.7 4.7 7.3 7.6 7.9 f ✓
 33 27 24 20 18 17 21 26 31 ✓
 883.4 882.2 882.2 882.5 882.5 886.8 886.9 885.4 885.2 884.9 ✓
 8.4 10.0 10.0 9.4 9.7 5.4 87.3 886.9 885.4 885.2 884.9 ✓
 24 22 20 19 17 9 4.9 16 20 30 33 ✓



D.A. = 44Ac.



$$\begin{array}{r} 5.7 \\ .85 \\ \hline 6.55 \end{array}$$

Profile of Prop. Channel Rt. & Left of Sta. 74

Top width = 12'

Bottom width = 6'

74 Left of Road.

B.M. 3.63 894.47 890.84

1.95 880.79 7.40 878.84

1.50 886.24 884.74

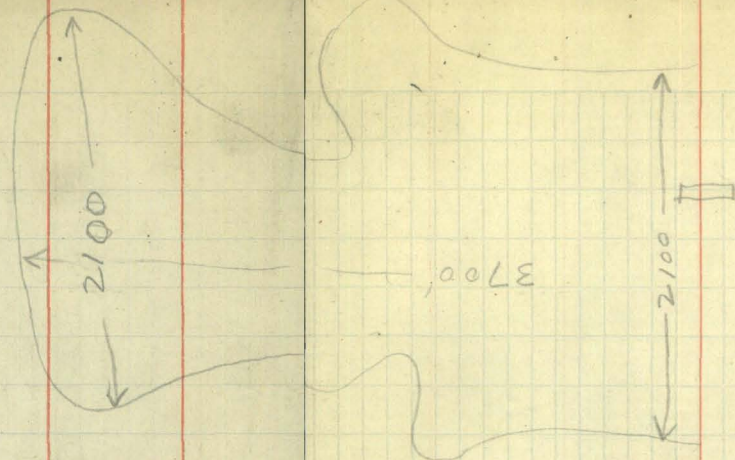
Right of Road

1.30 892.14 890.84

Sta 73+96
B.M. #23

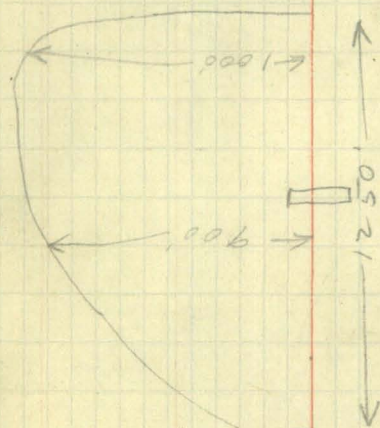
889.7	890.0	890.80	891.4	890.3	888.0
4.8	4.45	3.65	3.1	4.2	6.5
100	200	300	400	485	491

877.7	877.3	876.3	876.0	875.8	875.6	875.1	874.9	873.4
2.9	3.5	4.5	4.8	5.0	5.2	5.7	5.9	7.4
1600	1700	1800	1900	2000	2100	2200	2300	Ditch
883.8	883.0	882.1	881.2	880.1	879.7	878.8	878.8	2219
2.4	3.2	4.1	5.0	6.1	6.5	7.4	7.4	
800	900	1000	1100	1200	1300	1400	1500	
888.8	888.0	875	869	863	856	846		
4	3.3	4.1	4.5	5.2	5.8	6.5	1.5	
0	100	200	300	400	500	600	700	



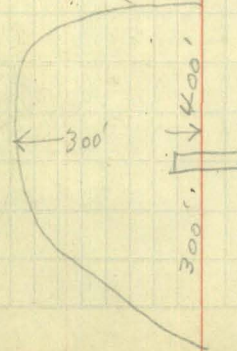
124+36

D.A. = 180 Ac.



Sta. 105

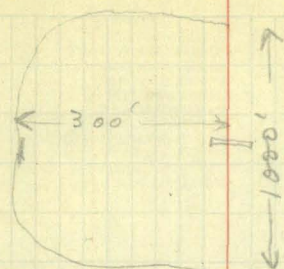
D.A. = 26 Ac.



95+01

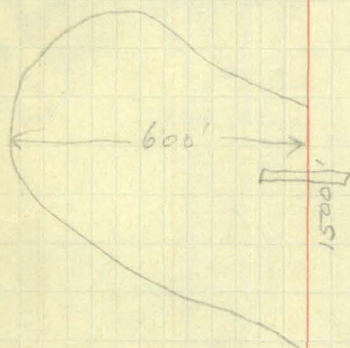
2x2x18.6

D.A. = 4 1/2 Ac.



