161

K & E

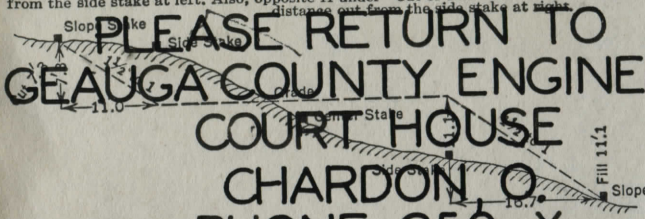
FIELD BOOK

F 360

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19·8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

KEUFFEL & ESSER CO., N. Y.

For Curve Tables see end of book.

Book 161

C.H. #13 South Hambden Road
Pg. 1-22-59

Pg 61 - Reff. for. I. pipes fd in Williams W— (CH 13?)

Pg 60 & 62 Culvt Sta 44+27 Bell Sf.

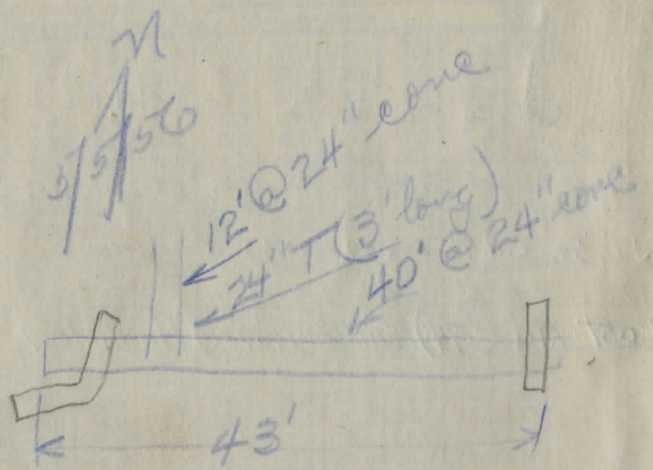
Cuyahoga River Bridge #13-D-10.15 68-70

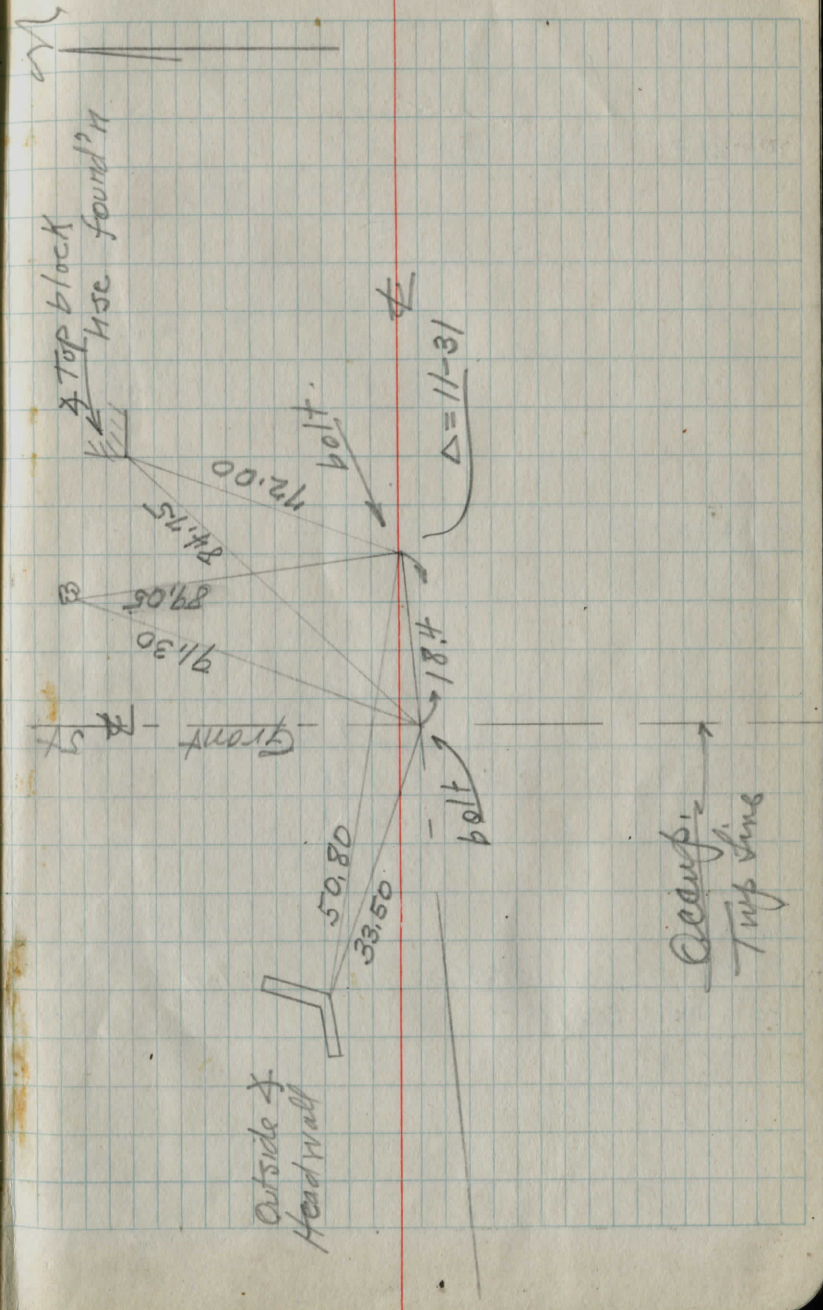
Jug St. C.H. 46 Sta 54+70.53 Topo-Levels 63-65

Aquilla C.H. #5 Profile Sta 101-111 66-67

Last Rd (#74) Random Traverse) Hambden 6-7

The paper in this book **No. F360** is made of **100%** high grade rag stock with a **WATER RESISTING** surface sizing.


N
3/5/56
12'@24" cone
24" T (3' long)
40'@24" cone
43'


℄ Top block
Use found'n
72.00
84.75
89.06
91.30
℄ Road
℄ Stone
Δ=11-31
110+
110+
18.44
50.80
33.50
Outside ℄ Headwall
Roadway
Top Stone

SOUTH HAMBDEN ROAD
Chardon Vill to. Clarion Ctr. N. Road

10+21.4

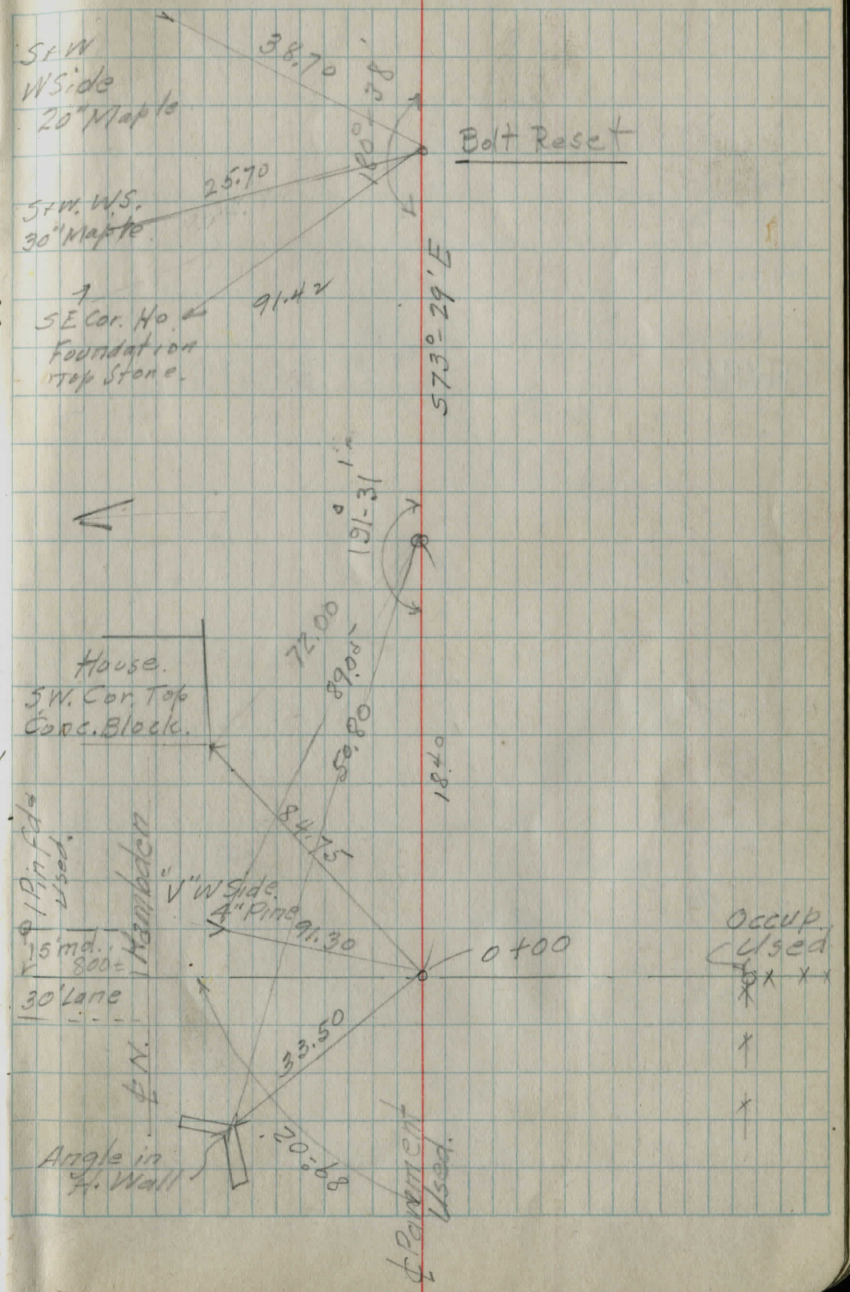
0+18.40 = PI.

I
E = 5.25'
Δ = 11°-21' Rt.
PC = 0+86.6
PT = 1+22.85
T = 105.05'
L = 209.45'

0+00 = E. Corporation Line Chardon.
Iron bolt set 0+00 = PI

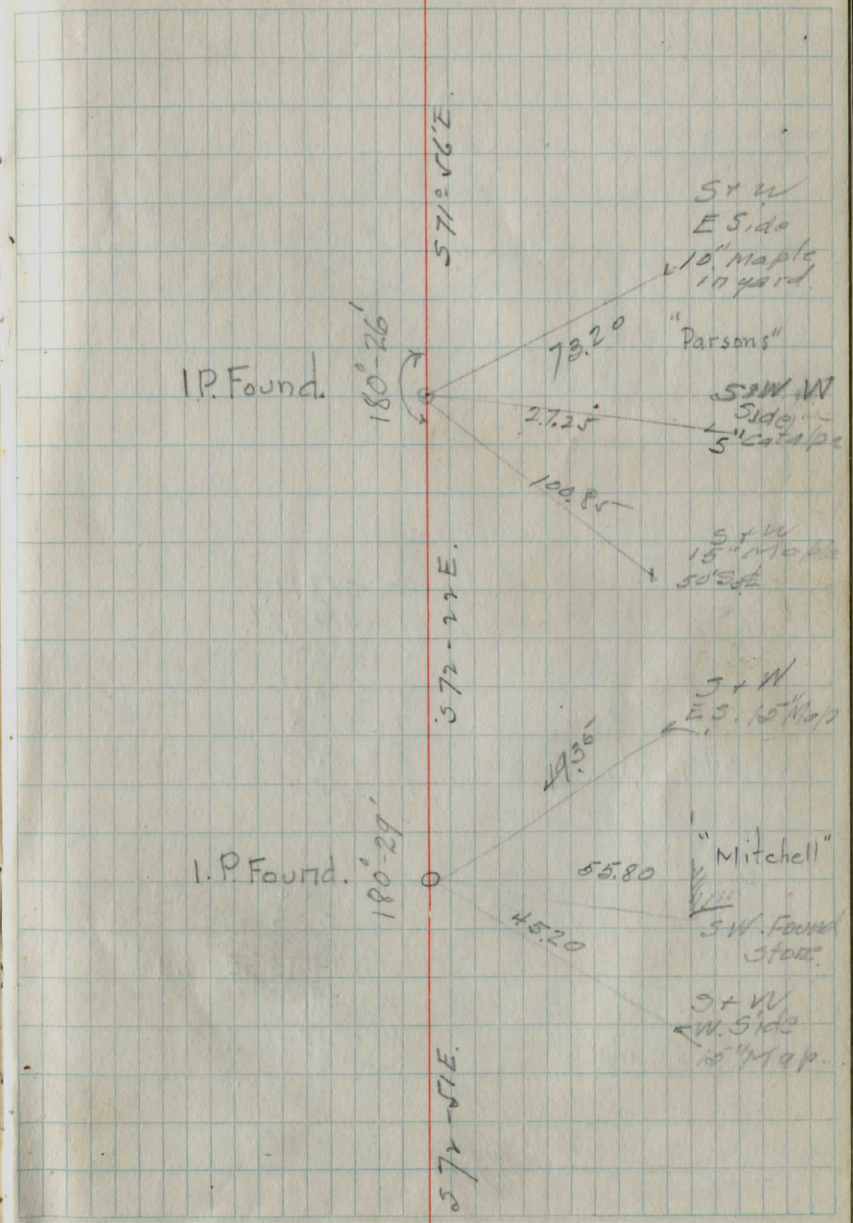
Graber
Richards
R. Hauter

Dec 14 1938
T. 25°.



39+94.4

37+87.5


I.P. Found.
S 71° 27' E.
92.08'
73.2°
"Parsons"
S & W
E Side
10" Maple
in yard
27.25'
S & W
Side
"
5
100.85'
S & W
15" Maple
50 E of
I.P. Found.
S 72° 12' E.
180.22'
49.3°
J & W
E.S. 15" Maple
55.80
"Mitchell"
S & W. Found
Stone
45.20
J & W
W. Side
15" Map.
S 72° 51' E.

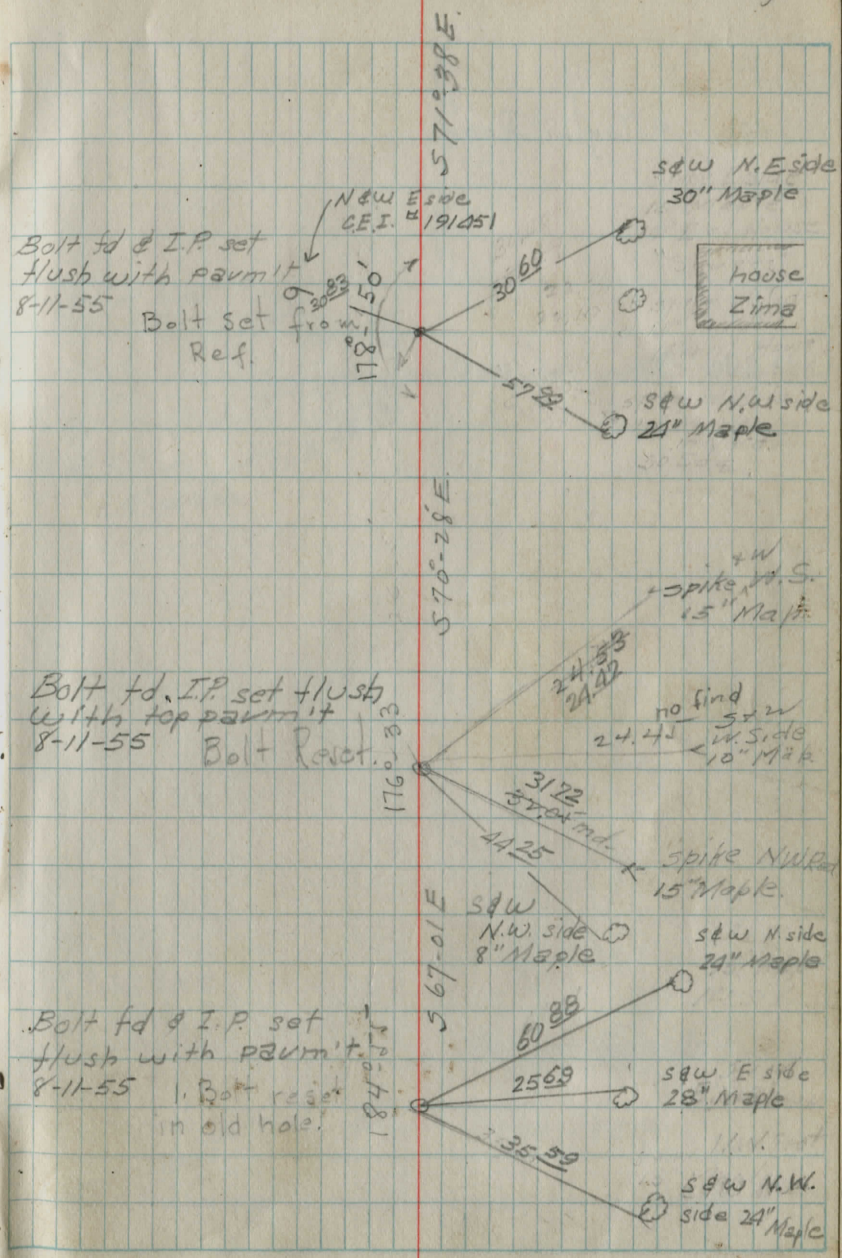
58+94.[illegible] = P.I

56+34.9 P.I.

46+05.65 = P.I.

Pc = 55+72.1
PT = 56+97.6
Δ = 3°-27'
D = 2°-45'
T = 62.8
E = 0.90
L = 125

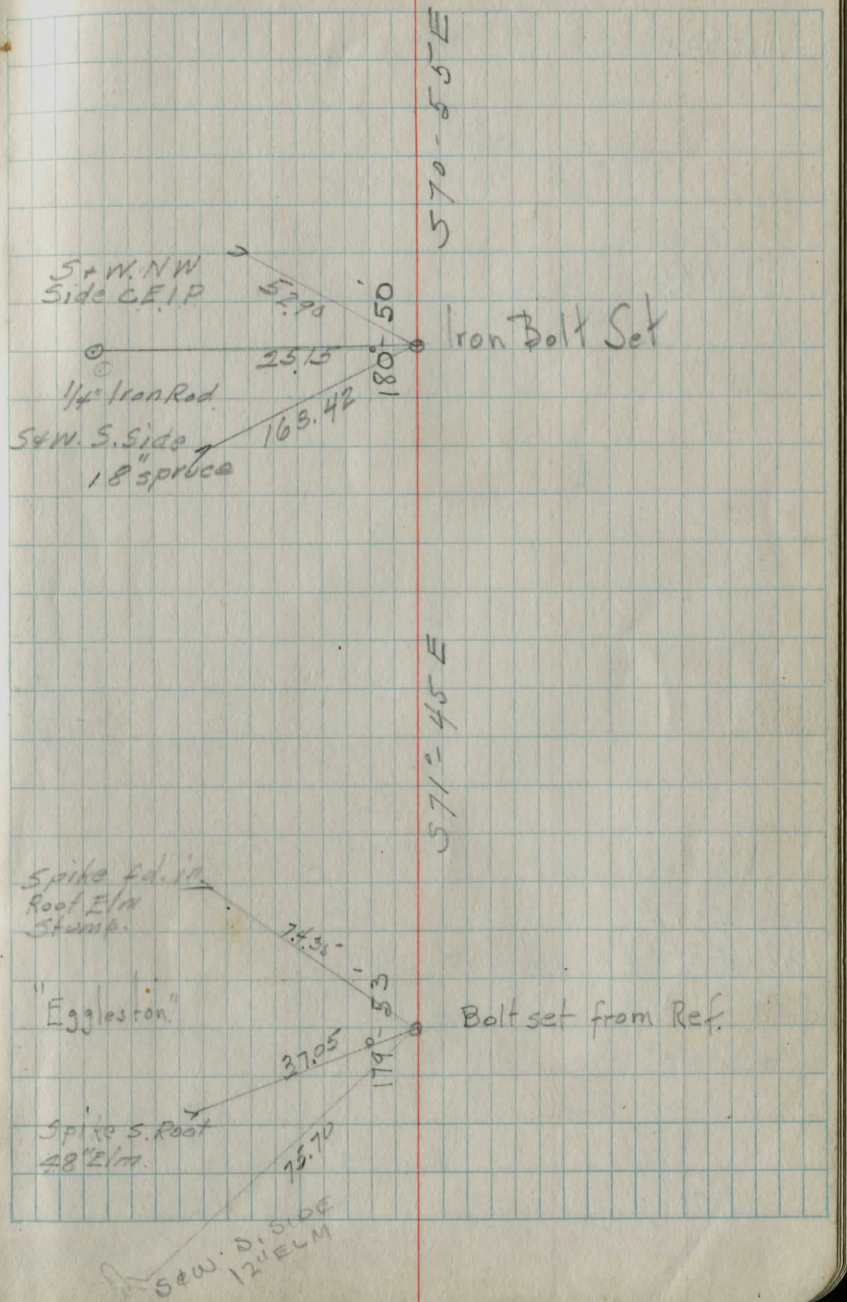
Δ = 4°-55'
D = 5°-30'
T = 44.73 E = 0.95
L = 89.4
Pc = 45+60.9
PT = 46+50.3



97+0. ℄ Taylor. Road.