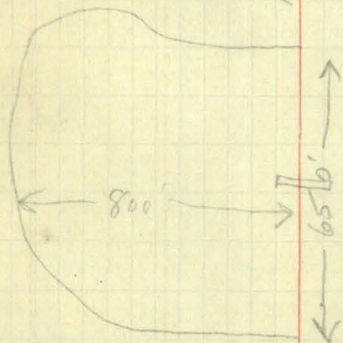
sta. 180+73

D. A. = 7 Ac.



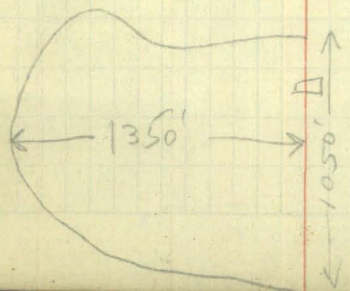
166+78

D. A. = 20 Ac.



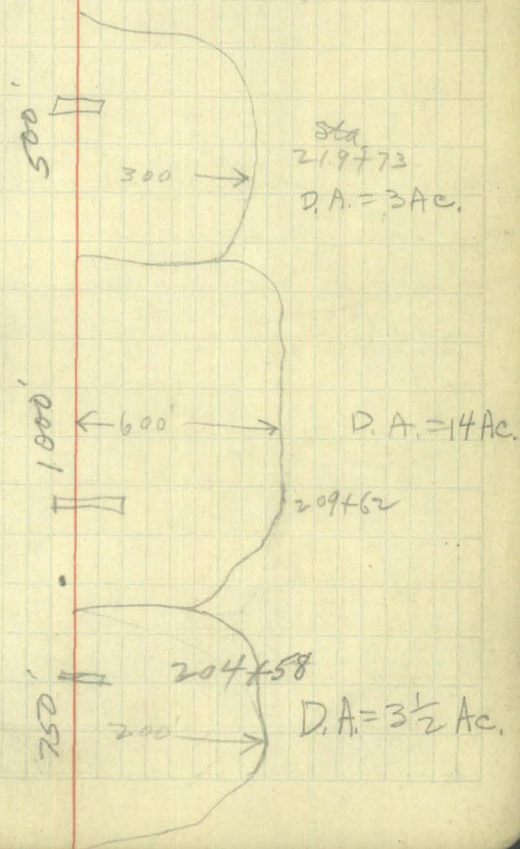
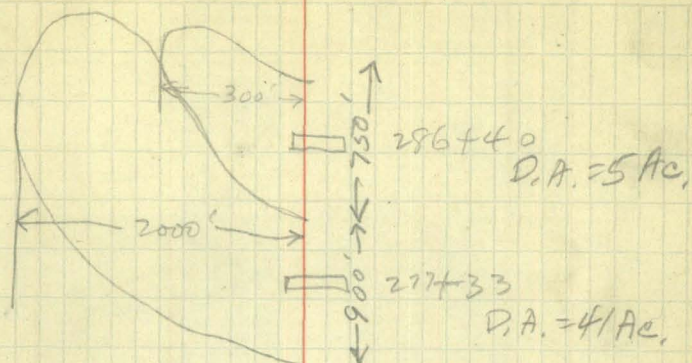
158+71

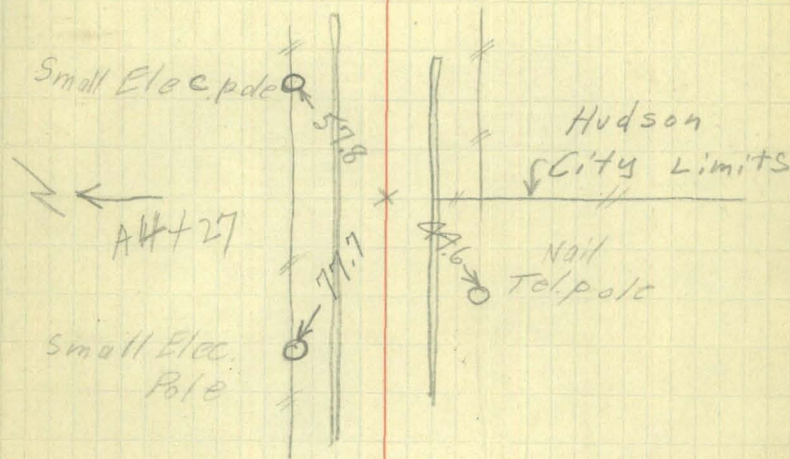
D. A. = 12 Ac.



Sta 153+72

D. A. = 32 Ac.





+27
A4 Bridge Spike = City Limits of Hudson - also Fence South

A3 +42
+18 Road, South
E. end High Truss

A2

A1

A 0+00 = W. end Black Hawk Br.

$$A + 00$$

A 3 + 00

Prop. Colv. 881.00

A2 + 63

A² + 42

AV 133.

Abutment

418

Stream Bed at E. Abut. = 866.5

B.M. #28 3.40 (884.57) 5.05 88% 11

A2

A1

BM #28

B.M. #27 5.67 (886.16) 880.49

$\begin{array}{r} 73.8 \\ 10.7 \\ \hline 33 \end{array}$	$\begin{array}{r} 14.2 \\ 10.3 \\ \hline 26 \end{array}$	$\begin{array}{r} 74.4 \\ 10.1 \\ \hline 19 \end{array}$	$\begin{array}{r} 77.9 \\ 6.6 \\ \hline 12 \end{array}$	$\begin{array}{r} 79.3 \\ 5.2 \\ \hline 8 \end{array}$	$\begin{array}{r} 79.6 \\ 4.9 \\ \hline \end{array}$	$\begin{array}{r} 79.2 \\ 5.3 \\ \hline 12 \end{array}$	$\begin{array}{r} 77.2 \\ 4.3 \\ \hline 13 \end{array}$	$\begin{array}{r} 74.0 \\ 10.5 \\ \hline 20 \end{array}$	$\begin{array}{r} 73.3 \\ 11.2 \\ \hline 26 \end{array}$	$\begin{array}{r} 74.2 \\ 10.3 \\ \hline 33 \end{array}$
$\begin{array}{r} 75.4 \\ 9.1 \\ \hline 33 \end{array}$	$\begin{array}{r} 74.6 \\ 9.9 \\ \hline 29 \end{array}$	$\begin{array}{r} 74.2 \\ 10.3 \\ \hline 25 \end{array}$	$\begin{array}{r} 75.2 \\ 9.3 \\ \hline 18 \end{array}$	$\begin{array}{r} 76.6 \\ 6.9 \\ \hline 11 \end{array}$	$\begin{array}{r} 78.3 \\ 6.2 \\ \hline 9 \end{array}$	$\begin{array}{r} 79.2 \\ 5.3 \\ \hline 6 \end{array}$	$\begin{array}{r} 79.4 \\ 5.1 \\ \hline 7 \end{array}$	$\begin{array}{r} 79.3 \\ 5.2 \\ \hline 10 \end{array}$	$\begin{array}{r} 78.1 \\ 6.4 \\ \hline 13 \end{array}$	$\begin{array}{r} 74.1 \\ 10.4 \\ \hline 19 \end{array}$
									$\begin{array}{r} 73.4 \\ 11.1 \\ \hline 25 \end{array}$	$\begin{array}{r} 74.3 \\ 10.2 \\ \hline 32 \end{array}$

$$\begin{array}{r} 75.0 \\ 9.5 \\ \hline 35 \end{array} \quad \begin{array}{r} 75.7 \\ 6.8 \\ \hline 80 \end{array} \quad \begin{array}{r} 75.1 \\ 9.4 \\ \hline 100 \end{array}$$
[illegible]

75.1	75.3	76.2	78.0	80.2	80.3	79.7	79.0
<u>9.4</u>	<u>9.2</u>	<u>8.3</u>	<u>6.5</u>	<u>4.3</u>	<u>4.2</u>	<u>4.8</u>	<u>5.5</u>
33	25	20	14	9	4.0	2.1	33

81.1	80.8	79.4	78.1	77.0	76.5	76.6	90.0
3.4	<u>3.7</u>	<u>5.1</u>	<u>6.4</u>	<u>7.5</u>	<u>8.0</u>	<u>7.9</u>	<u>4.5</u>
	10	18	33	50	100	200	275

74.4	74.5	76.3	81.4	80.9	77.4	78.4
<u>10.1</u>	<u>10.0</u>	<u>8.2</u>	<u>3.1</u>	<u>3.6</u>	<u>5.1</u>	<u>6.1</u>
33	18	13	8	10	19	33

$$\begin{array}{r} 882.2 \\ \hline 13 \end{array}$$

884.5

X end of SE Wing of Br

$$\frac{82.7}{3.5}$$

Sta. A3+00

48" X 36" Conc. Pipe

North Hub

9.38

875.47

873.4

2.07 = 2' - 1"

South Hub

10.75

874.10

873.7

0.40 = 0' - 5"

B.M.

3.74

884.85

881.11

A 7

1.7

882.8

A 6

3.5

881.0

A 5

4.3

880.2

884.51

Estimated No of
~~Moss~~ Trees & Stumps - Hudson - Cedar Falls Co. Road.

March - 30 - 1925 -
 H.D.V.

	4" to 7"	8" to 11"	12" - 17"	18" - 24"	over 24"	Brush	
Remove Trees -	III	III	III	III	III	300	Sta 0+00 To
Stumps	II	I	III	III	III	500	Sta 87+38
Trees	I		II	II	I	300	Sta 87+38 To
Stumps	I	III	III	III		200	Sta 140+60
Trees to cut down				III			
Trees Remove		III	II	III	+10	200	Sta 140+60 To
Stumps	III	III	III	III	+5	300	Sta 193+71
Trees Cut down				III		200	
Trees Remove							Sta 193+71 To
Stump "	III	III	III	II	III		Sta 238+00
Trees cut down							
Trees Remove			III	III	II		Sta 238+00 To
Stumps "					III		Sta 291+14
Trees cut down					III		
Trees Remove				III	III		
Stumps "	I	I	III	III	III		
Trees Remove	9	7	13	41	7		
Stumps "	25	29	48	46	182		
Trees Felled				7	20		

% 6 Elm trees front of Co. Round's Bldg.

Totals.

77. Trees with stumps Remove
 230. Stumps to be Removed
 27. Trees to be Felled.
 334

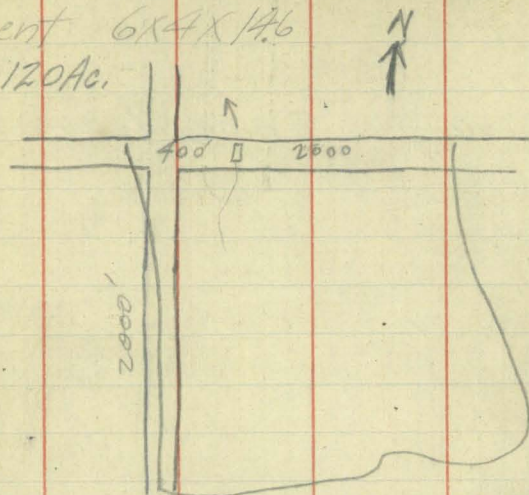
Grades for

Twin 6x4 Box

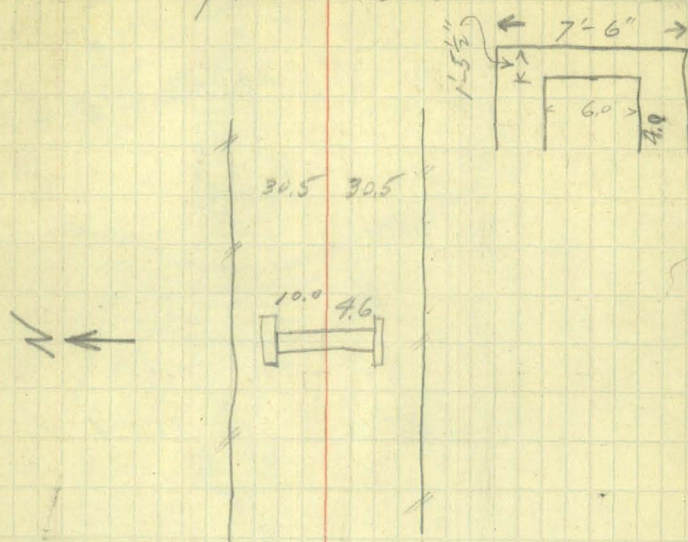
Elev. Hub Sta. 74	5.56	888.78		
East end	5.38	888.96	883.40	5.56 = 5'-7"
West end	6.00	888.34	883.75	4.59 = 4'-7"
B.M.	3.52	894.34	890.82	Nail H.L. Pole West side Rd. Sta. 72+56

July 20, 1925. 57

Culvert Survey NW Cor. Sec. 3
about 300 ft. East of Sec. Corner.
Present 6X4X14.6
D.A. = 120 Ac.