89+29.2 ℄

77+84.0



141+83 ℄

75.2

141+08.0

+61.4
107+~~68.9~~ ± Def 0°-35' Lt.

See Book 8 Pg 47 for intersection

0.12 — ⊙ 1 Pipe ℄ S. Hambden Ext.

0.03 — ⊙ 1 Pipe = 141+30.50

10.5 = 11'

CH. #3

141+08.0 ⊙ ℄ Claridon Ctr. Rd. North.

1. Pipe used.

1 Pipe at 15th POT So.

91°-56'

S 71°-02' E.

~~SPK~~ ~~5'00~~. 5' Root 20" Maple ℄

62.10 — S 22°-41' W

~~SPK~~ ~~5'W~~. 5'W. Root 40" Maple

41.65'

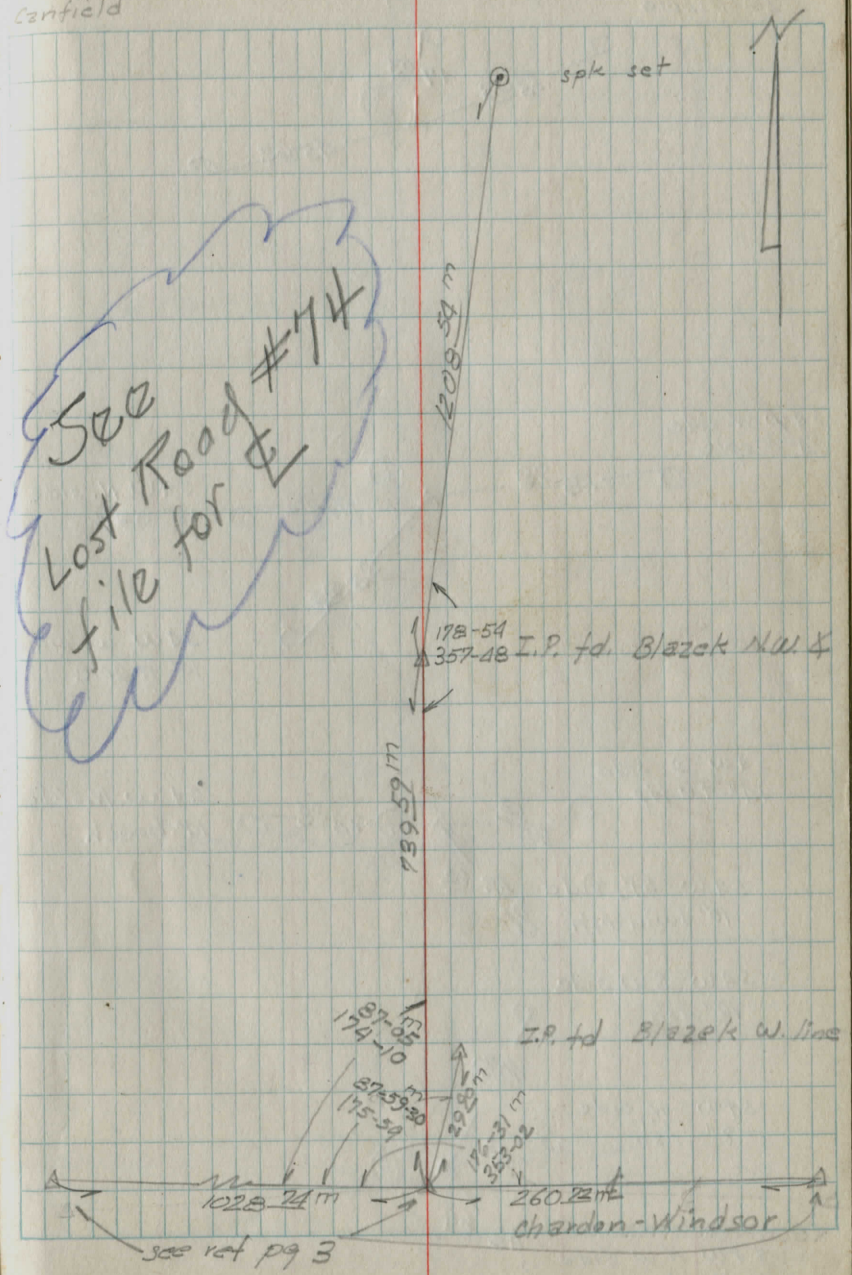
84.75

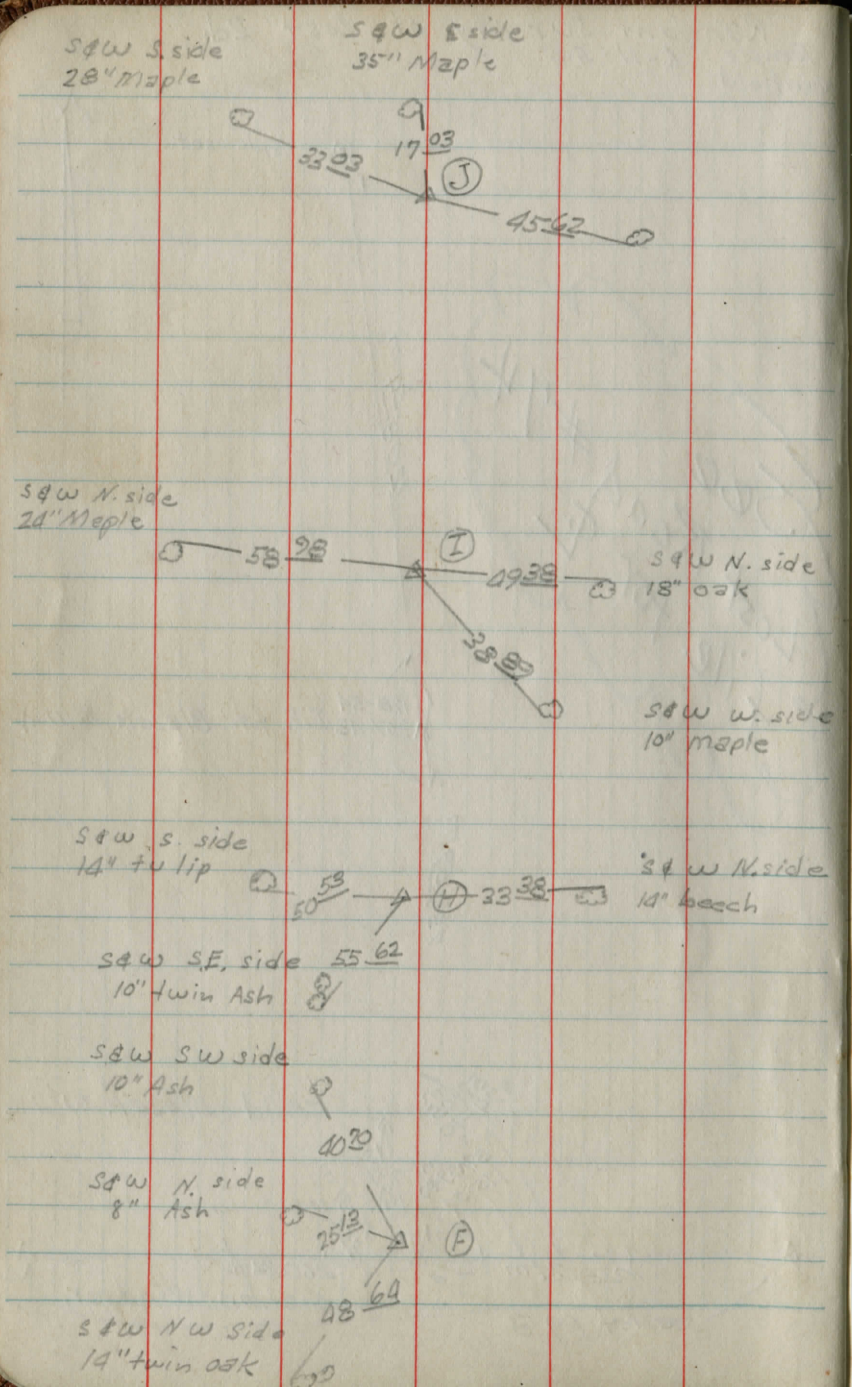
~~SPK~~ 5'W Side 20" Maple

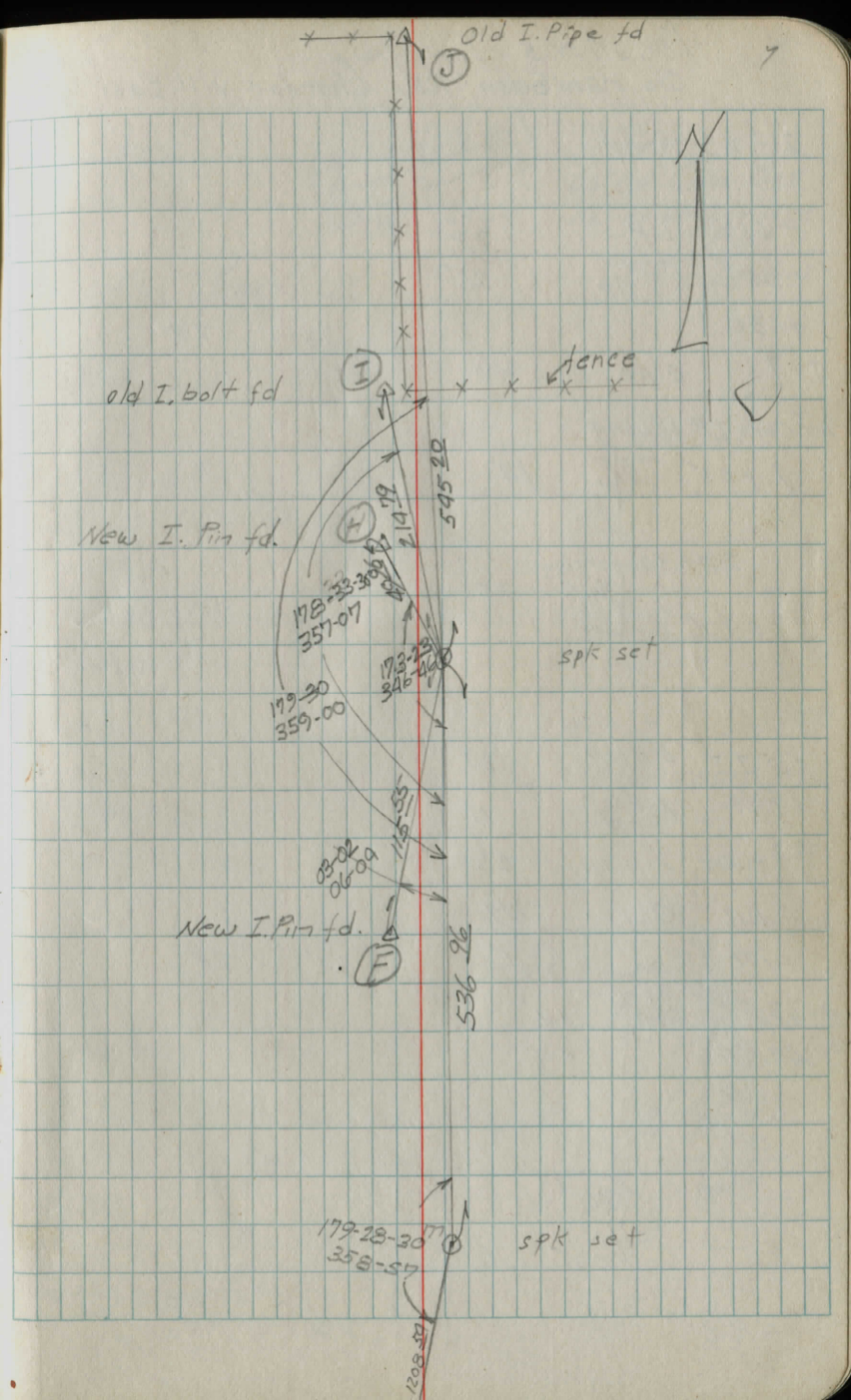
Bolt set in Front of House fd 5-6-62 7" Down ⊥ 2.5' N of Traveled ℄

Random Survey of Lost Rd.
Temple 8-11-55
Canfield

6




S&W S. side
28" Maple
S&W E side
35" Maple
17 03
33 03
J
45 62
S&W N. side
24" Maple
58 28
I
09 39
S&W N. side
18" oak
28 59
S&W W. side
10" maple
S&W S. side
14" tulip
50 53
H
33 38
S&W N. side
14" beech
S&W S.E. side
10" twin Ash
55 62
S&W S.W. side
10" Ash
40 20
S&W N. side
8" Ash
25 13
G
08 64
S&W N.W. side
14" twin oak


7
Old I. Pipe fd
J
I
fence
old I. bolt fd
New I. Pin fd.
H
545.20
178-33-30
357-07
spk set
179-30
359-00
08-02
06-09
New I. Pin fd.
G
536.26
179-28-30
358-57
spk set

Locations - Topographic 12-15-39
So. Hamboden Rd. Chardon vill. East'ly.

2+23 8" Ap 28

+58 L.P. 22

+35 8" Ap. 26'

+30 23 T.P.

+17 5" Ap. 26

24" Corr. I.P 18' Long

0+05 D.F. 13'

0+90 Ho. 75

0+66

+57 3" Map 27'

+52 Refl. post 11

+40 3" Map. 28

0+16 Cel. 27

0+11 29' 21' T.P.

0+23 14'

Fair Cond. Culv. 3'x3' Conc Box

40'

19'

32' G.P.

0-20

16' 0-20

13' T.P.

— 88 —

T 30°

6

26' 16'

16' 6+64

Fair
6.5'x4' Conc. Box
F.L. to be Lowered

PL
6+50

24" Corr. 18' Long

6+44 18" Map 25'

16'

5+99 ℄ Dr No

+77 L.P. 23'

5+23 30' Elm PL 33

5+17 20' T.P.

+36 L.P. 22'

4+27

PL 4+12

4+04 ℄ D. S

14'

12

110

4+16

Barb. Hedge

+93

H.

3+67

10" VSP Corr.

Dr

Hedge

℄ PL

3+20

14'

20'

T.P.

+42 ℄ Dr. So

+36 Hedge

+29 ℄ Dr. So

+20

3+17

03+0

2+97 L.P. 22'

9+98
9+26 19' TP
9+56
H.O. 90' Stone Ret Wall
9+22
9+40 31
9+21 36" Map. 24
No pipe
9+04 & Dr No
8+94 30'
+71 24" Map. 24
+58 L.P. 24
+48 30" Map. 25
8+20 36" Map 25
18" Corr 12' Long
+91 12" Map. 26
+74 15'
+61 10" Map. 25
7+17 18' TP
7+17 L.P. 23
6+74 29 10" Willow
6+74 18" Map. 24 31
6+50

12+09
+68
+68 25 48" C/M
11+33 79'
32'
+19 18 TP
15x18
11+03 L.P. 26 SH
38'
10+86
+90 18" Map. 23
+70 30" Map. 24 36' 10+71 Well
+57 E.S. Barn
+50 18" Map. 23'
10+12 30" Map. 23'
No pipe
& Dr No 9+98
+92 L.P. 24'
9+63 36" Map. 33
10+57
3 stone steps 80'
9+40 16' B.
9+56

+73 L.P. 28

16+16 19 T.P.

+43 25 15" Map

+32 L.P. 28

+23 30' → 26 15" Map

15+06 26' 15" Map

+90 26 15" Map

+76 27 15" Map

+61 27 18" Map

+51 19' TP

+43 28 15" Map

14+29 28' 15" Map

+95 28 18" Map

+45 28' →

+89 L.P. 26 PL

13+78 32'

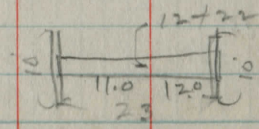
32

13+07 31 12" Elm

+85 18 TP

12+49 L.P. 27

2x2 Concbox
Colv
Good Cond.



Drainage Area Map

Drainage Area Map (3 1/2" = 1 mile)

+54 21+14 +97 L.P. 27

+91 30'

20+31

+94 28'

+57 L.P. 27

19+48 No pipe

+54 4 Dr No.

18+14 L.P. 27'

17+98

17+92

+81

17+16

175' → B- 22+50 21+90

20+70 17 60' 20+40

30' 2" Map

18' TP

End Fence

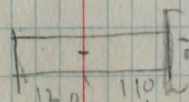
23' 15" Map

24' 14" Map

18 TP

27'

Poor.
Stone box Conc Hw So.



2.5 x 1.5
Flow North

18' TP

26 12" Map

+51 27' 28 20" Map

+18 LP 27'

+18 19 TP

25+06 24 15" Map

+57 28' 12" Map

24+20 Fence So 24'

+79 LP 28'

+16 18 TP

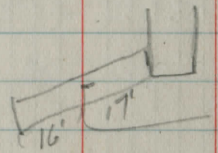
23+05 27 5" AP

+94 26" 12" Cotton W.

15'

22+94 ± Dr. N (Plank)

9'



22+80

10" C.I.P. Col. Good Cond exc post holes FL W. Too small.

+43

22+39 LP 27

22+19 = ℄ Dr. So

29' 6" Ch.

8" VSP 22' long Drive

22+10 30' 2" Map

12-16-38 11

1.P.

32+0 at 90° ℄ PL 30' 32+05 PL ext.

32+0 15" Cherry Stump 23

+80 LP 26

+66 31 15" Map

31+23 21 TP

+63 LP 27

+31 28 15" Map

30+26 3" Map 27

25

+86 28 20" Ash

+22 = 27' to Fence 20 TP

+19 LP 27

29+15 18" Map 24

28+53 27 30" Elm

+80 LP 29

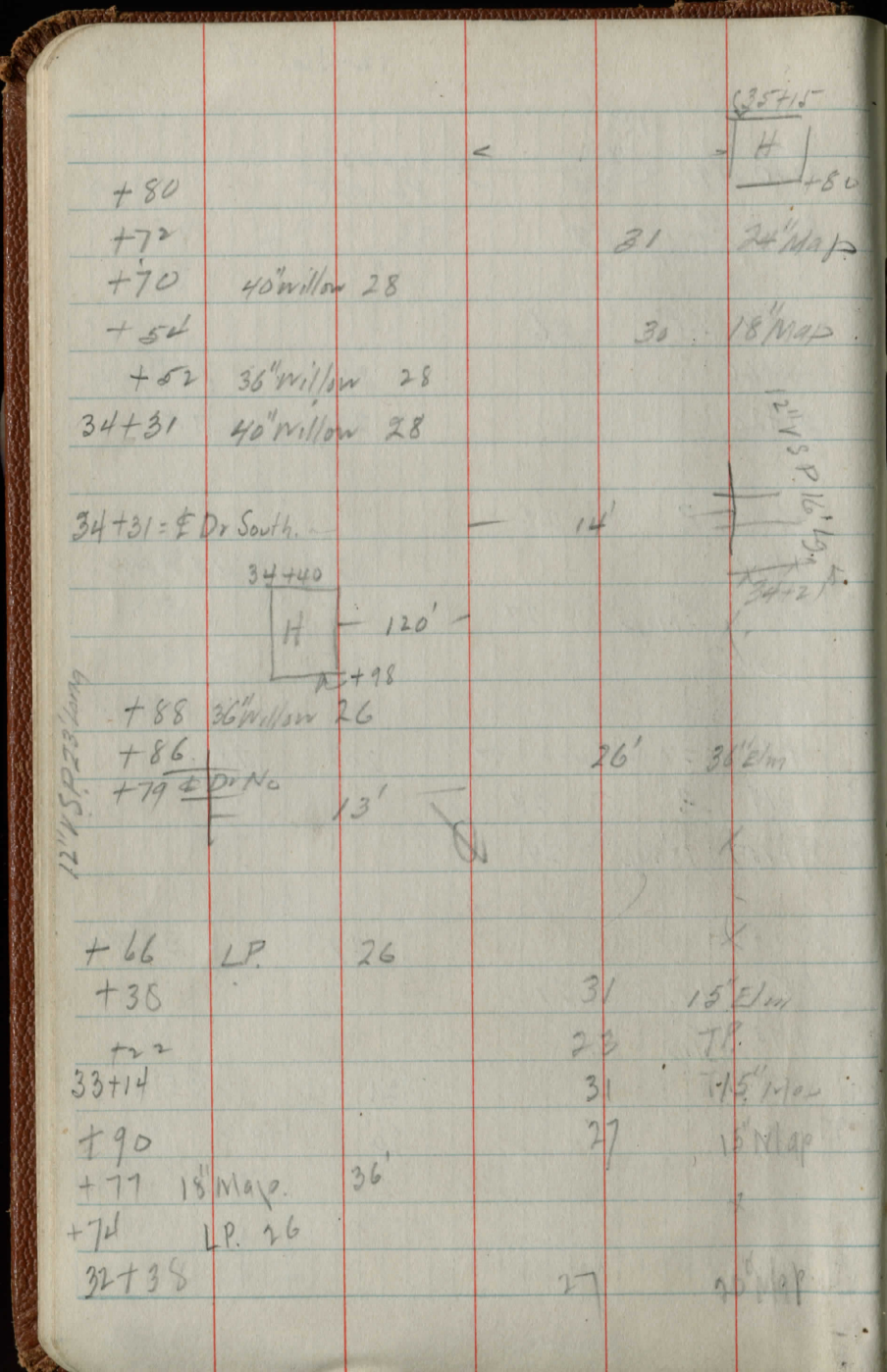
+74 18" Map 26

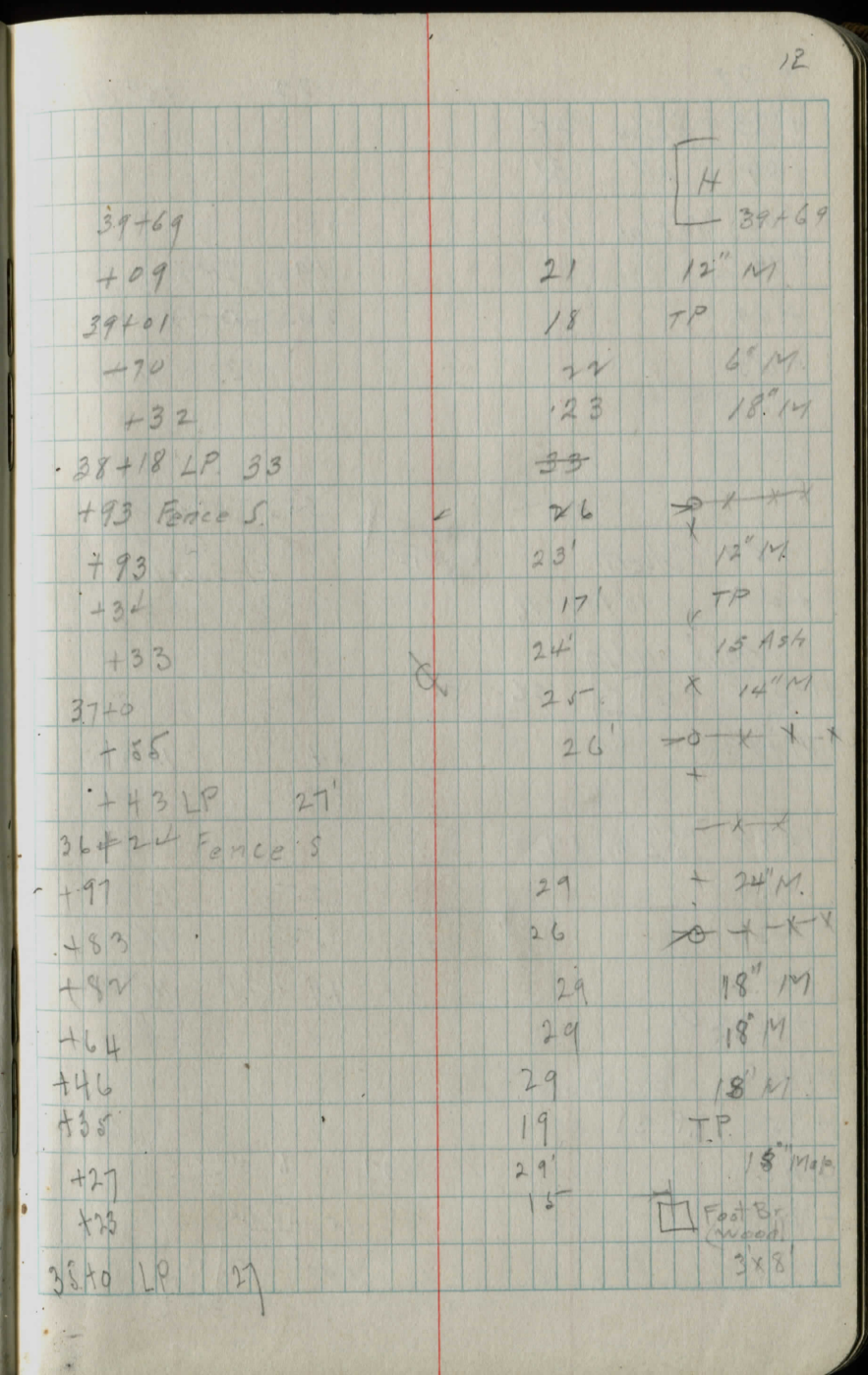
+58 21 8" Elm.

27+19 20' TP ℄ PL

18 24+92

26+60 LP 27


35+15
H
+80
+80
+72
+70 40"willow 28
+54
+52 36"willow 28
34+31 40"willow 28
34+31 = ℄ Dr South.
34+40
H
120'
+98
+88 36"willow 26
+86
+79 ℄ Dr No.
12"V.S.P.
+66 LP. 26
+38
+22
33+14
+90
+77 18"Map. 36'
+74 LP. 26
32+38
31 24"Map
30 18"Map
14'
12"V.S.P. 16'
34+21
26' 36"Elm
13'
31 15"Elm
28 T.P.
31 15"Map
27 15"Map
27 25"Map


H
39+69
39+09
39+01
+70
+32
38+18 LP. 33
+93 Fence S.
+93
+32
+33
37+0
+55
+43 LP. 27'
36+24 Fence S
+97
+83
+82
+64
+46
+35
+27
+23
35+0 LP. 27
21 12" M.
18 T.P.
22 6" M.
23 18" M.
26
23' 12" M.
17' T.P.
24' 15 Ash
25' 14" M.
26'
29 24" M.
26
29 18" M.
29 18" M.
29 18" M.
19 T.P.
29' 15" Map
15'
Foot Br. (wood)
3'x8'

+97 22 12" M

+73 8" Elm 24

+69 LP 31

+63 10" Elm 19

+74 19 TP

+69 20

+68 23 10" M

+57 Culvert. 3'x 1.5 Stone Box
Fair Cond
Fl. South

+49 10" M 16

Wood Plank Bridge

41+38 10 26

41+13 24 14" M

+94 Twin 20" Elm 19

+60 25 15" M

+34 25 10" M

+30 19 TP No Pipe

+23 ℄ Dr

40+08 = E.L. House.

+95 E.P. 31

+96 27 6" Catalpa 40+08

+79 15 Walk Stone

100

39+69

+16 18 12" M

44+0 18 10" M

+84 18' 10" M

+93 20" M 30

+86 T.P. 26

+74 20" M 32

12" Corr. 18' long

+68

Dr. So 11'

12" VSCP 20' Long

Dr. No +57

18'

+51 24" M. 34

+39 LP 30

+52 250'

+82 19 10" M

+79 27 20" M

+69 28 18" M

43+0 140

+85 28 18" M

+79 43+0

+57 24" M

+53 21 TP

+42 21 12" M

+30 30 10" M

+23 21 15" M

30 16" M

21 15" M

44+36

B

43+36

43+0

44+0

+26			25	12" M
47+17			19	8" St
+93			25	12" M
+85	LT & TP	28		
+61			25	15" M
+53			19	8" St
+20			18	6" St
46+12			24	15" M
+79			22	10" M
+71			16	8" St
+54			18	8" St.
+25			22	10" M
+38			16	8" St
+21			15	8" St
+11			23	12" M
45+11	(LP. Tel. also)	28		
+96			16	St
+95			24	10" M
+79			16	St
+65			16	St. Stump
+64			24	10" M
+46			17	10" Stump
+33			17	10" Stump
+31			25	12" M
44+23	8" Locust	32		

51+0			19	5" M
+92			25	15" M
+71			25	15" M
+69			19	6" M
+61			25	12" M
+44			24	18" M
+33	P.L.	29		
+29			25	12" M
+13			25	18" M
50+04			19	4" M
+82			24	10" M
+65			24	12" M
+41			19	10" St
+17			25	15" M
49+08			19	10" St
+85			25	12" M
+77			19	6" St
+59	L.P. & Tel.	29		
+53			25	24" M
+45			19	6" St
48+21			24	18" M
+89			24	15" M
+80			19	6" St
+58			25	15" M
47+50			19	8" St

	X			
+92	X		24	20"M
+84	X		18	10"St
+76	X X ○ 22'			
+62			24	15"M
				3'x 12' Stone Box Conc Slab Top. Good Cond. Fl. So. →
52+08	13' 12			
+53			18	8"St
+37			24	12"M
+29			18	6"M
+21			25	15"M
+11	Pole	28		
52+05			24	15"M
+96			18	5"M
+89			24	18"M
+73			24	15"M
+64			18	10"M
+57			24	10"M
+41			24	15"M
+32			19	10"M
+25			25	12"M
51+08		25		15"M

B +72	200' →		17	8"M
+40				
+33	H. H ← 75 → +43 +23		24	10"M
+16			23	15"M
+08			18	6"M
55+0 X ○	23'			
5570			24	12"M
+85			24	12"M
+77			18	3"M
+71			25	12"M
+53	X		25	15"M
+44	X		18	3"M
+36			24	18"M
+20	X		24	12"M
+12			18	3"M
54+05	X		24	12"M
+90	Pole	28		
+89			24	15"M
+79	X		18	6"M
+72			24	12"M
+57	X		24	15"M
+47	X		18	6"M
+41	X		24	6"M
+25			24	15"M
+16	X		18	10"M
53+08			24	6"M

+50 12"M 25
+42 L.P. 27
57+10 T.Pole 17
+71 25
56+67 24
T.P. + L.P. Separate from here East.
+47 PL 24
+42 24 15"M
PL 24
8"V.S.P. 14' Long
15'
℄ +30 Rd. North
+34 19 3"M
+28 25 8"M
+12 24 15"M
56+03 19 4"M
+96 24 8"M
+80 24 12"M
+65 24 12"M
+68 Pole 29
12" Corr. I.P. 16' Long
15'
℄ +54 Dr. No.
55+49 23 12"M

24" Stump
61+08 ℄ 23
+70 T.P. 29
59+46 26
no pipe
℄ Dr. 59+49
to NE skew
+44 15"M 24
+25 20"M 25
59+15 23 20"M
58+92 22 20"M
26'
+86 TP 21'
60'
59+02
M
58+64
+75 24"M 25
+62 Anchor Pole 26'
no pipe
one Septic tank
+58 ℄ Dr. So.
+44 6" Loc 21
+41 23 18"M
+21 23 15"M
+16 15"M 24'
58+0 24' 15"M
+81 22 15"M
30' 12" AP
+15 15"M 25
58+15
170'
75'
Stone
20'
40'
B
+72
57+72
59 +73 10"M 24'

+55 TP 29

+63 23' 20" Elm

66+40 24' 20" Elm

66+0 20 15 St

~~66+0~~

65+70 20 24" St

65+06 22' 8" Ash

+98 26 5 Ash

+84 TP 28

+81 23 10" Ash

+77 23 8" Ash 12" V SP 12' long.

< 14'

+66 ℄ Drs

+58 21 1" SP

+44 23' 15" 15" St

64+29 23 15" St

< 28' to Fence

< 60

H.

64+13

63+14 TP 28

+64 27 6" Cher

62+17 24 18" Mi

+86 24 18" Mad

+58 24 12" Apple

61+48 TP 28

Stone..

+57 Wat Tr 16

70+59 Fence Sw. — 26 —

70+33 < 21' 5" M

+30 ~~18" St~~ 36'

70+15 24" St 30'

70+12 70'

+17 8" St 30 11' 16'

+15 24" St 30'

2.5 x 2.0 Stone Bt Good. FL. Sw.

70+09 23 10" Hick

+8 70+0 24" St 30'

25 18" Butt'n't

+71 TP 28

+67 15" St 30

< 28 69+29

+21 15" St 14

69+04 12" St 21

TD

< 28' Fence

68+12 TP 28

℄ +79 Drs

8" Conif. 16' Lg.

< 15'

67+58

H

< 130'

67+37

+67 end shrub

67+43 shrub

67+0

20'

73+0 5"ch 25'
+94 T.P. 24

72+89
← 80' → B.
72 24
Stone+Wood
8"X6"
21" Long

℄ Dr. So 72+14

15'

12"VSP 32' Lg.
13'
72+03 ℄ Dr No
+89 15"M 24
+85
H 80
+60

+60 28"M 24
+38 12"M 24
+33 T.P. 20
+11 15"M. 25'
71+10 29 45 Ap
70+81 18"M 24

+91 25 6" Asb
+65 28 Tw 8" Ash.
+48 28' Brush.
T.P. 24 79+38
79+0
78+0
T.P. 24 +73
46" Elm. 30' +57
+47 30' Grapes
8" St 29 +28
10" Elm. 26 77+13
P.L. Lime Trees.
+94
16"M 26 +94
10" St 28 +30
12" St 26 +28
T.P. 23 76+14

2-12" St 26 +76
10" St 29 75+17

T.P. 25' +53
74+0
+85 30 28" M
+37 30 30" M
73+0

PL
X X XO 28' 83+50 PL
Not Taken

LT TP 25 +88
TP 24 +52

10" Corr. 18 Lg.
15'
+33 ℄ Dr.
+29 60' SH

82+20 20 7-24" Pines

20" Elm 28 +95
+85
70'
+50

+4 18" 3-1½" Pine
81+11 28 Trip 6" Ash
End of Brush

+65
H. TP 25 +93
80+44 +45 29 Tw 8" Ash

24" M 36 +28
10" CIP 16' Long
14'
℄ Dr. N. 80+13
80+44
250
B
80+5

SH 140'
79+74

1" Spr. 21 +38
℄ Jun.
1" Spruce 24' +28
℄ Anderson Junction 22 +22
1" Spruce 20 +45
X
X X 26' +17

LT TP 27 88+03
+85
85'
87+52

18" Corr 18' Lg. 16' 4" x 12' Plank Xing.
14' +42
Dr +38 87+35

87+0 23 6" Ash

6" Ap. 29 +85
5" Ap. 29 +45
LT TP 27 +30
5" Ap 29 86+13

6" Ap. 85+77

6" Ap. 29 +91
LT TP 25 +65
5" Ap 29 +54
8" Ap 29 84+24
6" Ap 29 +93
6" Ap 29 83+63

+31 35 Lt P

97+31 25 Guy

16' 18" VSP

97+07 Taylor Rd

Lt + TP 25' +74 12" VSP

14' + 21' Long

96+09 ± Dr.

96+01 23' 14" Spruce post

50' +81'

+56 25' 8" Weep Mtl H

95+54

TP + Lt 25 95+01

94+0

Lt + TP 25' 93+26

97+0

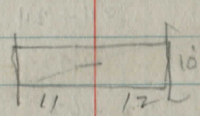
Pl 26' +76

Lt + TP 28 91+50

90+0

Lt + TP 28 89+75

88+40 Culv.



6" 2 Stone Conc Slab top

Ft 50 Good Exc Poor H.W.

6" Farm Tile 13'

105+85 17'

105+45 = ℄ Dr.

10" VSP 44' Lg

℄ Dr.

B

105+03

Lt + TP 28 104+19

104+13 29

36" M

+93

60'

H 104+59

Pl 27 +47

Lt TP 27 103+43

102+83 28' 18" M

Lt + TP 26 101+70

100+0

Lt + TP 26 99+95

+86

75'

H 98+66

12" Corr. P 18' Long 16'

℄ Dr.

+52

Lt + TP +66 26 98+25

200'

98+13

L+T P. 26 114+55

25' 113+30

L+T P. 27 113+0

23 +53

L.P. + T. 27 111+48

111+0

100' Stumpy Brush 25'

110+0

T+L P. 26 +96

22 +76

E. End Dr. Tile

15' 109+25

T+LP 28 +42

30" M 29 108+19

Y to pipe

& Dr +99

+75

H

+39

70'

30" M 31 107+31

107+0

18" M 29 +80

& Dr. 106+06

L+T P 28 +70

106+0

+88 26 4" M

+74 26 4" M

+42 27 4" M

+30 26 4" M

Conc. W.S.

15" Conc. I.P.

15" Conc.

18'

+18 & Dr So

122+09 26 10" M

+70 28 8" Cherry

L.P. 27 +55

+53 27 8" M

+68

H 440

+37 27 15" M

418 27 15" M

121+0

120+48

L+P+T 26 +80

119+65 DE

119+0

L+T P 26 118+03

117+0

L+T P. 27 116+31

116+0

115+0

121+26 26 12"Appl
← 28' to edge
Clear
Curve Ahead 1°

+30

LT+TP 26 130+29

1304 0

179+0

18" Corr. 18' Lg
← 16'
Ø Cr. +84

+84

LT+TP 26 128+54

128+0

127+0

LT+TP 26 126+79

LT+TP 26 125+06

+25

+25 26 14"M

124+04 26 10"M

+70 26 10"M

+54 26 8"M

+38 15"M

LP 26 +29

+16 26 10"M

123+03 26 4"M

+85

+65

LT+TP 23 +78

+72 34 36" elm

140+37 Ret wall 16' → 12 11 3'x1' Conc Box Fl. N Needs Cleaning Poor H.W.S.

Ø D. No pipes +28

T+TP 26 139+02

← 24'

138+0

LT+TP 26 137+24

136+0

LT+TP 26 135+50

134+0

LT+TP 26 133+79

133+0

TP+LT? 26 132+03

C.C.V. Ledge

X-Sections SO. HAMBDEN ROAD

H.I.

BM #1	2.96	1143.54			1140.58
0-200			4.3		
0-100			4.7		
0-20			4.6		
Culv.					
0+0			4.8		
1+0			5.9		
2+0			6.9		
	2.01	1138.35	7.20	1136.34	
3+0			2.4		
4+0			4.4		
5+0			6.4		
BM #2	7.04	1138.35	7.04	1131.31	1131.29
6+0			7.2		
Culv. +64	Note: Slab bottom = Elev 1125.1 See Pease Ditch Notes		6.7	1131.7	
	10.21	1142.52	6.04	1132.31	
7+0			10.9		
8+0			10.2		
9+0			7.5		

12-20-38 Graber Richards R. Haveter T 20° Windy. 40

Left .Right

1st Maple Tree W. of Corp. Line N. Side So. Hamboden Rd.

1139.2

4.3

4.7 1138.8

4.6 1139.0

End Pave

1145.8 7.7 FL West

1145.8 7.7 FL. East.