Mt Vernon Twp. on Bremer Co. Line



300' West
200' West
100' West
& Culv.
100' East
200' East
300' East

1.7	102.9
1.8	102.8
4.3	100.3
5.0	99.6
4.8	99.8
4.4	100.2
3.4	101.2

103.4 / 1020
12 / 300
196.1 / 300
95.9 / 30
93.7 / 13
95.1 / 12
99.8 / 6
97.8 / 5
99.6 / 5
99.8 / 5
100.0 / 5
Water 94.6 / 10
North 94.3 / 10
96.0 / 10
95.6 / 10
9.3 / 300

104.6

B.M. 4.57 104.57 100.00

Center N. Adwall. Conic Culvert

KEITH'S RAILROAD CURVE TABLES.

Published by KEUFFEL & ESSER CO., New York.

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in Washington, D.C.

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HOW TO USE KEITH'S TABLES.

EXAMPLE.

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

Ext. in Tab. IV opposite $23^{\circ} 20' = 120.87$
 $120.87 + 12 = 10.07$. Say a 10° Curve.

Tan. in Tab. IV opp. $23^{\circ} 20' = 1183.1$
 $1183.1 + 10 = 118.31$.

Tab. V. correction for A. $23^{\circ} 20'$ for a 10° Cur.=0.16
 $118.31 + 0.16 = 118.47 = \text{corrected Tangent}$.

(If corrected Ext. is required find in same way)
Ang. $23^{\circ} 20' = 23.33^{\circ} + 10 = 2.3333 = \text{L. C.}$

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

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

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

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

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

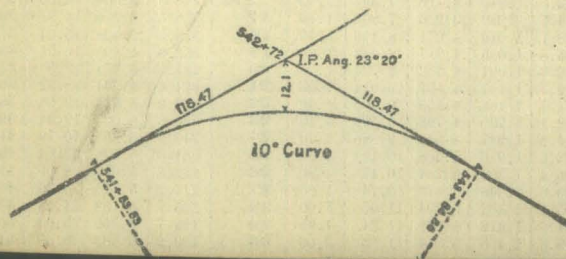


TABLE I. — Minutes in Decimals of a Degree.

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

TABLE II. — Inches in Decimals of a Foot.

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

TABLE III. — Radii, Ordinates and Deflections.

Deg.	Radius	Mid. Ord.	Tan. Def.	Chd. Def.	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Def.	Chd. Def.	Def. for 1 Foot
0° 10'	34377.7	.036	.145	.291	0.05	7°	819.0	1.528	6.105	12.21	2.10
20	17189.9	.073	.291	.582	0.10	20°	781.8	1.600	6.395	12.79	2.20
30	11459.9	.109	.436	.873	0.15	30	764.5	1.637	6.540	13.08	2.25
40	8594.4	.145	.582	1.164	0.20	40	747.9	1.673	6.685	13.37	2.30
50	6375.5	.182	.727	1.454	0.25	50	716.8	1.746	6.976	13.95	2.40
1	5729.6	.218	.873	1.745	0.30	20	688.2	1.819	7.266	14.53	2.50
10	4911.2	.255	1.018	2.036	0.35	30	674.7	1.855	7.411	14.82	2.55
20	4297.3	.291	1.164	2.327	0.40	40	661.7	1.892	7.556	15.11	2.60
30	3819.8	.327	1.309	2.618	0.45	50	637.3	1.965	7.846	15.69	2.70
40	3437.9	.364	1.454	2.909	0.50	20	614.6	2.037	8.136	16.27	2.80
50	3125.4	.400	1.600	3.200	0.55	30	603.8	2.074	8.281	16.56	2.85
2	2864.9	.436	1.745	3.490	0.60	40	593.4	2.110	8.426	16.85	2.90
10	2644.6	.473	1.891	3.781	0.65	50	573.7	2.183	8.716	17.43	3.00
20	2455.7	.509	2.036	4.072	0.70	30	546.4	2.292	9.150	18.30	3.15
30	2292.0	.545	2.181	4.363	0.75	40	521.7	2.402	9.585	19.16	3.30
40	2148.8	.582	2.327	4.654	0.80	50	499.1	2.511	10.02	20.04	3.45
50	2022.4	.618	2.472	4.945	0.85	20	478.3	2.620	10.45	20.91	3.60
3	1910.1	.655	2.618	5.235	0.90	30	459.3	2.730	10.89	21.77	3.75
10	1809.6	.691	2.763	5.526	0.95	40	441.7	2.839	11.32	22.64	3.90
20	1719.1	.727	2.908	5.817	1.00	50	425.4	2.949	11.75	23.51	4.05
30	1637.3	.764	3.054	6.108	1.05	20	410.3	3.058	12.18	24.37	4.20
40	1562.9	.800	3.199	6.399	1.10	30	396.2	3.168	12.62	25.24	4.35
50	1495.0	.836	3.345	6.689	1.15	40	383.1	3.277	13.05	26.11	4.50
4	1432.7	.873	3.490	6.980	1.20	50	370.8	3.387	13.49	26.97	4.65
10	1375.4	.909	3.635	7.271	1.25	20	359.3	3.496	13.92	27.84	4.80
20	1322.5	.945	3.718	7.561	1.30	30	348.5	3.606	14.35	28.70	4.95
30	1273.6	.982	3.826	7.852	1.35	40	338.3	3.716	14.78	29.56	5.10
40	1228.1	1.018	4.071	8.143	1.40	50	319.6	3.935	15.64	31.29	5.40
50	1185.8	1.055	4.217	8.433	1.45	20	302.9	4.155	16.51	33.01	5.70
3	1146.3	1.091	4.362	8.724	1.50	30	287.9	4.374	17.37	34.73	6.00
10	1109.3	1.127	4.507	9.014	1.55	40	274.4	4.594	18.22	36.44	6.30
20	1074.7	1.164	4.653	9.305	1.60	50	262.0	4.814	19.08	38.16	6.60
30	1042.1	1.200	4.798	9.596	1.65	20	250.8	5.035	19.94	39.87	6.90
40	1011.5	1.237	4.943	9.886	1.70	30	240.5	5.255	20.79	41.58	7.20
50	982.6	1.273	5.088	10.18	1.75	40	231.0	5.476	21.64	43.28	7.50
6	955.4	1.309	5.234	10.47	1.80	50	222.3	5.697	22.50	44.99	7.80
10	929.6	1.346	5.379	10.76	1.85	20	214.2	5.918	23.35	46.69	8.10
20	905.1	1.382	5.524	11.05	1.90	30	206.7	6.139	24.19	48.38	8.40
30	881.9	1.418	5.669	11.34	1.95	40	199.7	6.360	25.04	50.07	8.70
40	859.9	1.455	5.814	11.63	2.00	50	193.2	6.583	25.88	51.76	9.00