3.7/150 4.4/100 4.8/50 4.5/20 1138.7. 4.8 5.4/10 6.8/14 8.1/15 4.0/22 6.3/26

5.8/20 7.3/16 9.2/13 8.2/11 6.1/8 1137.6 5.9 6.4/13 8.8/15 5.8/19 5.1/21 5.7/25

8.2/25 7.2/21 7.6/19 10.8/14 7.6/10 1136.6 6.9 7.5/15 7.4/16 7.0/19 6.0/22 6.9/25

1.5/21 1.8/22 6.7/15 3.1/11 1136.0 2.4 2.9/12 5.2/14 2.3/18 1.1/20 2.1/23

Reverse 3.0/32 3.5/18 4.7/9 1134.0 4.4 6.1/12 8.0/17 3.1/23 2.6/28

1132.0

8.0/50 7.1/23 9.1/16 7.3/13 6.4 7.0/11 8.3/14 7.1/19 7.4/20

BM. 5+15 30" elm 30' Rt 3pt SE Post

9.0/25 9.1/21 10.5/16 7.7/11 1131.2 7.4 7.8/10 9.4/14 9.0/17 9.5/20

10.9 FL 1127.4 6.7 10.9 FL 1127.4

Bot Slab = El. 1125.1

X on N. Wall

12.7/20 12.9/16 11.4/11 1131.6 10.4 11.4/10 13.2/13 12.9/21

11.9/15 10.4/20 11.8/11 10.5/10 1132.3 10.2 11.0/12 12.6/15 11.9/20

7.1/20 8.4/12 8.0/12 1135.1 7.4 8.2/11 8.4/14 3.7/24

		1142.52			
10+0			5.0		
11+0			6.2		
12+0			7.1		
			7.2		
Culv+22			7.2	1135.3	
	9.15	1144.46	7.21	1135.31	
13+0			9.4		
14+0			7.5		
15+0			5.2		
16+0			4.2		
17+0			4.9		
BM#3	2.90	1144.46	2.90	1141.56	(1141.52 Pease Ditch)
17+92 Culvert.			4.3	1140.2	
18+0					
	11.30	1151.16	4.60	1139.86	
19+0			10.3		
20			8.9		

1137.5

3.1 / 2.5 — 5.8 / 14 — 6.0 — 5.6 / 11 — 8.2 / 30

1136.3

2.3 / 21 — 7.3 / 15 — 6.9 / 11 — 6.2 — 6.7 / 13 — 6.7 / 16 — 4.5 / 28

1135.4

9.9 / 24 — 9.5 / 15 — 7.9 / 12 — 7.1 — 7.8 / 11 — 10.0 / 14 — 9.3 / 20

1135.8

12.4 / 20 — 10.9 FL — 7.2 — 10.8 FL — Small drain. Area Sq Good Fall to 1401 ft.

1135.1

11.2 / 23 — 11.3 / 17 — 10.2 / 13 — 9.4 — 10.0 / 11 — 11.2 / 15 — 11.3 / 22

1137.0

8.3 / 22 — 9.2 / 16 — 8.1 / 13 — 7.5 — 8.0 / 16 — 9.8 / 14 — 7.5 / 20

1139.3

5.4 / 24 — 6.7 / 17 — 5.8 / 12 — 5.2 — 5.7 / 11 — 6.6 / 13 — 3.6 / 24

1140.1

5.0 / 26 — 6.2 / 18 — 5.1 / 14 — 4.4 — 4.9 / 12 — 5.9 / 16 — 2.9 / 24

1139.6

5.1 / 25 — 6.4 / 17 — 5.4 / 12 — 4.9 — 5.3 / 11 — 6.4 / 15 — 4.1 / 23

Spk. N 28° W Maple 23' rt Sta 17+0

7.5 FL — 1140.2 — 4.3 — 7.6 FL

5.0 / 27 — 6.0 / 21 — 7.5 / 16 — 4.5 / 10 — 1140.3 — 4.2 — 4.7 / 10 — 7.6 / 14 — 5.4 / 20

1140.9

10.6 / 21 — 12.4 / 15 — 11.8 / 12 — 10.3 — 10.9 / 11 — 11.9 / 14 — 11.8 / 23

1142.3

8.9 / 23 — 10.2 / 14 — 9.2 / 11 — 8.9 — 9.4 / 11 — 10.0 / 14 — 10.0 / 22

		H.I.			
		1151.16			
21+70			6.1		
22	1.04	1161.77	1.43	1149.73	
22+80 Culvert.			9.1		
23			8.2		
24			5.9		
25			3.6		
BM#4	1.88	1161.77	1.88	1159.89	1159.84
26			0.9		
	12.72	1174.07	0.42	1161.35	
27			9.6		
28			4.4		
29			0.6		
	10.77	1183.42	1.42	1172.65	
30			6.1		
31			2.0		
	12.86	1195.82	0.46	1182.96	

1145.1

4.9/27 7.6/14 5.7/11 6.1 6.8/11 7.6/14 5.0/26

1148.8

+2.0/25 0.0/19 3.7/14 2.9/11 2.4 2.7/11 3.6/16 0.6/26

11.9 FL. 1152.6 9.1 Cross Drainage Only 11.1 FL.

1153.6

5.8/26 7.3/21 10.7/15 8.9/11 8.2 8.4/12 9.8/15 7.3/21 8.6/25

1155.7

5.7/23 7.4/15 6.7/12 5.9 6.4/12 7.0/15 6.0/23

1158.2

3.2/23 4.6/14 3.8/11 3.6 4.0/11 4.6/14 3.9/23

BM#4 Spike N.W. Root 20 Map 28 Rt 35+50 (Reset)

1160.9

0.0/20 1.3/18 1.8/12 1.7/12 5.9 1.4/12 2.3/15 1.0/23

1164.7

0.0/29 10.6/14 9.7/11 9.2 9.8/12 10.4/14 8.8/23

+40/29 1½:1 5.5/13 4.8/10 4.4 4.9/12 6.5/15 3.0/22

1169.7

+50/29 1½:1 2.9/13 1.0/10 0.6 1.1/11 1.9/14 0.7/23

Spike 26" Elm N 5½ E

1173.5

5.0/26 5.8/17 8.9/14 6.4/11 6.1 6.8/12 8.7/14 6.7/20

1177.3

+1.0/20 0.0/18 4.6/13 2.4/10 4.0 2.6/12 3.8/14 0.0/21

1181.4

		1195.82		
32			8.7	
	13.2r	1208.60	0.44	1195.38
33			14.2	
34			7.0	
BM #5	10.75	1218.31	1.04	1207.56
35			11.4	
36			6.4	
	12.90	1230.82r	0.39	1217.92
37			13.1	1217.1
38			6.7	
	10.95	1241.48	0.29	1230.53
39			10.6	
40			5.0	
BM#6	4.6r	1241.48	4.6r	1236.86
41			4.7	
+57 Culv.			4.2r	1237.3
42			3.2r	
43			0.6	
	12.3r	1253.65	0.15	1241.33

1187.1

2.6/21 10.4/14 9.4/9 8.7 9.2/12 10.4/15 5.7/22 4.9/30

1194.4

8.8/27 16.6/14 14.8/9.0 14.2 14.4/13 15.2/15 9.3/26 9.8/30

1201.6

6.8/20 8.4/12 6.8/6 7.0 7.4/12 8.4/15 6.0/20 6.8/30

Spike N. Root 30" Maple 28' Rt Sta. 34+75

11.2/18 12.7/12 11.8/11 1206.9 11.4 11.9/12 12.8/15 10.6/19 9.1/30

1211.9

4.0/21 7.7/15 7.0/11 6.4 7.1/12 7.6/14 2.6/22 1.3/30

1217.7

10.5/24 14.8/15 13.9/13 13.1 13.7/12 14.8/15 9.4/24 3.2/30

1224.1

3.2/23 8.4/15 7.3/12 6.7 7.2/12 7.9/N 3.7/23

1230.9

5.6/26 11.9/14 11.2/12 10.6 11.2/13 12.1/15 7.7/21 7.7/30

1236.5

0.3/46 6.4/15 5.7/11 5.0 5.4/12 6.2/14 3.8/20 3.2/30

Spike NE Root 15" Maple 26' Rt Sta. 40+65

1236.8

7.2/27 6.4/17 5.0/12 4.7 5.3/9 6.8/18 6.4/18

1237.3

88 Fl 4.2r 8.8 Fl S.

4.2r/19 5.2r/15 3.7/10 3.2 1238.3 3.9/11 5.6/14 4.7/17

1240.9

0.0/23 1.9/17 1.1/12 0.6 1.2/11 2.4/13 1.8/17

		1253.65	7.6		
44	13.09	1266.14	0.60	1253.05	
45			12.2		
46			4.6		
	6.30	1270.32	2.12	1264.02	
47			6.3		
48			5.1		
49			4.7		
50			4.5		
51			6.4		
	1.72	1265.38	6.66	1263.66	
52			4.6		
	4.52	1265.38	4.52	1260.86	1260.87
Colv 52+58			5.0	1260.4	
53			5.0	1260.4	
54			4.0		
BM#7	3.72	1265.38	3.72	1261.66	
55			1.7		

1246.1

1.0/28 8.8/16 7.9/14 7.6 8.1/10 9.1/11 6.8/17

1254.0

4.5/31 13.6/17 12.4/14 12.1 12.4/8 12.3/9 8.2/16 7.4/30

1261.5

1.9/21 6.2/14 4.9/11 4.6 5.3/11 6.5/13 5.0/22 4.0/30

1264.0

7.2/17 8.7/13 6.9/10 6.3 6.7/12 8.2/16 5.9/23

1265.2

4.4/21 6.4/15 5.4/11 5.1 5.7/10 7.2/14 5.1/18

1265.6

4.6/22 6.7/13 5.1/11 4.7 5.4/10 6.7/12 5.0/20

1265.8

4.2/24 7.0/16 4.9/11 4.5 5.0/9 6.8/13 4.4/19 5.0/30

1263.9

4.5/22 5.4/15 7.0/11 6.4 6.9/10 8.7/13 4.3/21

1260.8

5.6/8 7.1/14 5.2/10 4.6 5.1/10 7.1/14 4.9/20 3.6/30

BM NE Cor N. HW (approx) X on stone gone

7.7/60 8.6 FL 1269.4 3.0 8.3 FL. 10.8/30

5.7/19 7.3/14 5.4/12 1260.4 3.0 5.7/10 7.6/12 7.0/20 8.9/30

4.9/20 5.4/14 4.4/11 1261.4 4.0 4.5/9 6.5/13 3.7/18 2.5/30

Spike NW. Root 18" Map 24' Rt. ℄ 52+05

0.0/27 3.8/14 2.2/11 1263.7 1.7 2.5/10 4.0/13 0.0/20

		HI		
	1.00	1265.38		
	1300	127813	0.25	1265.13
56			12.0	
57			9.9	
58			6.2	
59			3.0	
60			4.6	
61			7.2	
	2.93	1273.60	7.46	1270.67
			2.65	1270.95 1270.83
62			4.8	
BM#8	2.32	1273.60	2.32	1271.28 1271.28
63			7.6	
64			10.5	
	0.29	1271.57		1271.28 =
	1.86	1262.66	10.97	1260.80
65			1.9	1260.9

1266.1

10.5/30 11.5/21 14.0/17 12.4/11 12.0 12.6/11 14.1/13 12.0/20

1268.2

9.9/22 11.5/16 10.3/12 9.9 10.5/11 11.7/17 10.2/20

1271.9

5.2/22 8.3/15 6.7/11 6.2 6.8/10 7.5/13 4.4/21

1273.1

+0.3/20 4.0/15 5.5/12 3.0 3.7/11 4.6/13 2.3/19

1273.5

3.9/21 6.3/14 5.7/12 4.6 5.4/11 6.2/13 6.1/18

1270.9

6.1/23 9.0/14 7.7/11 7.2 8.0/11 8.8/13 7.5/17 8.5/30

Old B.M. 6.71 approx. Stump rotted.

3.5/22 4.8/16 5.5/12 1268.8 4.8 5.8/12 6.7/18 4.0/20

Spike 5 Root 20" Maple 31' Lt Sta 5+2 62+0.5

1266.0

5.3/24 9.7/15 8.3/12 7.6 8.4/12 9.1/14 6.0/21

1263.1

9.0/27 10.6/20 12.5/15 11.2/12 10.5 11.3/12 12.3/14 9.4/21

BM #8

-1.8/21 2.8/18 4.3/15 2.8/11 1.9 3.0/12 4.2/14 2.2/29

		H I 1262.66		
66+0			4.6	1258.1
67			6.9	1255.8
68			8.8	1253.9
	1.82	1256.60	7.88	1254.78
69			4.8	1251.8
70			6.8	1249.8
Culv. 70+12			7.0	1249.6
TP on St.	11.56	Trough. 1260.78	7.38	1249.22
71			10.0	1250.8
B.M.#9	5.45	1260.98	5.45	1255.53
72			5.9	1254.9
73			2.5	1258.5
	9.13	1268.02	1.89	1258.89
74			6.9	1261.1
75			4.3	1263.7
76			3.1	1264.9
77			1.8	1266.2

2.5/29 6.9/18 5.4/11 4.6 5.4/12 6.5/14 3.1/20

4.1/28 8.8/15 7.5/11 6.9 7.7/11 8.9/13 5.7/22 7.0/30

5.9/28 7.6/20 10.6/15 7.6/11 8.8 9.3/11 10.9/15 8.8/20

2.5/30 3.9/22 6.4/13 5.4/16 4.8 5.6/12 7.0/15 3.7/23

5.8/27 7.9/17 9.8/13 7.5/10 6.8 7.6/12 9.9/15 8.0/21 10.7/30

Feed Rise 12.5 FLN 7.0 FLS 12.8 Good F... 5.0 1/4

8.0/24 8.0/20 11.7/14 10.5/12 10.0 11.0/12 12.7/14 4.8/20 10.0/23

Spike 5 R.S.T. 12" Maple 28 L.T. 5 R.S. 71+30

4.4/21 8.7/15 6.7/10 5.9 6.6/12 8.2/15 6.5/20 7.8/30

0.0/23 4.0/14 2.9/11 2.3 3.1/12 4.1/14 1.8/20

4.1/24 8.8/14 7.5/12 6.9 7.5/12 8.7/14 6.0/23

1.8/27 2.7/21 6.2/12 5.0/12 4.3 3.0/11 6.7/13 3.8/14

1.0/21 4.6/14 3.7/11 3.1 3.8/12 5.5/14 2.9/21

1.0/19 3.7/13 2.3/11 1.8 2.7/12 4.4/15 2.0/20

		H1 1268.02			
11	3.66	1269.93	1.75	1266.27	
	1.95	1269.93	1.95	1267.98	1267.65
78			4.3	1265.6	
79			6.5	1263.4	
80			10.1	1259.8	
	0.48	1256.38	1.03	1257.90	
81			3.3	1255.1	
B.M.#10	4.83	1258.38	4.83	1253.55	
82			7.9	1250.5	
83			12.4	1246.0	
	2.18	1247.34	1.32	1245.16	
84			5.0	1242.4	
85			9.0	1238.3	
86			13.2	1234.1	
	0.26	1234.67	1.93	1234.41	
87			5.4	1229.3	
B.M.#11	4.92	1234.67	4.92	1229.75	
88			7.8	1226.9	

old BM. Approx. on 4.

— 2.7/2.2 6.0/1.3 5.3/1.0 4.3 8.4/1.7 6.3/1.4 3.8/2.1 —

— 5.1/2.2 8.4/1.4 7.2/1.1 6.5 7.4/1.2 8.4/1.4 5.7/1.2 —

— 8.2/2.2 14.1/1.2 10.3/1.1 10.1 10.9/1.2 11.9/1.4 8.7/2.1

0.6/2.3 — 5.4/1.5 — 3.6/1.1 3.3 4.1/1.1 5.9/1.3 1.9/1.2 —

Spike S. Root 18" Elm 75' Lt. 5+43.8 1+90

5.7/2.5 — 9.7/1.5 — 8.4/1.3 7.9 8.6/1.4 9.3/1.2 7.7/1.6

10.1/1.3 — 14.9/1.5 — 13.0/1.3 12.4 12.0+2.7/1.7 13.7/1.3 11.5/2.0 —

3.1/2.2 7.2/1.5 — 5.4/1.1 5.0 3.7/1.2 2.0/1.3 3.3/2.1 —

5.4/2.3 11.1/1.5 — 9.3/1.2 9.0 9.7/1.3 14.7/1.5 — 6.0/2.4 —

9.4/2.3 13.2/1.5 — 11.3/1.2 13.2 14.0/1.3 15.4/1.3 — 9.8/2.5 —

6.0/2.1 7.3/1.4 6.1/1.1 5.4 6.7/1.4 7.5/1.5 5.8/2.7 —

15" Pine 80' Lt. 87+50 Spike S. Side

— 8.4/2.1 11.3/1.5 — 8.5/1.0 7.8 8.6/1.2 10.2/1.4 9.1/2.0 10.7/2.0

		1234.67		
Curve 88+40			8.3	1226.4
	6.95	1235.87	5.75	1228.92
89			9.6	1226.3
90			8.2	1227.7
91			6.1	1229.8
92			2.6	1233.3
	12.40	1247.63	0.64	1235.23
93			10.5	1237.1
94			6.2	1241.4
95			1.8	1245.8
	13.16	1260.45	0.34	1247.29
96			10.4	1250.1
			11.72	1248.73 1248.47
BM #12	7.00	1260.45	7.00	1253.45
97			7.2	1253.3
98			4.2	1256.1
	12.65	1272.10	1.00	1259.45
99	1.01		12.9	1259.2

12.2/100 F1 13.0 8.3 F2 13.5 14.4/102

10.6/20 11.0/14 10.1/11 9.6 10.4/12 13.5/15 10.8/20 12.4/32

8.8/20 9.2/15 9.0/13 8.2 8.9/12 9.6/14 8.7/18

4.9/21 7.3/14 6.5/11 6.1 6.6/12 7.4/15 4.2/22

0.6/23 4.5/14 3.1/12 2.6 3.2/12 4.1/16 10.5/23

8.5/22 12.6/14 11.1/12 10.5 11.0/12 12.2/15 7.8/24

3.6/23 8.2/14 6.7/14 6.2 6.9/13 7.7/15 3.6/24

0.0/21 3.8/13 2.6/11 1.8 2.4/14 3.7/16 0.3/23 0.0/30

9.0/20 12.9/13 11.1/10 10.4 10.9/14 12.2/16 8.8/23

Spike at 1.8 at 5+96 +70 at 96+70

Spike NE Root 12" Spruce 31' Rt 5+96+70

5.1/22 9.4/15 7.7/12 7.2 6.9/20 6.3/30 5.6/100 = Top/Rt

13/23 5.8/15 4.9/11 4.4 4.8/13 6.4/16 2.2/22

10.7/23 14.6/16 13.1/12 12.9 13.6/12 14.8/15 11.3/22

		1272.10			
100			9.8	1262.3	
101			6.1	1266.0	
102			2.6	1269.5	
	1255	1284.15	0.50	1271.60	
103			11.4	1272.8	
104			8.0	1276.2	
105			3.7	1280.5	
	11.96	1296.05	0.06	1284.09	
106			11.5	1284.6	
107			7.8	1288.3	
108			5.2	1290.9	
B IV #13	3.84	1296.05	3.84	1292.21	1291.89
109			6.2	1289.9	
110			10.1	1286.0	
	0.11	1283.42	1274	1283.31	
111			4.1	1279.3	

6.6/24 11.7/16 10.2/13 9.8 10.3/12 12.0/14 8.0/21

2.8/25 8.0/10 6.7/12 6.1 6.7/13 8.0/15 3.8/23

0.0/23 4.7/14 3.2/12 2.6 3.3/14 4.4/16 0.5/24

11.0/20 13.7/14 12.0/12 11.4 12.1/13 13.2/15 1.5/20

7.6/19 10.0/14 8.5/11 8.0 8.5/12 9.8/15 7.5/22

1.5/2 5.3/14 4.7/10 3.7 4.3/14 4.4/16 4.8/17 2.5/24 2.0/30

10.1/23 11.0/15 12.0/9 11.5 12.1/18 13.0/14 10.0/20

6.6/25 8.3/9 7.8 8.4/13 9.0/15 7.7/20 6.7/23

5.0/25 5.4/8 5.2 5.9/11 7.1/14 5.2/19

Spike & Wash 5 Bot 30 Wide 32 Lt 108+20

6.0/25 6.7/11 6.2 6.8/12 7.7/17 5.0/19

9.0/23 10.0/16 11.3/13 10.5/11 10.1 10.7/11 11.6/14 7.7/22

2.2/2 8.8/13 4.6/11 4.1 4.1/11 2.1/13 0.8/19

		1283.42		
112			10.2	1273.2
	1.08	1271.95	12.55	1270.87
113			3.4	1268.6
114			7.9	1264.1
115			13.6	1258.4
	0.80	1260.13	12.62	1259.33
116			7.3	1252.8
117			11.2	1248.9
	0.99	1248.50	12.62	1247.51
118			2.6	1245.9
119			5.2	1243.3
120			7.6	1240.9
121			9.6	1238.9
BM #14	0.24	1240.99	7.75	1240.75
122			3.6	1237.4
123			2.3	1235.7

9.5/9 11.6/12 10.8/9 10.2 10.8/12 11.8/14 8.8/18

— 2.7/19 5.1/13 3.7/10 3.4 4.9/9 5.3/14 1.5/19 —

— 6.6/20 9.6/13 8.5/12 7.9 8.7/13 9.8/15 5.5/22 —

— 10.0/24 12.7/13 14.3/11 13.6 14.4/12 15.4/14 14.4/21 10.6/30

— 5.8/20 9.3/13 8.0/11 7.3 8.1/13 9.4/12 5.0/22 —

— 11.0/21 13.3/13 12.0/11 11.2 12.1/12 13.0/12 10.7/21 —

— 3.0/19 4.3/12 3.3/12 2.6 3.4/11 4.6/13 2.6/19

5.2/17 7.0/12 6.0/12 5.7 6.0/11 7.3/14 5.7/19 6.4/30

8.1/17 8.4/12 8.1/11 7.6 8.3/11 11.0/13 7.8/17 —

— 9.0/21 11.0/12 10.3/12 9.6 10.4/12 11.7/13 8.3/21 —

Spike NW Root 15" Maple 30 Rt @ 121+20

2.8/21 5.1/15 4.4/12 3.6 4.2/19 5.2/12 2.0/23 —

— 5.9/21 7.0/13 5.9/12 5.3 6.1/11 7.9/13 5.2/19

		HI			
		1240.99			
124			7.0	1234.0	
125	4.50		8.8	1232.2	
	11.50	1235.38	10.11	1230.88	
126			5.2	1230.2	
127			6.9	1228.5	
128			9.2	1226.2	
	8.52	1235.31	8.52	1226.86	1226.51
129			11.6	1223.7	
BM #15	1.55	1225.23	11.70	1223.68	
130			4.0	1221.2	
131			7.4	1217.8	
132			11.6	1213.6	
	1.92	1214.09	13.06	1212.17	
133			5.4	1208.7	
134			10.0	1204.1	
	2.50	1204.91	11.68	1202.41	
135			4.7	1200.2	

6.7/2 8.6/15 7.4/12 7.0 7.8/12 8.8/14 6.3/20

6.4/22 10.0/14 9.0/12 8.8 9.4/13 10.4/14 7.6/20

3.8/20 6.5/15 5.7/14 5.2 5.8/11 7.0/13 3.4/19

3.8/23 8.2/16 7.4/14 6.9 7.7/11 8.8/13 5.7/20

7.1/23 11.7/15 9.8/14 9.2 10.9/11 11.5/14 7.6/20

Stump Lone elm. old B.T. Old Bench not found.

10.2/21 13.3/15 14.0/12 11.6 12.3/11 13.8/13 7.5/20

Spike SW Side CE1. Pole 17 up. 26' Left of Sta 130+30

1.8/21 6.7/12 4.5/11 4.0 4.5/11 5.4/14 2.6/20

4.1/25 9.5/12 7.9/12 7.4 8.2/11 10.1/14 6.6/20

7.0/27 13.5/12 12.3/11 11.6 13.8/13 14.0/16 9.0/22

1.8/27 7.0/14 5.9/11 5.4 6.0/13 8.0/14 1.8/21

7.0/23 12.1/14 10.6/12 10.0 10.6/12 13.1/16 7.2/22

7.1/24 7.1/15 5.3/12 4.7 6.1/12 7.0/15 0.0/22

		1204.91			
136			8.8	1196.1	
137			11.4	1193.5	
	1.20	1193.26	12.85	1192.06	
138			1.8	1191.5	
139			3.4	1189.9	
140			4.9	1188.4	87.6
141			6.7	1186.6	45.7
+50			7.6	1185.6	
BM #16			4.52	1188.74	
			5.10	1186.16 (Approx Location.)	1187.78
B.M. #16	2.33	1191.07		1188.74	
140+37	Calc				

5 2

— 6.7/22	10.4/15	9.3/11	8.8	9.3/11	11.1/14	5.3/22 —
— 10.6/20	13.9/14	12.7/11	11.4	12.1/11	13.3/14	10.7/20
— 2.6/16	3.8/14	2.3/12	1.8	2.6/12	3.5/14	2.1/17
— 4.4/17	5.8/13	3.9/9	3.4	4.1/13	4.8/15 —	4.2/14
— 5.7/17	7.3/13	5.6/10	4.9	5.6/12 —	7.0/14	4.7/17 —
			6.7			
			7.6			

Spike in N.E. Root 36" Elm. 30' Rt 140+70.
old Bench not found. New spike Set.

North		South
6.90	3.48	6.5
FL	℄	F.L.

1-5-39 Check Levels.

		HI			
	432	1145.88			1141.56
	12.16	1057.66	0.37	1045.51	
	11.45	1068.49	0.62	1057.04	
	8.65	1168.49	8.65	1059.84	1159.84
TP	11.99	1180.28	0.20	1168.29	
	13.19	1193.17	0.30	1179.98	
	12.92	1205.27	0.82	1192.35	
	11.23	1216.16	0.34	1204.93	
	8.68	1216.16	8.68	1207.52	1207.58
	13.06	1228.34	0.88	1215.28	
	13.18	1240.98	0.54	1227.80	
			4.20	1236.78	1236.86

South Hambden. EC & E.R.

BM #3

BM #4

BM #5

BM #6

1-17-39.

Present Culverts.

	Left	Right	
6+64	16	16	6.5 x 4 Conc + Stone Box
12+22	11	12	2x2 Conc Box.
17+92	12	11	2.5 x 1.5 Stone Box Conc H.W.'s
22+80	16	17	10" C.I.P.
41+57	13	12	3 x 1.5' Stone Box
52+58	13	12	3x1.5' Stone Box
70+12	11	16	2.5'x2 Stone Box
88+40	11	12	6'x2 Stone. Conc. Top
140+37	12	11	3x1 Conc Box.

Rebuild

extend (Knock off H.W.S.) with conc box

Rebuild (conc pipe)

Extend 6'± 10" & New H wall SE 22+90.2 NW 22+78

New 36' Conc Pipe culv. 40'± long

New 24" Conc Pipe Culv

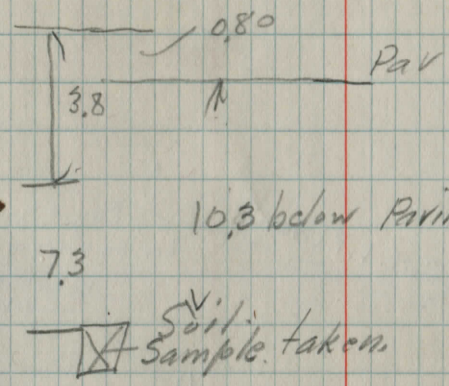
New 36' Conc pipe 40' rubble wall 3'± high

Build new abt 4' wall two 36" conc pipes

Left and rebuild H wall

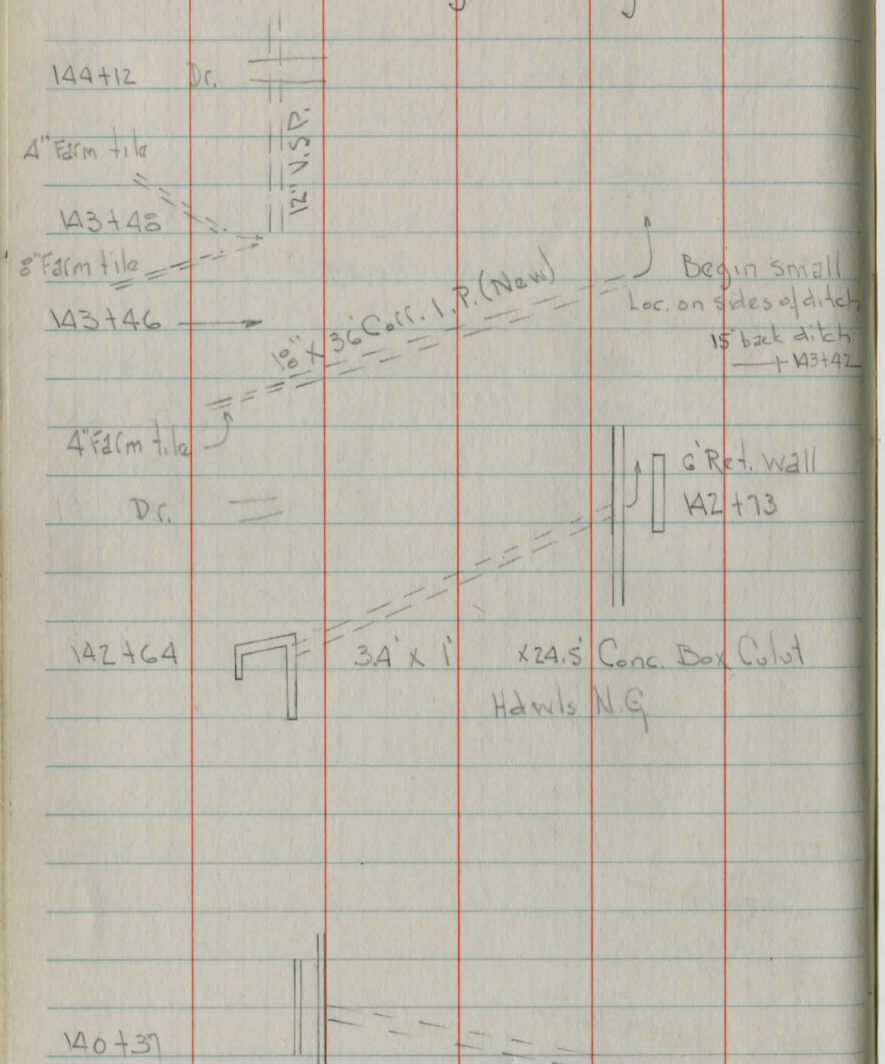
Sta 4 Relay Pipe at Williams, S. Side
Shove South

Chk X sec Sta 11+0 for wall. A Spec Sec
Dr 18+54 Dr. pipe headed 18" Pipe?
Snyder (N. Town) Dr ok Relay
Chk 34 to 36 X sec for tile (30" elm to ft)
Dr 39+0 West Chk for trees.
42+0 to 43+50 5 Side Trees ok
41+63 Elm on N Side ok
44+0 to 47 Check Sec for trees
57+75 to 59+30 6" farm tile S. Side
59+46 Dr. Work check Sec for pipe of Excavg
64+98 3 ash trees to come out
66+0 2 Elms to remove)
67+79 ~~2 ft~~ 10'
66+50 to 67+79 Dr 55 8" tile
71+0 to Dr 72+03 N Side 10" tile
Taylor Rd turnouts not to be on West
new Structure 18" pipe
Leave 6" tile in at Ferguson Ave
At Fisher Rd. move drive pipe South



11/3/39 Pomeroy Clause Richards

X Sections of Ditch for S.S.

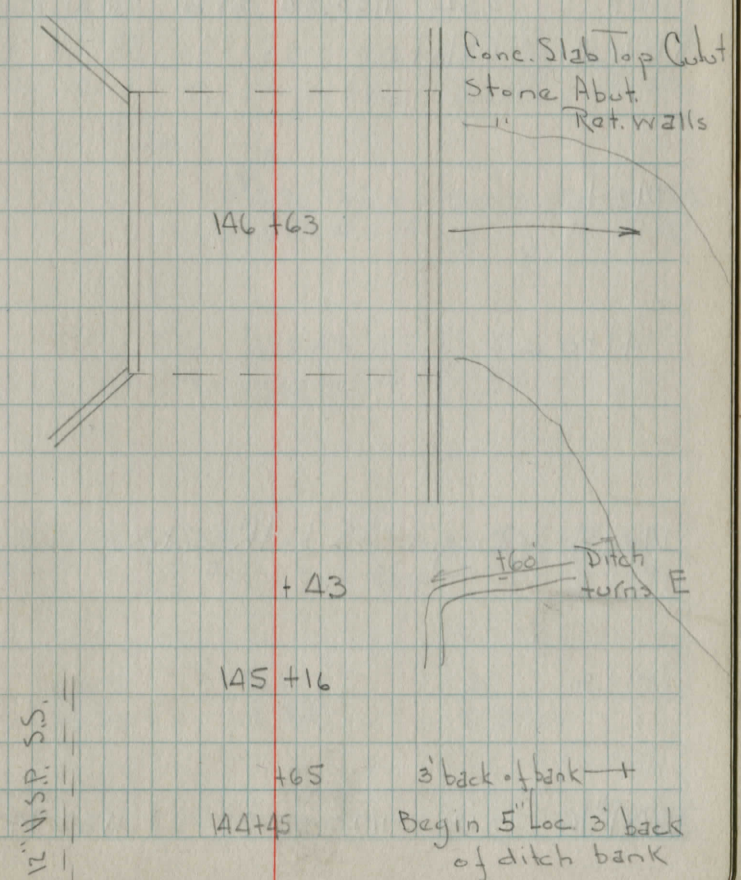


Stakes set 10' back of ditch ℄

Fair - 38°

5'C

So. Hamboden Rd at Lampmans ℄.



+ 48				
+ 46	Colvt			
143+00				
T.P.	2.52	11°3.80	9.5°	11°1.28
142+64	Colvt			
142+00				
141+00				
140+00	Begin S.S. both sides			
139+50				
BM #16	2.12	1190.86		11°8.74

5.5
F.L. S.S.

5.3 F.L.

3.15 ℄ Rd

6.6 F.L.

7.9 Ditch

1181.5
2.3 ℄ Rd ± 21

2.7 13

6.1 8 11

4.7 7

3.3 0

2.52 Stk

7.3 20

7.6 10

7.9 6' from Hdwl

11.5 F.L.

8.6 ℄ Rd

11.2 F.L.

8.5 6' from Hdwl

8.4 10

9.2 15

10.5 20

1185.9
4.95 Stk

5.0 0

6.5 5

8.0 8

9.4 9 11

8.2 12

7.0 15

7.4 ℄

5.2 10

3.32 Stk

4.2 0

4.5 .5

7.2 9 11

5.6 13

2.83 Stk

3.6 0

3.1 .5

3.6 8

5.3 9 10

3.4 12

3.0 Edge Rd 0

3.3 2

5.2 5

2.9 8 10

3.5 14

4.15 ℄ Ditch

1.06 ℄ Rd

4.1 ℄ Ditch

BM			2.23	1188.70	(1188.74)
T.P.	4.76	1190.93	1.24	1186.17	
T.P.	12.07	1187.41	1.08	1175.34	
145+43					
T.P.	3.76	1176.42	11.14	1172.66	
145+0					
144+0					
		1183.00			

3.0	5.9	6.3	8.0	10.3		
℄	Ditch	25	45	50		
±1.8						

12.3
FL, 55.

8.1	9.4	10.6	11.9	3.3	2.59	
℄	20	14	8	1	S+K	
±3.0			12			

4.0	4.9	8.5	9.3	3.5	3.3	2.63
℄	5	13	8	1	0	S+K
±3.2	20	15	12			

S.S. So. Hambden (Corp line East)

~~Col 0+6+69~~

End 6+52 clean ditch

4+40 End

4+16 Outlet 14" Corr I.P.

3+20 Inlet 16" V.S.P.

21" Corr. I.P. is Long 1+05

1½ ditch Not bad

Insert 6" pipe 0+11

Begin Hdwall 0+10

0+00 Begin

4/10/40 Culvert Sta 44+27 E. of Auburn Rd-179+24 E. of S. Russell Vill.
Cloudy
Roma Roy
Richards BELL STREET

B.M.	3.47	1219.10		1215.63
℄			4.1	15.00
Top o.p.			5.85	13.25
F.L.			7.6	11.5
50' South			7.8	11.3
100' "			8.0	11.1
200' "			8.1	11.0
300' "			8.6	10.5
400' "			8.5	10.6
T.P.			5.98	1213.12
Top o.p	North		5.95	13.15
F.L.	"		7.8	11.3
50'	"		7.6	11.5
100'	"		8.0	11.1
200'	"		8.4	10.7
300'	"		8.6	10.5
400'	"		8.7	Note: Alt 10.4
T.P.	5.31	1213.49		1213.12
500'	South		7.5	11.0
+30	" Angle to W		7.0	11.5
6	"		7.0	11.5
+50	" " " S		6.7	11.8
7			6.5	12.0
8			6.4	12.1
9			6.0	12.5 1400 ± 5.0

N.E. + N Headwall.
Culvert has conc. floor Ht. of op. 2.2
Cond. OK

4+50 grade increases

See pg 62

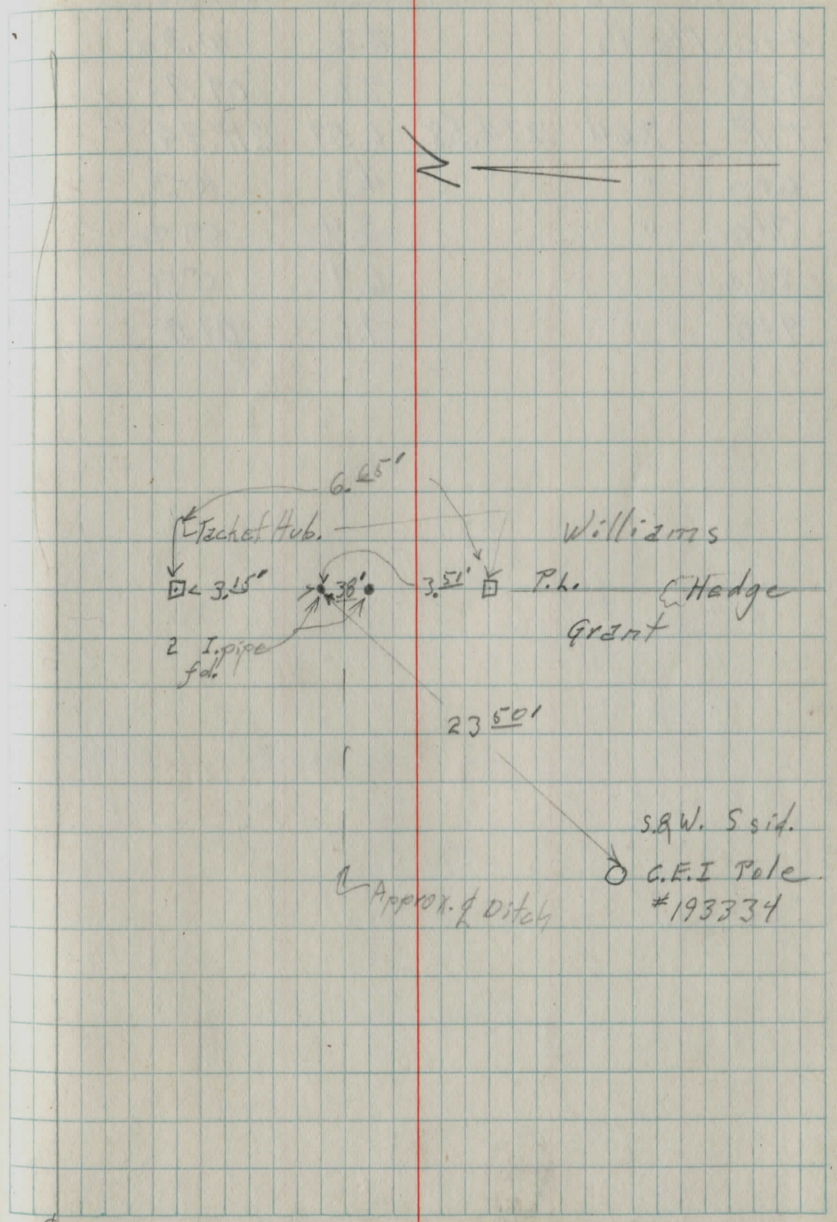
48 Wm George "Drainage"
N. side Bell Rd
Newbury
12/5/53

F.L Neath 11.3
900' 7.0
4.3

9 | 4.3
36
70
72

	New Gr.	Existing Gr.	Cut
F.L.	11.3	11.3	0.0
	- .48		
100' Gr.	10.82	11.1	.3
	- 48		
200' Gr.	10.34	10.7	.4
	- 48		
300' Gr.	9.86	10.5	.7
	- 48		
400' Gr.	9.38	10.3	.9
	- 48		
500' Gr.	8.90	9.9	1.0
	- 48		
600' Gr.	8.42	10.3	1.9
	- 48		
700' Gr.	7.94	9.2	1.3
	- 48		
800' Gr.	7.46	7.9	.4
	- 48		
900' Gr.	6.98	7.0	0.0

Approx. Sta. 3+36



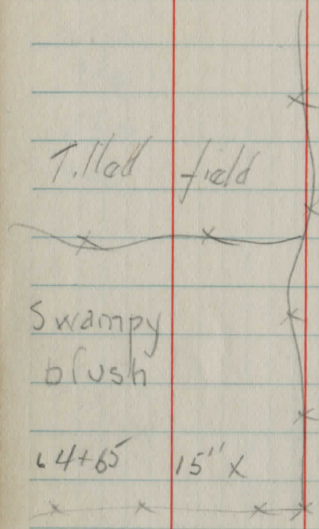
B.M.	2.00	1218.51		1215.63
4+0	North		0.2	10.3
5+0	"		0.6	09.9
T.P.	2.64	1214.58	6.57	1211.94
6+0	"		4.3	10.3
7+0	"		5.4	09.2
8+0			6.7	07.9
9+0			7.6	07.0

11.3
07
11.3

R.E. of H. Headwall

Topo Sta 54 to 70+53
Jog Street

West East



Levels Sta 54 to 70+53

JUG STREET.