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

Angle	Tangent	External	Angle	Tangent	External	Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.09
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

$$\begin{array}{r} 264 + 74.1 \\ 13 + 24.6 \\ \hline 277 + 98.7 \end{array}$$

$$\begin{array}{r} 291 + 23.3 \\ 264 + 74.1 \\ \hline 26 + 49.2 \end{array}$$

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

Angle	Tangent	External	Angle	Tangent	External	Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32°	1643.0	230.9	42°	2199.4	407.6	52°	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33°	1697.2	246.1	43°	2257.0	428.5	53°	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34°	1751.7	261.8	44°	2314.9	450.0	54°	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35°	1806.6	278.1	45°	2373.3	472.1	55°	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.7
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.3	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36°	1861.7	294.9	46°	2432.1	494.8	56°	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37°	1917.1	312.2	47°	2491.3	518.2	57°	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38°	1972.9	330.2	48°	2551.0	542.2	58°	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39°	2029.0	348.6	49°	2611.2	566.9	59°	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40°	2085.4	367.7	50°	2671.8	592.3	60°	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

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

Angle	Tangent	External	Angle	Tangent	External	Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10'	3386.3	925.9	10'	4099.5	1315.6	10'	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62°	3442.7	954.8	72°	4162.8	1352.6	82°	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63°	3511.1	990.2	73°	4239.7	1398.0	83°	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64°	3580.3	1026.6	74°	4317.6	1444.6	84°	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65°	3650.2	1063.9	75°	4396.5	1492.4	85°	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66°	3720.9	1102.2	76°	4476.5	1541.4	86°	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.3
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.4	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67°	3792.4	1141.4	77°	4557.6	1591.6	87°	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68°	3864.7	1181.6	78°	4639.8	1643.0	88°	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69°	3937.9	1222.7	79°	4723.2	1695.8	89°	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70°	4011.9	1265.0	80°	4807.7	1749.9	90°	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