	+	H.I.	-	Elev
BM.	1.53	1229.10		1227.57
70+0				
69+0				
68+0				
67.+0				
T.P	3.40	1226.65	5.85	1223.25
66+0				
65+0				
64+65				
64+0				
63+0				
62+0				
61+0				

R.P. in N.E. side 12" Ash stub. Sta 70+

E. side Rt. 168.

East Ditch	℄ 25.60			West Ditch
	3.5			23.3 5.8
22.7 6.4	24.0 5.1			22.3 6.8
22.3 6.8	23.6 5.5			21.9 7.2
21.8 7.3	23.3 5.8			21.4 7.7
21.55 5.1	22.65 4.0			20.75 5.9
20.65 6.0	22.25 4.4			20.35 6.3
F.L 19.95 6.7	F.L 19.45 7.2	7.9 100	8.9 200	F.L. 4" F.Tile 15.0 ±100
20.45 6.2	4.6 22.05			20.05 6.6
20.85 5.8	4.5 22.15			20.15 6.5
20.85 5.8	22.25 4.4			20.35 6.3
20.45 6.2	4.4 22.25			20.25 6.4

	+	H.I	−	Elev.	
		1226.65			
T.P.	4.72	1227.02	4.35	1222.30	
60+0					
59+0					
+82					
58+0					
57+0					
+48					
56+0					
55+0					
+22					
54					
T.T.	4.07	1226.62	4.47	1222.55	
T.P.	7.04	1230.38	3.28	1223.34	
		1230.40	2.83	1227.55	1227.57
			4.72		
					1225.68
			1227.57		
			1.89		
			1225.68		

Ditch E

22.62
6.5
4.7
22.62
6.7
4.4
F.4. 20.22
6.8 10" V/S
22.82
4.2
22.72
4.3
22.02
5.0
16.62
F.4. 8"
10.4 V.S.P.
19.62
7.4
12.22
14.02
14.8
13.0

Ditch W

20.42
6.6
20.82
6.2
20.92
6.1
20.92
6.1
F.4. 8" 20.72
V.S.P. 6.3
21.52
5.5
19.02
8.0
F.4. 8" 13.52
V.S.P. 13.5
12.42
14.6

New B.M. W.W. of W. Headwall

Profile County Home Road

	+	H.I.	−	E
B.M.	0.00	1091.16		1091.16 ±
T.P.	2.21	1080.78	12.59	1078.57
111+60	24" Corr. I.P. Culvt.			
111+0				
111+10				
110+25				
110+0				
109+0				
108+65	H_2O runs over Road			
108+0				
107+59	10" C.I.P. Westend Culvt 12" Corr. E "			
107+0				
106+30				
106+20	F.L. 12" Corr.			
106+15				

East West

Staple in top stone post Sta. 117 +10

		76.78	72.13
Lots of fall	10.95 F.L.	4.0 E	8.65 FL
		76.58	74.88
	6.2 D	4.2 E	5.9 D
			D/C. Plank Kover.
		76.78	D/C. 12" Conc. 75.18
	6.1 D	4.0 E	5.6 D 74.98
		76.08	
	6.9 D	4.7 E	5.0 D 74.48
		75.78	
	6.5	5.0 E	5.0 D 74.78
		75.98	
	6.6 D	4.0 E	6.0 D 74.18
		76.18	
Good fall	1.5 F.L.	4.6 E	6.6 F.L. 75.68
		76.68	
	6.3 D	4.1 E	5.1 W
			D/C. Stone
			76.18
			4.6
			F.L. inlet S/S.

D/C D/C.

1080.78

106+00

105+20

105+00

104+

101+37

E

No dit

77.58

92

℄

W

No D

67

74.38

C0.4

Fl. 10" Farm tile (outlet SS)

76.08

74.48

C0.7

D

A.7

℄ 71.88

C0.3

D 70.48

11.0

D

05

℄

10.3

D

Culvert

8-7-48
J.M.
A.T.

RESETING BM

	+	HI	−		
BM #3	5.84 ✓	1193.97		1188.13	
			11.83		
T.P.	0.88 ✓	1183.02 ✓	11.83 ✓	1182.14	
T.P.	1.27	1171.32 ✓	12.97	1170.05 ✓	
BM		FS PK Nail →	6.77 ✓	1164.55	1164.50 use
BM	7.15 ✓	1169.78 ✓	8.69	1162.63 ✓	1162.58 use
			6.48	1163.30	63.25
BM			5.99	1163.79	63.76
			4.35	65.43	65.40
			4.21	65.57	65.55
			9.50	60.28	60.23
			9.46	60.32	60.25

8-17-48

	7.54	1170.12		1162.58

8-27-48

BM	7.06	69.64		1162.58
NW ¼ footer			13.89	55.75
SW ¼ "			13.97	55.67

CHARDON - WINDSOR

BRIDGE

Spk. SW root 30" Elm 75' Lt ℄ Sta 18+10

Spk 5 root 10" Elm ± 70' NE of bridge

Spk E side 1st Tel. pole W of brge

Grade stk NW ¼

X Send W edge about

edge rd ℄ W

" " " E

S footer stk

N " "

Readings taken when abut ½ poured

Beam Lengths
Meas. 9-1-48

New
32 - 4" ✓
32 - 4 1/2" ✓
32 - 4 1/4" ✓
32 - 4 1/4" ✓

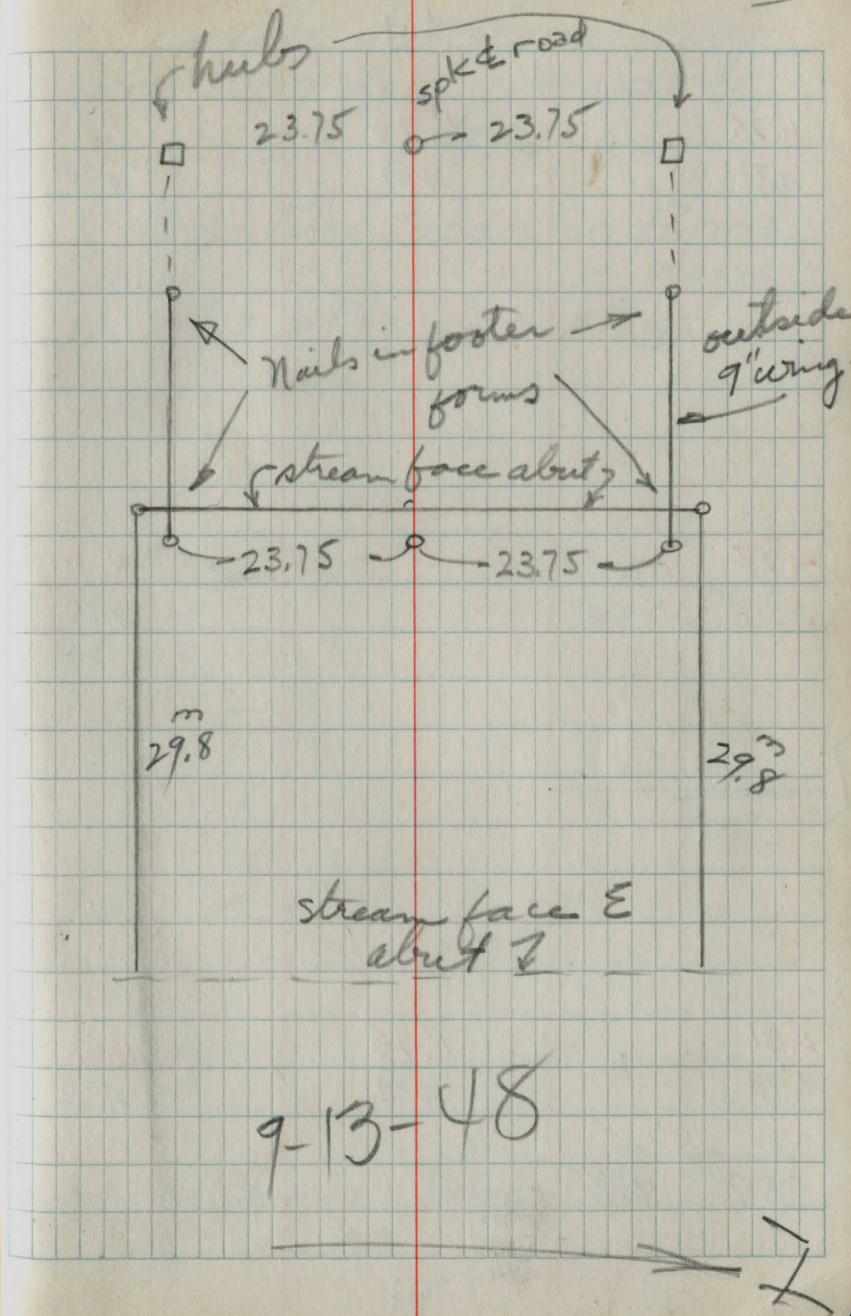
old
✓ 32 - 4"
✓ 32 - 5 1/4"
✓ 32 - 4
✓ 32 - 4
✓ 32 - 4

Channels
✓ 32 - 3
✓ 32 - 3

8-7-48

BM	3.72	66.30		1162.58
SW & E foot			10.58	55.72
NW " " "			10.54	55.76
Stk South EX			3.60	
footer			C 7.0	
			10.55	
Stk in cofferdam			3.55	
N end			C 7.0	

Grades W footer



9-13-48

Levels to show sag in Chardon - Windsor Bridge

Red = Elev. taken on forms
Black = " " " conc
2 wks after pouring

Spk Tel pole W of bdge

W

4.28		4.23	4.32
4.71		4 64	4 75

4.29	ctr		4.30
4.75	brge		4 76

4.31		4.23	4.32
4.73		4 64	4 75

BM	7 85	1162.58	

W

12 Gauge Uniplate @ 20¢ per lin ft $1.25
Channel bar. 50¢ " " (with Lag Bolts) "

Rd ℄ W side	4.73
" " E "	4.56
Rd	4.58
Bk side form @	
form W side	4.58
" S "	4.64

CURVE TABLES.

Published by KEUFFEL & ESSER CO.

HOW TO USE CURVE TABLES.

Table I. contains Tangents and Externals 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 I.: 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.

EXAMPLE.

Wanted a Curve with an Ext. of about 12 ft. Angle of Intersection or I. P. = 23° 20′ to the R. at Station 542+72.

Ext. in Tab. I opposite 23° 20′ = 120.87
120.87 ÷ 12 = 10.07. Say a 10° Curve.

Tan. in Tab. I opp. 23° 20′ = 1183.1
1183.1 ÷ 10 = 118.31.

Correction for A. 23° 20′ for a 10° Cur. = 0.16
118.31 + 0.16 = 118.47 = corrected Tangent.

(If corrected Ext. is required find in same way)
Ang. 23° 20′ = 23.33° ÷ 10 = 2.3333 = L. C.

2° 19½′ = def. for sta.	542	I. P. = sta.	542+72
4° 49½′ = " " "	+50	Tan. =	1.18.47
7° 19½′ = " " "	543	B. C. = sta.	541+53.53
9° 49½′ = " " "	+50	L. C. =	2.33.33
11° 40′ = " " "	543+	E. C. = Sta.	543+86 86
	86.86		

100 − 53.53 = 46.47 × 3′ (def. for 1 ft. of 10° Cur.) = 139.41′ = 2° 19½′ = def. for sta. 542.

Def. for 50 ft. = 2° 30′ for a 10° Curve.

Def. for 36.86 ft. = 1° 50½′ for a 10° Curve.

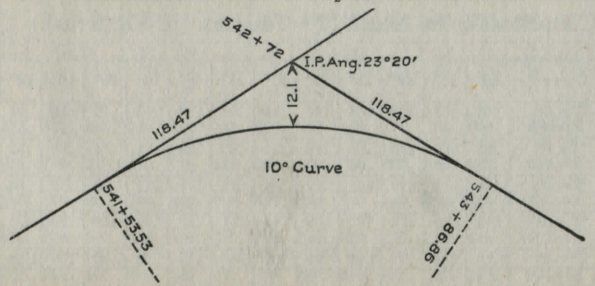


Table I. — Tangents and Externals to a 1° Curve.

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
1°	50.00	.22	**8°**	400.66	13.99	**15°**	754.32	49.44
10′	58.34	.30	10′	409.03	14.58	10′	762.80	50.55
20	66.67	.39	20	417.41	15.18	20	771.29	51.68
30	75.01	.49	30	425.79	15.80	30	779.77	52.82
40	83.34	.61	40	434.17	16.43	40	788.26	53.97
50	91.68	.73	50	442.55	17.07	50	796.75	55.13
2	100.01	.87	**9**	450.93	17.72	**16**	805.25	56.31
10	108.35	1.02	10	459.32	18.38	10	813.75	57.50
20	116.68	1.19	20	467.71	19.06	20	822.25	58.70
30	125.02	1.36	30	476.10	19.75	30	830.76	59.91
40	133.36	1.55	40	484.49	20.45	40	839.27	61.14
50	141.70	1.75	50	492.88	21.16	50	847.78	62.38
3	150.04	1.96	**10**	501.28	21.89	**17**	856.30	63.63
10	158.38	2.19	10	509.68	22.62	10	864.82	64.90
20	166.72	2.43	20	518.08	23.38	20	873.35	66.18
30	175.06	2.67	30	526.48	24.14	30	881.88	67.47
40	183.40	2.93	40	534.89	24.91	40	890.41	68.77
50	191.74	3.21	50	543.29	25.70	50	898.95	70.09
4	200.08	3.49	**11**	551.70	26.50	**18**	907.49	71.42
10	208.43	3.79	10	560.11	27.31	10	916.03	72.76
20	216.77	4.10	20	568.53	28.14	20	924.58	74.12
30	225.12	4.42	30	576.95	28.97	30	933.13	75.49
40	233.47	4.76	40	585.36	29.82	40	941.69	76.86
50	241.81	5.10	50	593.79	30.68	50	950.25	78.26
5	250.16	5.46	**12**	602.21	31.56	**19**	958.81	79.67
10	258.51	5.83	10	610.64	32.45	10	967.38	81.09
20	266.86	6.21	20	619.07	33.35	20	975.96	82.53
30	275.21	6.61	30	627.50	34.26	30	984.53	83.97
40	283.57	7.01	40	635.93	35.18	40	993.12	85.43
50	291.92	7.43	50	644.37	36.12	50	1001.7	86.90
6	300.28	7.86	**13**	652.81	37.07	**20**	1010.3	88.39
10	308.64	8.31	10	661.25	38.03	10	1018.9	89.89
20	316.99	8.76	20	669.70	39.01	20	1027.5	91.40
30	325.35	9.23	30	678.15	39.99	30	1036.1	92.92
40	333.71	9.71	40	686.60	40.99	40	1044.7	94.46
50	342.08	10.20	50	695.06	42.00	50	1053.3	96.01
7	350.44	10.71	**14**	703.51	43.03	**21**	1061.9	97.57
10	358.81	11.22	10	711.97	44.07	10	1070.6	99.16
20	367.17	11.75	20	720.44	45.12	20	1079.2	100.75
30	375.54	12.29	30	728.90	46.18	30	1087.8	102.35
40	383.91	12.85	40	737.37	47.25	40	1096.4	103.97
50	392.28	13.41	50	745.85	48.34	50	1105.1	105.60

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
5°	T=.02	.03	.05	.06	.08	.10	.11	.13	.15	.16	.18	.20	.21	.23
	E=.000	.000	.001	.001	.002	.002	.002	.003	.003	.004	.004	.004	.005	.005
10°	T=.03	.05	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
	E=.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	T=.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
	E=.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	T=.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
	E=.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	T=.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
	E=.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135

Table I. — Tangents and Externals to a 1° Curve.