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

Angle	Tangent	External	Angle	Tangent	External	Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4336.1
10'	5847.5	2457.1	10'	6971.8	3294.1	10'	8362.7	4407.6
20'	5864.6	2469.3	20'	6992.0	3310.1	20'	8388.9	4429.2
30'	5881.7	2481.5	30'	7012.7	3326.1	30'	8415.1	4450.9
40'	5898.8	2493.8	40'	7033.6	3342.3	40'	8441.5	4472.7
50'	5916.0	2506.1	50'	7054.5	3358.5	50'	8468.0	4494.6
92°	5933.2	2518.5	102°	7075.5	3374.9	112°	8494.6	4516.6
10'	5950.5	2531.0	10'	7096.6	3391.2	10'	8521.3	4538.8
20'	5967.9	2543.5	20'	7117.8	3407.7	20'	8548.1	4561.1
30'	5985.3	2556.0	30'	7139.0	3424.3	30'	8575.0	4583.4
40'	6002.7	2568.6	40'	7160.3	3440.9	40'	8602.1	4606.0
50'	6020.2	2581.3	50'	7181.7	3457.6	50'	8629.3	4628.6
93°	6037.8	2594.0	103°	7203.2	3474.4	113°	8656.6	4651.3
10'	6055.4	2606.8	10'	7224.7	3491.3	10'	8684.0	4674.2
20'	6073.1	2619.7	20'	7246.3	3508.2	20'	8711.5	4697.2
30'	6090.8	2632.6	30'	7268.0	3525.2	30'	8739.2	4720.3
40'	6108.6	2645.5	40'	7289.8	3542.4	40'	8767.0	4743.6
50'	6126.4	2658.5	50'	7311.7	3559.6	50'	8794.9	4766.9
94°	6144.3	2671.6	104°	7333.6	3576.8	114°	8822.9	4790.4
10'	6162.6	2684.7	10'	7355.6	3594.2	10'	8851.0	4814.1
20'	6180.2	2697.9	20'	7377.8	3611.7	20'	8879.3	4837.8
30'	6198.3	2711.2	30'	7399.9	3629.2	30'	8907.7	4861.7
40'	6216.4	2724.5	40'	7422.2	3646.8	40'	8936.3	4885.7
50'	6234.6	2737.9	50'	7444.6	3664.5	50'	8965.0	4909.9
95°	6252.8	2751.3	105°	7467.0	3682.3	115°	8993.8	4934.1
10'	6271.1	2764.8	10'	7489.6	3700.2	10'	9022.7	4958.6
20'	6289.4	2778.3	20'	7512.2	3718.2	20'	9051.7	4983.1
30'	6307.9	2792.0	30'	7534.9	3736.2	30'	9080.9	5007.8
40'	6326.3	2805.6	40'	7557.7	3754.4	40'	9110.3	5032.6
50'	6344.8	2819.4	50'	7580.5	3772.6	50'	9139.8	5057.6
96°	6363.4	2833.2	106°	7603.5	3791.0	116°	9169.4	5082.7
10'	6382.1	2847.0	10'	7626.6	3809.4	10'	9199.1	5107.9
20'	6400.8	2861.0	20'	7649.7	3827.9	20'	9229.0	5133.3
30'	6419.5	2875.0	30'	7672.9	3846.5	30'	9259.0	5158.8
40'	6438.4	2889.0	40'	7696.3	3865.2	40'	9289.2	5184.5
50'	6457.3	2903.1	50'	7719.7	3884.0	50'	9319.5	5210.3
97°	6476.2	2917.3	107°	7743.2	3902.9	117°	9349.9	5236.2
10'	6495.2	2931.6	10'	7766.8	3921.9	10'	9380.5	5262.3
20'	6514.3	2945.9	20'	7790.5	3940.9	20'	9411.3	5288.6
30'	6533.4	2960.3	30'	7814.3	3960.1	30'	9442.2	5315.0
40'	6552.6	2974.7	40'	7838.1	3979.4	40'	9473.2	5341.5
50'	6571.9	2989.2	50'	7862.1	3998.7	50'	9504.4	5368.2
98°	6591.2	3003.8	108°	7886.2	4018.2	118°	9535.7	5395.1
10'	6610.6	3018.4	10'	7910.4	4037.8	10'	9567.2	5422.1
20'	6630.1	3033.1	20'	7934.6	4057.4	20'	9598.9	5449.2
30'	6649.6	3047.9	30'	7959.0	4077.2	30'	9630.7	5476.5
40'	6669.2	3062.8	40'	7983.5	4097.1	40'	9662.6	5504.0
50'	6688.8	3077.7	50'	8008.0	4117.0	50'	9694.7	5531.7
99°	6708.6	3092.7	109°	8032.7	4137.1	119°	9727.0	5559.4
10'	6728.4	3107.7	10'	8057.4	4157.3	10'	9759.4	5587.4
20'	6748.2	3122.9	20'	8082.3	4177.5	20'	9792.0	5615.5
30'	6768.1	3138.1	30'	8107.3	4197.9	30'	9824.8	5643.8
40'	6788.1	3153.3	40'	8132.3	4218.4	40'	9857.7	5672.3
50'	6808.2	3168.7	50'	8157.5	4239.0	50'	9890.8	5700.9
100°	6828.3	3184.1	110°	8182.8	4259.7	120°	9924.0	5729.7
10'	6848.5	3199.6	10'	8208.2	4280.5	10'	9957.5	5758.6
20'	6868.8	3215.1	20'	8233.7	4301.4	20'	9991.0	5787.7
30'	6889.2	3230.8	30'	8259.3	4322.4	30'	10025.0	5817.0
40'	6909.6	3246.5	40'	8285.0	4343.6	40'	10059.0	5846.5
50'	6930.1	3262.3	50'	8310.8	4364.8	50'	10093.0	5876.1

Table V. Corrections for use with table IV,

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		For Tangents Add													
Δ	ANGLE	CURVE 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°		.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°		.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°		.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°		.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°		.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°		.11	.22	.34	.47	.58	.69	.79	.81	.92	1.04	1.29	1.42	1.54	1.66
40°		.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°		.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°		.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°		.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°		.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°		.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°		.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°		.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°		.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°		.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°		.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°		.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.88	5.38	5.83
100°		.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34

For Externals Add

Δ	ANGLE	CURVE 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°		.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°		.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°		.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°		.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°		.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°		.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°		.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°		.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°		.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°		.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°		.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°		.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01
70°		.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°		.095	.182	.266	.353	.440	.528	.618	.707	.797	.877	.971	1.07	1.18	1.29
80°		.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°		.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°		.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°		.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°		.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96

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

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

CURVE FORMULAS.

$T = R \tan \frac{1}{2} I$	$R = T \cot. \frac{1}{2} I$	Chord def. = $\frac{\text{chord}^2}{R}$
$T = 50 \tan. \frac{1}{2} I$	$R = 50$	
$\text{Sin. D} = \frac{50}{R}$	$\text{Sin. D} = \frac{R}{50}$	No. chords = $\frac{1}{2} \frac{I}{D}$
$\text{Sin. D} = 50 \tan. \frac{1}{2} I$	$E = R \text{ ex. sec. } \frac{1}{2} I$	
T	$E = T \tan \frac{1}{2} I$	Tan. def. = $\frac{1}{2}$ chord def.

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

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

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

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

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

To find angle for a given distance and deflection.