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
22°	1113.7	107.24	**29°**	1481.8	188.51	**36°**	1861.7	294.9
10′	1122.4	108.90	10′	1490.7	190.74	10′	1870.9	297.7
20	1131.0	110.57	20	1499.6	192.99	20	1880.1	300.6
30	1139.7	112.25	30	1508.5	195.25	30	1889.4	303.5
40	1148.4	113.95	40	1517.4	197.53	40	1898.6	306.4
50	1157.0	115.66	50	1526.3	199.82	50	1907.9	309.3
23	1165.7	117.38	**30**	1535.3	202.12	**37**	1917.1	312.2
10	1174.4	119.12	10	1544.2	204.44	10	1926.4	315.2
20	1183.1	120.87	20	1553.1	206.77	20	1935.7	318.1
30	1191.8	122.63	30	1562.1	209.12	30	1945.0	321.1
40	1200.5	124.41	40	1571.0	211.48	40	1954.3	324.1
50	1209.2	126.20	50	1580.0	213.86	50	1963.6	327.1
24	1217.9	128.00	**31**	1589.0	216.3	**38**	1972.9	330.2
10	1226.6	129.82	10	1598.0	218.7	10	1982.2	333.2
20	1235.3	131.65	20	1606.9	221.1	20	1991.5	336.3
30	1244.0	133.50	30	1615.9	223.5	30	2000.9	339.3
40	1252.8	135.35	40	1624.9	226.0	40	2010.2	342.4
50	1261.5	137.23	50	1633.9	228.4	50	2019.6	345.5
25	1270.2	139.11	**32**	1643.0	230.9	**39**	2029.0	348.6
10	1279.0	141.01	10	1652.0	233.4	10	2038.4	351.8
20	1287.7	142.93	20	1661.0	235.9	20	2047.8	354.9
30	1296.5	144.85	30	1670.0	238.4	30	2057.2	358.1
40	1305.3	146.79	40	1679.1	241.0	40	2066.6	361.3
50	1314.0	148.75	50	1688.1	243.5	50	2076.0	364.5
26	1322.8	150.71	**33**	1697.2	246.1	**40**	2085.4	367.7
10	1331.6	152.69	10	1706.3	248.7	10	2094.9	371.0
20	1340.4	154.69	20	1715.3	251.3	20	2104.3	374.2
30	1349.2	156.70	30	1724.4	253.9	30	2113.8	377.5
40	1358.0	158.72	40	1733.5	256.5	40	2123.3	380.8
50	1366.8	160.76	50	1742.6	259.1	50	2132.7	384.1
27	1375.6	162.81	**34**	1751.7	261.8	**41**	2142.2	387.4
10	1384.4	164.86	10	1760.8	264.5	10	2151.7	390.7
20	1393.2	166.95	20	1770.0	267.2	20	2161.2	394.1
30	1402.0	169.04	30	1779.1	269.9	30	2170.8	397.4
40	1410.9	171.15	40	1788.2	272.6	40	2180.3	400.8
50	1419.7	173.27	50	1797.4	275.3	50	2189.9	404.2
28	1428.6	175.41	**35**	1806.6	278.1	**42**	2199.4	407.6
10	1437.4	177.55	10	1815.7	280.8	10	2209.0	411.1
20	1446.3	179.72	20	1824.9	283.6	20	2218.6	414.5
30	1455.1	181.89	30	1834.1	286.4	30	2228.1	418.0
40	1464.0	184.08	40	1843.3	289.2	40	2237.7	421.4
50	1472.9	186.29	50	1852.5	292.0	50	2247.3	425.0

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
20°	T=.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
	E=.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	T=.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
	E=.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	T=.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
	E=.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	T=.11	.22	.34	.47	.58	.69	.80	.93	1.05	1.17	1.29	1.42	1.54	1.66
	E=.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	T=.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
	E=.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	T=.15	.30	.44	.60	.76	.91	1.05	1.21	1.37	1.52	1.70	1.87	2.04	2.21
	E=.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445

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

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
43°	2257.0	428.5	**50°**	2671.8	592.3	**57°**	3110.9	790.1
10′	2266.6	432.0	10′	2681.9	596.6	10′	3121.7	795.2
20	2276.2	435.6	20	2692.1	600.9	20	3132.6	800.4
30	2285.9	439.2	30	2702.3	605.3	30	3143.4	805.6
40	2295.6	442.8	40	2712.5	609.6	40	3154.2	810.9
50	2305.2	446.4	50	2722.7	614.0	50	3165.1	816.1
44	2314.9	450.0	**51**	2732.9	618.4	**58**	3176.0	821.4
10	2324.6	453.6	10	2743.1	622.8	10	3186.9	826.7
20	2334.3	457.3	20	2753.4	627.2	20	3197.8	832.0
30	2344.1	461.0	30	2763.7	631.7	30	3208.8	837.3
40	2353.8	464.6	40	2773.9	636.2	40	3219.7	842.7
50	2363.5	468.4	50	2784.2	640.7	50	3230.7	848.1
45	2373.3	472.1	**52**	2794.5	645.2	**59**	3241.7	853.5
10	2383.1	475.8	10	2804.9	649.7	10	3252.7	858.9
20	2392.8	479.6	20	2815.2	654.3	20	3263.7	864.3
30	2402.6	483.4	30	2825.6	658.8	30	3274.8	869.8
40	2412.4	487.2	40	2835.9	663.4	40	3285.8	875.3
50	2422.3	491.0	50	2846.3	668.0	50	3296.9	880.8
46	2432.1	494.8	**53**	2856.7	672.7	**60**	3308.0	886.4
10	2441.9	498.7	10	2867.1	677.3	10	3319.1	892.0
20	2451.8	502.5	20	2877.5	682.0	20	3330.3	897.5
30	2461.7	506.4	30	2888.0	686.7	30	3341.4	903.2
40	2471.5	510.3	40	2898.4	691.4	40	3352.6	908.8
50	2481.4	514.3	50	2908.9	696.1	50	3363.8	914.5
47	2491.3	518.2	**54**	2919.4	700.9	**61**	3375.0	920.2
10	2501.2	522.2	10	2929.9	705.7	10	3386.3	925.9
20	2511.2	526.1	20	2940.4	710.5	20	3397.5	931.6
30	2521.1	530.1	30	2951.0	715.3	30	3408.8	937.3
40	2531.1	534.2	40	2961.5	720.1	40	3420.1	943.1
50	2541.0	538.2	50	2972.1	725.0	50	3431.4	948.9
48	2551.0	542.2	**55**	2982.7	729.9	**62**	3442.7	954.8
10	2561.0	546.3	10	2993.3	734.8	10	3454.1	960.6
20	2571.0	550.4	20	3003.9	739.7	20	3465.4	966.5
30	2581.0	554.5	30	3014.5	744.6	30	3476.8	972.4
40	2591.0	558.6	40	3025.2	749.6	40	3488.3	978.3
50	2601.1	562.8	50	3035.8	754.6	50	3499.7	984.3
49	2611.2	566.9	**56**	3046.5	759.6	**63**	3511.1	990.2
10	2621.2	571.1	10	3057.2	764.6	10	3522.6	996.2
20	2631.3	575.3	20	3067.9	769.7	20	3534.1	1002.3
30	2641.4	579.5	30	3078.7	774.7	30	3545.6	1008.3
40	2651.5	583.8	40	3089.4	779.8	40	3557.2	1014.4
50	2661.6	588.0	50	3100.2	784.9	50	3568.7	1020.5

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
40°	T=.13	.26	.40	.53	.67	.80	.93	.106	1.20	1.34	1.49	1.64	1.79	1.94
	E=.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	T=.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
	E=.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	T=.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
	E=.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	T=.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
	E=.046	.093	.142	.188	.236	.283	.332	3.81	.420	.479	.530	.582	.641	.700
60°	T=.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
	E=.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	T=.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
	E=.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.711	.845	.922	1.01

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

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
64°	3580.3	1026.6	**71°**	4086.9	1308.2	**78°**	4639.8	1643.0
10′	3591.9	1032.8	10′	4099.5	1315.6	10′	4653.6	1651.7
20	3603.5	1039.0	20	4112.1	1322.9	20	4667.4	1660.5
30	3615.1	1045.2	30	4124.8	1330.3	30	4681.3	1669.2
40	3626.8	1051.4	40	4137.4	1337.7	40	4695.2	1678.1
50	3638.5	1057.7	50	4150.1	1345.1	50	4709.2	1686.9
65	3650.2	1063.9	**72**	4162.8	1352.6	**79**	4723.2	1695.8
10	3661.9	1070.2	10	4175.6	1360.1	10	4737.2	1704.7
20	3673.7	1076.6	20	4188.5	1367.6	20	4751.2	1713.7
30	3685.4	1082.9	30	4201.2	1375.2	30	4765.3	1722.7
40	3697.2	1089.3	40	4214.0	1382.8	40	4779.4	1731.7
50	3709.0	1095.7	50	4226.8	1390.4	50	4793.6	1740.8
66	3720.9	1102.2	**73**	4239.7	1398.0	**80**	4807.7	1749.9
10	3732.7	1108.6	10	4252.6	1405.7	10	4822.0	1759.0
20	3744.6	1115.1	20	4265.6	1413.5	20	4836.2	1768.2
30	3756.5	1121.7	30	4278.5	1421.2	30	4850.5	1777.4
40	3768.5	1128.2	40	4291.5	1429.0	40	4864.8	1786.7
50	3780.4	1134.8	50	4304.6	1436.8	50	4879.2	1796.0
67	3792.4	1141.4	**74**	4317.6	1444.6	**81**	4893.6	1805.3
10	3804.4	1148.0	10	4330.7	1452.5	10	4908.0	1814.7
20	3816.4	1154.7	20	4343.8	1460.4	20	4922.5	1824.1
30	3828.4	1161.3	30	4356.9	1468.4	30	4937.0	1833.6
40	3840.5	1168.1	40	4370.1	1476.4	40	4951.5	1843.1
50	3852.6	1174.8	50	4383.3	1484.4	50	4966.1	1852.6
68	3864.7	1181.6	**75**	4396.5	1492.4	**82**	4980.7	1862.2
10	3876.8	1188.4	10	4409.8	1500.5	10	4995.4	1871.8
20	3889.0	1195.2	20	4423.1	1508.6	20	5010.0	1881.5
30	3901.2	1202.0	30	4436.4	1516.7	30	5024.8	1891.2
40	3913.4	1208.9	40	4449.7	1524.9	40	5039.5	1900.9
50	3925.6	1215.8	50	4463.1	1533.1	50	5054.3	1910.7
69	3937.9	1222.7	**76**	4476.5	1541.4	**83**	5069.2	1920.5
10	3950.2	1229.7	10	4489.9	1549.7	10	5084.0	1930.4
20	3962.5	1236.7	20	4503.4	1558.0	20	5099.0	1940.3
30	3974.8	1243.7	30	4516.9	1566.3	30	5113.9	1950.3
40	3987.2	1250.8	40	4530.4	1574.7	40	5128.9	1960.2
50	3999.5	1257.9	50	4544.0	1583.1	50	5143.9	1970.3
70	4011.9	1265.0	**77**	4557.6	1591.6	**84**	5159.0	1980.4
10	4024.4	1272.1	10	4571.2	1600.1	10	5174.1	1990.5
20	4036.8	1279.3	20	4584.8	1608.6	20	5189.3	2000.6
30	4049.3	1286.5	30	4598.5	1617.1	30	5204.4	2010.8
40	4061.8	1293.6	40	4612.2	1625.7	40	5219.7	2021.1
50	4074.4	1300.9	50	4626.0	1634.4	50	5234.9	2031.4

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
60°	T=.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
	E=.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	T=.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
	E=.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.711	.845	.922	1.01
70°	T=.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
	E=.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	T=.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
	E=.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
80°	T=.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
	E=.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	T=.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
	E=.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91

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

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
85°	5250.3	2041.7	**92°**	5933.2	2518.5	**99°**	6708.6	3092.7
10′	5265.6	2052.1	10′	5950.5	2531.0	10′	6728.4	3107.7
20	5281.0	2062.5	20	5967.9	2543.5	20	6748.2	3122.9
30	5296.4	2073.0	30	5985.3	2556.0	30	6768.1	3138.1
40	5311.9	2083.5	40	6002.7	2568.6	40	6788.1	3153.3
50	5327.4	2094.1	50	6020.2	2581.3	50	6808.2	3168.7
86	5343.0	2104.7	**93**	6037.8	2594.0	**100**	6828.3	3184.1
10	5358.6	2115.3	10	6055.4	2606.8	10	6848.5	3199.6
20	5374.2	2126.0	20	6073.1	2619.7	20	6868.8	3215.1
30	5389.9	2136.7	30	6090.8	2632.6	30	6889.2	3230.8
40	5405.6	2147.5	40	6108.6	2645.5	40	6909.6	3246.5
50	5421.4	2158.4	50	6126.4	2658.5	50	6930.1	3262.3
87	5437.2	2169.2	**94**	6144.3	2671.6	**101**	6950.6	3278.1
10	5453.1	2180.2	10	6162.6	2684.7	10	6971.3	3294.1
20	5469.0	2191.1	20	6180.2	2697.9	20	6992.0	3310.1
30	5484.9	2202.2	30	6198.3	2711.2	30	7012.7	3326.1
40	5500.9	2213.2	40	6216.4	2724.5	40	7033.6	3342.3
50	5517.0	2224.3	50	6234.6	2737.9	50	7054.5	3358.5
88	5533.1	2235.5	**95**	6252.8	2751.3	**102**	7075.5	3374.9
10	5549.2	2246.7	10	6271.1	2764.8	10	7096.6	3391.2
20	5565.4	2258.0	20	6289.4	2778.3	20	7117.8	3407.7
30	5581.6	2269.3	30	6307.9	2792.0	30	7139.0	3424.3
40	5597.8	2280.6	40	6326.3	2805.6	40	7160.3	3440.9
50	5614.2	2292.0	50	6344.8	2819.4	50	7181.7	3457.6
89	5630.5	2303.5	**96**	6363.4	2833.2	**103**	7203.2	3474.4
10	5646.9	2315.0	10	6382.1	2847.0	10	7224.7	3491.3
20	5663.4	2326.6	20	6400.8	2861.0	20	7246.3	3508.2
30	5679.9	2338.2	30	6419.5	2875.0	30	7268.0	3525.2
40	5696.4	2349.8	40	6438.4	2889.0	40	7289.8	3542.4
50	5713.0	2361.5	50	6457.3	2903.1	50	7311.7	3559.6
90	5729.7	2373.3	**97**	6476.2	2917.3	**104**	7333.6	3576.8
10	5746.3	2385.1	10	6495.2	2931.6	10	7355.6	3594.2
20	5763.1	2397.0	20	6514.3	2945.9	20	7377.8	3611.7
30	5779.9	2408.9	30	6533.4	2960.3	30	7399.9	3629.2
40	5796.7	2420.9	40	6552.6	2974.7	40	7422.2	3646.8
50	5813.6	2432.9	50	6571.9	2989.2	50	7444.6	3664.5
91	5830.5	2444.9	**98**	6591.2	3003.8	**105**	7467.0	3682.3
10	5847.5	2457.1	10	6610.6	3018.4	10	7489.6	3700.2
20	5864.6	2469.3	20	6630.1	3033.1	20	7512.2	3718.2
30	5881.7	2481.5	30	6649.6	3047.9	30	7534.9	3736.2
40	5898.8	2493.8	40	6669.2	3062.8	40	7557.7	3754.4
50	5916.0	2506.1	50	6688.8	3077.7	50	7580.5	3772.6

Corrections to be Added (T = Tangent. E. = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
85°	T=.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
	E=.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	T=.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
	E=.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	T=.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.49	4.98	5.38	5.83
	E=.174	.350	.522	.706	.985	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	T=.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
	E=.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
105°	T=.46	.94	1.42	1.90	2.38	2.87	3.34	3.84	4.35	4.84	5.35	5.87	6.40	6.93
	E=.230	.470	.700	.938	1.17	1.42	1.65	1.90	2.14	2.39	2.64	2.90	3.16	3.41

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

Chord = 100 ft.

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
106°	7603.5	3791.0	**111°**	8336.7	4386.1	**116°**	9169.4	5082.7
10′	7626.6	3809.4	10′	8362.7	4407.6	10′	9199.1	5107.9
20	7649.7	3827.9	20	8388.9	4429.2	20	9229.0	5133.3
30	7672.9	3846.5	20	8415.1	4450.9	30	9259.0	5158.8
40	7696.3	3865.2	40	8441.5	4472.7	40	9289.2	5184.5
50	7719.7	3884.0	50	8468.0	4494.6	50	9319.5	5210.3
107	7743.2	3902.9	**112**	8494.6	4516.6	**117**	9349.9	5236.2
10	7766.8	3921.9	10	8521.3	4538.8	10	9380.5	5262.3
20	7790.5	3940.9	20	8548.1	4561.1	20	9411.3	5288.6
30	7814.3	3960.1	30	8575.0	4583.4	30	9442.2	5315.0
40	7838.1	3979.4	40	8602.1	4606.0	40	9473.2	5341.5
50	7862.1	3998.7	50	8629.3	4628.6	50	9504.4	5368.2
108	7886.2	4018.2	**113**	8656.6	4651.3	**118**	9535.7	5395.1
10	7910.4	4037.8	10	8684.0	4674.2	10	9567.2	5422.1
20	7934.6	4057.4	20	8711.5	4697.2	20	9598.9	5449.2
30	7959.0	4077.2	30	8739.2	4720.3	30	9630.7	5476.5
40	7983.5	4097.1	40	8767.0	4743.6	40	9662.6	5504.0
50	8008.0	4117.0	50	8794.9	4766.9	50	9694.7	5531.7
109	8032.7	4137.1	**114**	8822.9	4790.4	**119**	9727.0	5559.4
10	8057.4	4157.3	10	8851.0	4814.1	10	9759.4	5587.4
20	8082.3	4177.5	20	8879.3	4837.8	20	9792.0	5615.5
30	8107.3	4197.9	30	8907.7	4861.7	30	9824.8	5643.8
40	8132.3	4218.4	40	8936.3	4885.7	40	9857.7	5672.3
50	8157.5	4239.0	50	8965.0	4909.9	50	9890.8	5700.9
110	8182.8	4259.7	**115**	8993.8	4934.1	**120**	9924.0	5729.7
10	8208.2	4280.5	10	9022.7	4958.6	10	9957.5	5758.6
20	8233.7	4301.4	20	9051.7	4983.1	20	9991.0	5787.7
30	8259.3	4322.4	30	9080.9	5007.8	30	10025.0	5817.0
40	8285.0	4343.6	40	9110.3	5032.6	40	10059.0	5846.5
50	8310.8	4364.8	50	9139.8	5057.6	50	10093.0	5876.1

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
100°	T=.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
	E=.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
105°	T=.46	.94	1.42	1.90	2.38	2.87	3.34	3.84	4.35	4.84	5.35	5.87	6.40	6.93
	E=.230	.470	.700	.938	1.17	1.42	1.65	1.90	2.14	2.39	2.64	2.90	3.16	3.41
110°	T=.50	1.03	1.55	2.08	2.60	3.14	3.66	4.21	4.76	5.31	5.86	6.43	7.01	7.59
	E=.260	.535	.808	1.08	1.36	1.63	1.91	2.19	2.49	2.61	3.05	3.35	3.65	3.95
115°	T=.54	1.13	1.70	2.29	2.86	3.45	4.03	4.63	5.23	5.83	6.44	7.07	7.70	8.35
	E=.307	624	.939	1.26	1.57	1.89	2.21	2.54	2.87	3.20	3.53	3.88	4.23	4.58
120°	T=.61	1.25	1.89	2.52	3.16	3.81	4.44	5.11	5.78	6.44	7.11	7.80	8.51	9.21
	E=.339	.720	1.08	1.45	1.82	2.20	2.56	2.95	3.33	3.72	4.10	4.50	4.91	5.32

Table II. — Radii, Ordinates and Deflections. Chord = 100 ft.