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

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

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

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

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

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

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

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

Natural Sines

deg.	0'	10'	20'	30'	40'	50'	deg.	0'	10'	20'	30'	40'	50'	deg.	
0	0000	0029	0058	0087	0116	0145	89	40	6428	6450	6472	6494	6517	6539	49
1	0175	0204	0233	0262	0291	0320	88	41	6561	6583	6604	6626	6648	6670	48
2	0349	0378	0407	0436	0465	0494	87	42	6691	6713	6734	6756	6777	6799	47
3	0523	0552	0581	0610	0640	0669	86	43	6820	6841	6862	6884	6905	6926	46
4	0698	0727	0756	0785	0814	0843	85	44	6947	6967	6988	7009	7030	7050	45
5	0872	0901	0929	0958	0987	1016	84	45	7071	7092	7112	7133	7153	7173	44
6	1045	1074	1103	1132	1161	1190	83	46	7193	7214	7234	7254	7274	7294	43
7	1219	1248	1279	1305	1334	1363	82	47	7314	7333	7353	7373	7392	7412	42
8	1392	1421	1449	1478	1507	1536	81	48	7431	7451	7470	7490	7509	7528	41
9	1564	1593	1622	1650	1679	1708	80	49	7547	7566	7585	7604	7623	7642	40
10	1736	1765	1794	1822	1851	1880	79	50	7660	7679	7698	7716	7735	7753	39
11	1908	1937	1965	1994	2022	2051	78	51	7771	7790	7808	7826	7844	7862	38
12	2079	2108	2136	2164	2193	2221	77	52	7880	7898	7916	7934	7951	7969	37
13	2250	2278	2306	2334	2363	2391	76	53	7986	8004	8021	8039	8056	8073	36
14	2419	2447	2476	2504	2532	2560	75	54	8090	8107	8124	8141	8158	8175	35
15	2588	2616	2644	2672	2700	2728	74	55	8192	8208	8225	8241	8258	8274	34
16	2756	2784	2812	2840	2868	2896	73	56	8290	8307	8323	8339	8355	8371	33
17	2924	2952	2979	3007	3035	3062	72	57	8387	8403	8418	8434	8450	8465	32
18	3090	3118	3145	3173	3201	3228	71	58	8480	8496	8511	8526	8542	8557	31
19	3256	3283	3311	3338	3365	3393	70	59	8572	8587	8601	8616	8631	8646	30
20	3420	3448	3475	3502	3529	3557	69	60	8660	8675	8689	8704	8718	8732	29
21	3581	3611	3638	3665	3692	3719	68	61	8746	8760	8774	8788	8802	8816	28
22	3746	3773	3800	3827	3854	3881	67	62	8829	8843	8857	8870	8884	8897	27
23	3907	3934	3961	3987	4014	4041	66	63	8910	8923	8936	8949	8962	8975	26
24	4067	4094	4120	4147	4173	4200	65	64	8988	9001	9013	9026	9038	9051	25
25	4226	4253	4279	4305	4331	4358	64	65	9063	9075	9088	9100	9112	9124	24
26	4384	4410	4436	4462	4488	4514	63	66	9135	9147	9159	9171	9182	9194	23
27	4540	4566	4592	4617	4643	4669	62	67	9205	9216	9228	9239	9250	9261	22
28	4695	4720	4746	4772	4797	4823	61	68	9272	9283	9293	9304	9315	9325	21
29	4848	4874	4899	4924	4950	4975	60	69	9336	9346	9356	9367	9377	9387	20
30	5000	5025	5050	5075	5100	5125	59	70	9397	9407	9417	9426	9436	9446	19
31	5150	5175	5200	5225	5250	5275	58	71	9455	9465	9474	9483	9492	9502	18
32	5299	5324	5348	5373	5398	5422	57	72	9511	9520	9528	9537	9546	9555	17
33	5446	5471	5495	5519	5544	5568	56	73	9563	9572	9580	9588	9596	9605	16
34	5592	5616	5640	5664	5688	5712	55	74	9613	9621	9628	9636	9644	9652	15
35	5736	5760	5783	5807	5831	5854	54	75	9659	9667	9674	9681	9689	9696	14
36	5878	5901	5925	5948	5972	5995	53	76	9703	9710	9717	9724	9730	9737	13
37	6018	6041	6065	6088	6111	6134	52	77	9744	9750	9757	9763	9769	9775	12
38	6157	6180	6202	6225	6248	6271	51	78	9781	9787	9793	9799	9805	9811	11
39	6293	6316	6338	6361	6383	6406	50	79	9816	9822	9827	9833	9838	9843	10
deg.	60'	50'	40'	30'	20'	10'	deg.	deg.	60'	50'	40'	30'	20'	10'	deg.

deg.	60'	50'	40'	30'	20'	10'	deg.	60'	50'	40'	30'	20'	10'	deg.
80	9848	9853	9858	9863	9868	9872	9	9872	9879	9884	9888	9892	9896	8
81	9877	9881	9886	9890	9894	9898	8	9898	9903	9907	9911	9914	9918	7
82	9903	9907	9911	9914	9918	9922	7	9922	9926	9929	9932	9936	9939	6
83	9925	9929	9932	9936	9939	9942	6	9942	9946	9949	9951	9954	9957	5
84	9945	9948	9951	9954	9957	9959	5	9959	9962	9964	9967	9969	9971	4
85	9962	9964	9967	9969	9971	9974	4	9974	9976	9978	9980	9981	9983	3
86	9976	9978	9980	9981	9983	9985	3	9985	9987	9988	9989	9990	9992	2
87	9986	9988	9989	9990	9992	9993	2	9993	9994	9995	9996	9997	9997	1
88	9994	9995	9996	9997	9997	9998	1	9998	9999	9999	9999	1.0000	1.0000	0
89	9998	9999	9999	9999	1.0000	1.0000	0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0

Natural Cosines

X

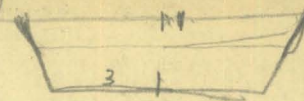
Natural Tangents

deg	0'	10'	20'	30'	40'	50'	deg	0'	10'	20'	30'	40'	50'	deg
0	0000	0029	0058	0087	0116	0145	89	40	8391	8441	8491	8541	8591	8642
1	0175	0204	0233	0262	0291	0320	88	41	8693	8744	8796	8847	8899	8952
2	0349	0378	0407	0437	0466	0495	87	42	9004	9057	9110	9163	9217	9271
3	0524	0553	0582	0612	0641	0670	86	43	9325	9380	9435	9490	9545	9601
4	0699	0729	0758	0787	0816	0846	85	44	9657	9713	9770	9827	9884	9942
5	0875	0904	0934	0963	0992	1022	84	45	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295
6	1051	1080	1110	1139	1169	1198	83	46	1.0355	1.0416	1.0477	1.0533	1.0599	1.0661
7	1228	1257	1287	1317	1346	1376	82	47	1.0724	1.0786	1.0850	1.0913	1.0977	1.1041
8	1405	1435	1465	1495	1524	1554	81	48	1.1106	1.1171	1.1237	1.1303	1.1369	1.1436
9	1584	1614	1644	1673	1703	1733	80	49	1.1504	1.1571	1.1640	1.1708	1.1778	1.1847
10	1763	1793	1823	1853	1883	1914	79	50	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276
11	1944	1974	2004	2035	2065	2095	78	51	1.2349	1.2423	1.2497	1.2572	1.2647	1.2723
12	2126	2156	2186	2217	2247	2278	77	52	1.2799	1.2876	1.2954	1.3032	1.3111	1.3190
13	2300	2330	2370	2401	2432	2462	76	53	1.3270	1.3351	1.3452	1.3514	1.3597	1.3680
14	2493	2524	2555	2586	2617	2648	75	54	1.3764	1.3848	1.3934	1.4019	1.4106	1.4193
15	2679	2711	2742	2773	2805	2836	74	55	1.4281	1.4370	1.4460	1.4550	1.4641	1.4733
16	2867	2899	2931	2962	2994	3026	73	56	1.4826	1.4919	1.5013	1.5108	1.5204	1.5301
17	3057	3089	3121	3153	3185	3217	72	57	1.5399	1.5497	1.5597	1.5697	1.5798	1.5900
18	3249	3281	3314	3346	3378	3411	71	58	1.6003	1.6107	1.6212	1.6319	1.6426	1.6534
19	3443	3476	3508	3541	3574	3607	70	59	1.6643	1.6753	1.6864	1.6977	1.7090	1.7205
20	3640	3673	3706	3739	3772	3805	69	60	1.7321	1.7437	1.7556	1.7675	1.7797	1.7917
21	3839	3872	3906	3939	3973	4006	68	61	1.8040	1.8165	1.8291	1.8418	1.8546	1.8676
22	4040	4074	4108	4142	4176	4210	67	62	1.8807	1.8940	1.9074	1.9210	1.9347	1.9486
23	4245	4279	4314	4348	4383	4417	66	63	1.9626	1.9768	1.9912	2.0057	2.0204	2.0353
24	4452	4487	4522	4557	4592	4628	65	64	2.0503	2.0655	2.0809	2.0965	2.1123	2.1283
25	4663	4699	4734	4770	4806	4841	64	65	2.1445	2.1609	2.1775	2.1943	2.2113	2.2286
26	4877	4913	4950	4986	5022	5059	63	66	2.2460	2.2637	2.2817	2.2998	2.3183	2.3369
27	5095	5132	5169	5206	5243	5280	62	67	2.3559	2.3750	2.3945	2.4142	2.4342	2.4545
28	5317	5354	5392	5430	5467	5505	61	68	2.4751	2.4960	2.5172	2.5386	2.5605	2.5826
29	5543	5581	5619	5658	5696	5735	60	69	2.6051	2.6279	2.6511	2.6746	2.6985	2.7228
30	5774	5812	5851	5890	5930	5969	59	70	2.7475	2.7725	2.7980	2.8239	2.8502	2.8770
31	6009	6048	6088	6128	6168	6208	58	71	2.9042	2.9319	2.9600	2.9887	3.0178	3.0475
32	6249	6289	6330	6371	6412	6453	57	72	3.0777	3.1084	3.1397	3.1716	3.2041	3.2371
33	6494	6536	6577	6619	6661	6703	56	73	3.2709	3.3052	3.3402	3.3759	3.4124	3.4495
34	6745	6787	6830	6873	6916	6959	55	74	3.4874	3.5261	3.5656	3.6059	3.6470	3.6891
35	7002	7046	7090	7133	7177	7221	54	75	3.7321	3.7760	3.8208	3.8657	3.9136	3.9617
36	7265	7310	7355	7400	7445	7490	53	76	4.0108	4.0611	4.1126	4.1653	4.2193	4.2747
37	7536	7581	7627	7673	7720	7766	52	77	4.3315	4.3897	4.4494	4.5107	4.5736	4.6382
38	7813	7860	7907	7954	8002	8050	51	78	4.7046	4.7729	4.8430	4.9152	4.9894	5.0658
39	8098	8146	8195	8243	8292	8342	50	79	5.1446	5.2257	5.3093	5.3955	5.4845	5.5764

deg	60'	50'	40'	30'	20'	10'	deg	60'	50'	40'	30'	20'	10'	deg
80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970	9	80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970
81	6.3158	6.4348	6.5606	6.6912	6.8269	6.9682	8	81	6.3158	6.4348	6.5606	6.6912	6.8269	6.9682
82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530	7	82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530
83	8.1443	8.3450	8.5555	8.7769	9.0098	9.2536	6	83	8.1443	8.3450	8.5555	8.7769	9.0098	9.2536
84	9.5144	9.7882	10.078	10.385	10.711	11.059	5	84	9.5144	9.7882	10.078	10.385	10.711	11.059
85	11.430	11.826	12.250	12.706	13.197	13.727	4	85	11.430	11.826	12.250	12.706	13.197	13.727
86	14.300	14.924	15.605	16.350	17.169	18.075	3	86	14.300	14.924	15.605	16.350	17.169	18.075
87	19.081	20.206	21.470	22.903	24.542	26.432	2	87	19.081	20.206	21.470	22.903	24.542	26.432
88	28.636	31.242	34.368	38.189	42.964	49.104	1	88	28.636	31.242	34.368	38.189	42.964	49.104
89	57.290	68.750	85.940	114.588	171.885	343.770	0	89	57.290	68.750	85.940	114.588	171.885	343.770

Natural Cotangents

24

218500
9250

185
50.27
4380
92500
87120
53800

344 + 26.5
291 + 23.3

52 + 98.2

291 + 23.3
13 + 24.55
304 + 47.85

52 +
1324.55

4 5298.2
4
12
12

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 14 FEET WIDE. SIDE SLOPES 1 1/2 TO 1.

FOR SINGLE TRACK EMBANKMENT.

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

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

MADE IN GERMANY.