Deg.	Radius	Mid. Ord.	Tan. Dist.	Def. Dist.	Def. for 1 Ft.	Deg.	Radius	Mid. Ord.	Tan. Dist.	Def. Dist.	Def. for 1 Ft.
	ft.	ft.	ft.	ft.	′		ft.	ft.	ft.	ft.	′
0° 10′	34377.	.036	.145	.291	0.05	7°	819.0	1.528	6.105	12.21	2.10
20	17189.	.073	.291	.582	0.10	20′	781.8	1.600	6.395	12.79	2.20
30	11459.	.109	.436	.873	0.15	30	764.5	1.637	6.540	13.08	2.25
40	8594.4	.145	.582	1.164	0.20	40	747.9	1.673	6.685	13.37	2.30
50	6875.5	.182	.727	1.454	0.25	8	716.8	1.746	6.976	13.95	2.40
1	5729.6	.218	.873	1.745	0.30	20	688.2	1.819	7.266	14.53	2.50
10	4911.2	.255	1.018	2.036	0.35	30	674.7	1.855	7.411	14.82	2.55
20	4297.3	.291	1.164	2.327	0.40	40	661.7	1.892	7.556	15.11	2.60
30	3819.8	.327	1.309	2.618	0.45	9	637.3	1.965	7.846	15.69	2.70
40	3437.9	.364	1.454	2.909	0.50	20	614.6	2.037	8.136	16.27	2.80
50	3125.4	.400	1.600	3.200	0.55	30	603.8	2.074	8.281	16.56	2.85
2	2864.9	.436	1.745	3.490	0.60	40	593.4	2.110	8.426	16.85	2.90
10	2644.6	.473	1.891	3.781	0.65	10	573.7	2.183	8.716	17.43	3.00
20	2455.7	.509	2.036	4.072	0.70	30	546.4	2.292	9.150	18.30	3.15
30	2292.0	.545	2.181	4.363	0.75	11	521.7	2.402	9.585	19.16	3.30
40	2148.8	.582	2.327	4.654	0.80	30	499.1	2.511	10.02	20.04	3.45
50	2022.4	.618	2.472	4.945	0.85	12	478.3	2.620	10.45	20.91	3.60
3	1910.1	.655	2.618	5.235	0.90	30	459.3	2.730	10.89	21.77	3.75
10	1809.6	.691	2.763	5.526	0.95	13	441.7	2.839	11.32	22.64	3.90
20	1719.1	.727	2.908	5.817	1.00	30	425.4	2.949	11.75	23.51	4.05
30	1637.3	.764	3.054	6.108	1.05	14	410.3	3.058	12.18	24.37	4.20
40	1562.9	.800	3.199	6.398	1.10	30	396.2	3.168	12.62	25.24	4.35
50	1495.0	.836	3.345	6.689	1.15	15	383.1	3.277	13.05	26.11	4.50
4	1432.7	.873	3.490	6.980	1.20	30	370.8	3.387	13.49	26.97	4.65
10	1375.4	.909	3 635	7.271	1.25	16	359.3	3.496	13.92	27.84	4.80
20	1322.5	.945	3.718	7.561	1.30	30	348.5	3.606	14.35	28.70	4.95
30	1273.6	.982	3.926	7.852	1.35	17	338.3	3.716	14.78	29.56	5.10
40	1228.1	1.018	4.071	8.143	1.40	18	319.6	3.935	15.64	31.29	5.40
50	1185.8	1.055	4.217	8.433	1.45	19	302.9	4.155	16.51	33.01	5.70
5	1146.3	1.091	4.362	8.724	1.50	20	287.9	4.374	17.37	34.73	6.00
10	1109.3	1.127	4.507	9.014	1.55	21	274.4	4.594	18.22	36.44	6.30
20	1074.7	1.164	4.653	9.305	1.60	22	262.0	4.814	19.08	38.16	6.60
30	1042.1	1.200	4.798	9.596	1.65	23	250.8	5.035	19.94	39.87	6.90
40	1011.5	1.237	4.943	9.886	1.70	24	240.5	5.255	20.79	41.58	7.20
50	982.6	1.273	5.088	10.18	1.75	25	231.0	5.476	21.64	43.28	7.50
6	955.4	1.309	5.234	10.47	1.80	26	222.3	5.697	22.50	44.99	7.80
10	929.6	1.346	5.379	10.76	1.85	27	214.2	5.918	23.35	46.69	8.10
20	905.1	1.382	5.524	11.05	1.90	28	206.7	6.139	24.19	48.38	8.40
30	881.9	1.418	5.669	11.34	1.95	29	199.7	6.360	25.04	50.07	8.70
40	859.9	1.455	5.814	11.63	2.00	30	193.2	6.583	25.88	51.76	9.00

The middle ordinate in inches for any cord of length (C) is equal to .0012 C^2 multiplied by the middle ordinate taken from the above table. Thus, if it desired to bend a 30 ft. rail to fit a 10 degree curve, its middle ordinate should be .0012×900×2.183 or 2.36 inches.

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

Degree of Curve	Radius 50 / sin. ½ def. ang.	½ sub chord / R = sin of ½ def. angle				Length of arc for 100 ft.
		12.5 Ft.	15 Ft.	20 Ft.	25 Ft.	
30°	193.18	1° 51′	2° 17′	2° 58′	3° 43′	101.15
32°	181.39	1° 59′	2° 25′	3° 10′	3° 58′	101.33
34°	171.01	2° 06′	2° 33′	3° 21′	4° 12′	101.48
36°	161.80	2° 13′	2° 41′	3° 33′	4° 26′	101.66
38°	153.58	2° 20′	2° 49′	3° 44′	4° 40′	101.85
40°	146.19	2° 27′	2° 57′	3° 55′	4° 54′	102.06
42°	139.52	2° 34′	3° 05′	4° 07′	5° 08′	102.29
44°	133.47	2° 41′	3° 13′	4° 18′	5° 22′	102.53
46°	127.97	2° 48′	3° 21′	4° 29′	5° 36′	102.76
48°	122.92	2° 55′	3° 29′	4° 40′	5° 50′	103.00
50°	118.31	3° 02′	3° 38′	4° 51′	6° 04′	103.24
52°	114.06	3° 09′	3° 46′	5° 02′	6° 17′	103.54
54°	110.11	3° 16′	3° 54′	5° 13′	6° 31′	103.84
56°	106.50	3° 22′	4° 02′	5° 23′	6° 44′	104.14
58°	103.14	3° 29′	4° 10′	5° 34′	6° 57′	104.43
60°	100.00	3° 35′	4° 18′	5° 44′	7° 11′	104.72

CURVE FORMULAS

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

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

$\text{Sin. } \frac{1}{2} D = \frac{50}{R}$

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

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

$R = \frac{50}{\text{Sin. } \frac{1}{2} D}$

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

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

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

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

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

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

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft. see Table II.), 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.

GENERAL DATA

Right Angle Triangles. Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

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

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

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

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

Leveling. The correction for curvature and refraction, in feet and decimals of feet is equal to $0.5774 d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{2}{3} d^2$. Both corrections are negative.

Probable Error. If d_1, d_2, d_3, etc. are the discrepancies of various results from the mean, and if Σd^2 = the sum of the squares of these differences and n = the number of observations, then the probable error of the mean $= \pm 0.6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$

Solar Ephemeris. Attention is called to the Solar Ephemeris for the current year, published by Keuffel & Esser Co., and furnished free of charge upon request, which is $3\frac{1}{4} \times 5\frac{1}{2}$ in., with about 90 pages of data very useful to the Surveyor; such as the adjustments of transits, levels and solar attachments; directions and tables for determining the meridian and the latitude from observations on the sun and Polaris; stadia measurements; magnetic declination; arithmetic constants; English and Metric conversions; trigonometric formulas; Natural and Logarithmic Functions; and Logarithms of Numbers.

Table IV. — 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 V. — Inches in Decimals of a Foot.

1-16	3-32	⅛	3-16	¼	5-16	⅜	½	⅝	¾	⅞
.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

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							
0	0	0	1.	∞	∞	1.	90
10	0029	.0029		343.8	343.8	1.	50
20	.0058	.0058		171.9	171.9	.99998	40
30	.0087	.0087		114.6	114.6	.99996	30
40	.0116	.0116	1.0001	85.94	85.94	.99993	20
50	.0145	.0145	1.0001	68.76	68.75	.99989	10
1	.0175	.0175	1.0002	57.30	57.29	.99985	89
10	.0204	.0204	1.0002	49.11	49.10	.99979	50
20	.0233	.0233	1.0003	42.98	42.96	.99973	40
30	.0262	.0262	1.0003	38.20	38.19	.99966	30
40	.0291	.0291	1.0004	34.38	34.37	.99958	20
50	.0320	.0320	1.0005	31.26	31.24	.99949	10
2	.0349	.0349	1.0006	28.65	28.64	.99939	88
10	.0378	.0378	1.0007	26.45	26.43	.99929	50
20	.0407	.0407	1.0008	24.56	24.54	.99917	40
30	.0436	.0437	1.0010	22.93	22.90	.99905	30
40	.0465	.0466	1.0011	21.49	21.47	.99892	20
50	.0494	.0495	1.0012	20.23	20.21	.99878	10
3	.0523	.0524	1.0014	19.11	19.08	.99863	87
10	.0552	.0553	1.0015	18.10	18.07	.99847	50
20	.0581	.0582	1.0017	17.20	17.17	.99831	40
30	.0610	.0612	1.0019	16.38	16.35	.99813	30
40	.0640	.0641	1.0020	15.64	15.60	.99795	20
50	.0669	.0670	1.0022	14.96	14.92	.99776	10
4	.0698	.0699	1.0024	14.34	14.30	.99756	86
10	.0727	.0729	1.0027	13.76	13.73	.99736	50
20	.0756	.0758	1.0029	13.23	13.20	.99714	40
30	.0785	.0787	1.0031	12.75	12.71	.99692	30
40	.0814	.0816	1.0033	12.29	12.25	.99668	20
50	.0843	.0846	1.0036	11.87	11.83	.99644	10
5	.0872	.0875	1.0038	11.47	11.43	.99619	85
10	.0901	.0904	1.0041	11.10	11.06	.99594	50
20	.0929	.0934	1.0043	10.76	10.71	.99567	40
30	.0958	.0963	1.0046	10.43	10.39	.99540	30
40	.0987	.0992	1.0049	10.13	10.08	.99511	20
50	.1016	.1022	1.0052	9.839	9.788	.99482	10
6	.1045	.1051	1.0055	9.567	9.514	.99452	84
10	.1074	.1080	1.0058	9.309	9.255	.99421	50
20	.1103	.1110	1.0061	9.065	9.010	.99390	40
30	.1132	.1139	1.0065	8.834	8.777	.99357	30
40	.1161	.1169	1.0068	8.614	8.556	.99324	20
50	.1190	.1198	1.0072	8.405	8.345	.99290	10
7	.1219	.1228	1.0075	8.206	8.144	.99255	83
10	.1248	.1257	1.0079	8.016	7.953	.99219	50
20	.1276	.1287	1.0082	7.834	7.770	.99182	40
30	.1305	.1317	1.0086	7.661	7.596	.99144	30
40	.1334	.1346	1.0090	7.496	7.429	.99106	20
50	.1363	.1376	1.0094	7.337	7.269	.99067	10
							82
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							
8	.1392	.1405	1.0098	7 185	7.115	.99027	82
10	.1421	.1435	1.0102	7.040	6.968	.98986	50
20	.1449	.1465	1.0107	6.900	6.827	.98944	40
30	.1478	.1495	1.0111	6.766	6.691	.98902	30
40	.1507	.1524	1.0115	6.636	6.561	.98858	20
50	.1536	.1554	1.0120	6.512	6.435	.98814	10
9	.1564	.1584	1.0125	6.394	6.314	.98769	81
10	.1593	.1614	1.0129	6.277	6.197	.98723	50
20	.1622	.1644	1.0134	6.166	6.084	.98676	40
30	.1650	.1673	1.0139	6.059	5.976	.98629	30
40	.1679	.1703	1.0144	5.955	5.871	.98580	20
50	.1708	.1733	1.0149	5.855	5.769	.98531	10
10	.1736	.1763	1.0154	5.759	5.671	.98481	80
10	.1765	.1793	1.0160	5.665	5.576	.98430	50
20	.1794	.1823	1.0165	5.575	5.485	.98378	40
30	.1822	.1853	1.0170	5.488	5.396	.98325	30
40	.1851	.1883	1.0176	5.403	5.309	.98272	20
50	.1880	.1914	1.0181	5.320	5.226	.98218	10
11	.1908	.1944	1.0187	5.241	5.145	.98163	79
10	.1937	.1974	1.0193	5.164	5.066	.98107	50
20	.1965	.2004	1.0199	5.089	4.989	.98050	40
30	.1994	.2035	1.0205	5.016	4.915	.97992	30
40	.2022	.2065	1.0211	4.945	4.843	.97934	20
50	.2051	.2095	1.0217	4.877	4.773	.97875	10
12	.2079	.2126	1.0223	4.810	4.705	.97815	78
10	.2108	.2156	1.0230	4.745	4.638	.97754	50
20	.2136	.2186	1.0236	4.682	4.574	.97692	40
30	.2164	.2217	1.0243	4.620	4.511	.97630	30
40	.2193	.2247	1.0249	4.560	4.449	.97566	20
50	.2221	.2278	1.0256	4.502	4.390	.97502	10
13	.2250	.2309	1.0263	4.445	4.331	.97437	77
10	.2278	.2339	1.0270	4.390	4.275	.97371	50
20	.2306	.2370	1.0277	4.336	4.219	.97304	40
30	.2334	.2401	1.0284	4.284	4.165	.97237	30
40	.2363	.2432	1.0291	4.232	4.113	.97169	20
50	.2391	.2462	1.0299	4.182	4.061	.97100	10
14	.2419	.2493	1.0306	4.133	4.011	.97030	76
10	.2447	.2524	1.0314	4.086	3.962	.96959	50
20	.2476	.2555	1.0321	4.039	3.914	.96887	40
30	.2504	.2586	1.0329	3.994	3.867	.96815	30
40	.2532	.2617	1.0337	3.949	3.821	.96742	20
50	.2560	.2648	1.0345	3.906	3.776	.96667	10
15	.2588	.2679	1.0353	3.864	3.732	.96593	75
10	.2616	.2711	1.0361	3.822	3.689	.96517	50
20	.2644	.2742	1.0369	3.782	3.647	.96440	40
30	.2672	.2773	1.0377	3.742	3.606	.96363	30
40	.2700	.2805	1.0386	3.703	3.566	.96285	20
50	.2728	.2836	1.0394	3.665	3.526	.96206	10
							74
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							
16	.2756	.2867	1.0403	3.628	3.487	.96126	74
10	.2784	.2899	1.0412	3.592	3.450	.96046	50
20	.2812	.2931	1.0423	3.556	3.412	.95964	40
30	.2840	.2962	1.0429	3.521	3.376	.95882	30
40	.2868	.2994	1.0438	3.487	3.340	.95799	20
50	.2896	.3026	1.0448	3.453	3.305	.95715	10
17	.2924	.3057	1.0457	3.420	3.271	.95630	73
10	.2952	.3089	1.0466	3.388	3.237	.95545	50
20	.2979	.3121	1.0476	3.357	3.204	.95459	40
30	.3007	.3153	1.0485	3.326	3.172	.95372	30
40	.3035	.3185	1.0495	3.295	3.140	.95284	20
50	.3062	.3217	1.0505	3.265	3.108	.95195	10
18	.3090	.3249	1.0515	3.236	3.078	.95106	72
10	.3118	.3281	1.0525	3.207	3.048	.95015	50
20	.3145	.3314	1.0535	3.179	3.018	.94924	40
30	.3173	.3346	1.0545	3.152	2.989	.94832	30
40	.3201	.3378	1.0555	3.124	2.960	.94740	20
50	.3228	.3411	1.0566	3.098	2.932	.94646	10
19	.3256	.3443	1.0576	3.072	2.904	.94552	71
10	.3283	.3476	1.0587	3.046	2.877	.94457	50
20	.3311	.3508	1.0598	3.020	2.850	.94361	40
30	.3338	.3541	1.0608	2.996	2.824	.94264	30
40	.3365	.3574	1.0619	2.971	2.798	.94167	20
50	.3393	.3607	1.0631	2.947	2.773	.94068	10
20	.3420	.3640	1.0642	2.924	2.747	.93969	70
10	.3448	.3673	1.0653	2.900	2.723	.93869	50
20	.3475	.3706	1.0665	2.878	2.699	.93769	40
30	.3502	.3739	1.0676	2.856	2.675	.93667	30
40	.3529	.3772	1.0688	2.833	2.651	.93565	20
50	.3557	.3805	1.0700	2.811	2.628	.93462	10
21	.3584	.3839	1.0711	2.790	2.605	.93358	69
10	.3611	.3872	1.0723	2.769	2.583	.93253	50
20	.3638	.3906	1.0736	2.749	2.560	.93148	40
30	.3665	.3939	1.0748	2.729	2.539	.93042	30
40	.3692	.3973	1.0760	2.709	2.517	.92935	20
50	.3719	.4006	1.0773	2.689	2.496	.92827	10
22	.3746	.4040	1.0785	2.670	2.475	.92718	68
10	.3773	.4074	1.0798	2.650	2.455	.92609	50
20	.3800	.4108	1.0811	2.632	2.434	.92499	40
30	.3827	.4142	1.0824	2.613	2.414	.92388	30
40	.3854	.4176	1.0837	2.595	2.394	.92276	20
50	.3881	.4210	1.0850	2.577	2.375	.92164	10
23	.3907	.4245	1.0864	2.559	2.356	.92050	67
10	.3934	.4279	1.0877	2.542	2.337	.91936	50
20	.3961	.4314	1.0891	2.525	2.318	.91822	40
30	.3987	.4348	1.0904	2.508	2.300	.91706	30
40	.4014	.4383	1.0918	2.491	2.282	.91590	20
50	.4041	.4417	1.0932	2.475	2.264	.91472	10
							66
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							
24	.4067	.4452	1.0946	2.459	2.246	.91355	66
10	.4094	.4487	1.0961	2.443	2.229	.91236	50
20	.4120	.4522	1.0975	2.427	2.211	.91116	40
30	.4147	.4557	1.0989	2.411	2.194	.90996	30
40	.4173	.4592	1.1004	2.396	2.177	.90875	20
50	.4200	.4628	1.1019	2.381	2.161	.90753	10
25	.4226	.4663	1.1034	2.366	2.145	.90631	65
10	.4253	.4699	1.1049	2.351	2.128	.90507	50
20	.4279	.4734	1.1064	2.337	2.112	.09383	40
30	.4305	.4770	1.1079	2.323	2.097	.90259	30
40	.4331	.4806	1.1095	2.309	2.081	.90133	20
50	.4358	.4841	1.1110	2.295	2.066	.90007	10
26	.4384	.4877	1.1126	2.281	2.050	.89879	64
10	.4410	.4913	1.1142	2.268	2.035	.89752	50
20	.4436	.4950	1.1158	2.254	2.020	.89623	40
30	.4462	.4986	1.1174	2.241	2.006	.89493	30
40	.4488	.5022	1.1190	2.228	1.991	.89363	20
50	.4514	.5059	1.1207	2.215	1.977	.89232	10
27	.4540	.5095	1.1223	2.203	1.963	.89101	63
10	.4566	.5132	1.1240	2.190	1.949	.88968	50
20	.4592	.5169	1.1257	2.178	1.935	.88835	40
30	.4617	.5206	1.1274	2.166	1.921	.88701	30
40	.4643	.5243	1.1291	2.154	1.907	.88566	20
50	.4669	.5280	1.1308	2.142	1.894	.88431	10
28	.4695	.5317	1.1326	2.130	1.881	.88295	62
10	.4720	.5354	1.1343	2.119	1.868	.88158	50
20	.4746	.5392	1.1361	2.107	1.855	.88020	40
30	.4772	.5430	1.1379	2.096	1.842	.87882	30
40	.4797	.5467	1.1397	2.085	1.829	.87743	20
50	.4823	.5505	1.1415	2.073	1.816	.87603	10
29	.4848	.5543	1.1434	2.063	1.804	.87462	61
10	.4874	.5581	1.1452	2.052	1.792	.87321	50
20	.4899	.5619	1.1471	2.041	1.780	.87178	40
30	.4924	.5658	1.1490	2.031	1.767	.87036	30
40	.4950	.5696	1.1509	2.020	1.756	.86892	20
50	.4975	.5735	1.1528	2.010	1.744	.86748	10
30	.5000	.5774	1.1547	2.000	1.732	.86603	60
10	.5025	.5812	1.1566	1.990	1.720	.86457	50
20	.5050	.5851	1.1586	1.980	1.709	.86310	40
30	.5075	.5890	1.1606	1.970	1.698	.86163	30
40	.5100	.5930	1.1626	1.961	1.686	.86015	20
50	.5125	.5969	1.1646	1.951	1.675	.85866	10
31	.5150	.6009	1.1666	1.942	1.664	.85717	59
10	.5175	.6048	1.1687	1.932	1.653	.85567	50
20	.5200	.6088	1.1707	1.923	1.643	.85416	40
30	.5225	.6128	1.1728	1.914	1.632	.85264	30
40	.5250	.6168	1.1749	1.905	1.621	.85112	20
50	.5275	.6208	1.1770	1.896	1.611	.84959	10
							58
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

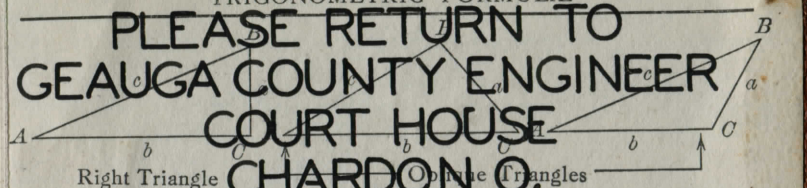
Natural Trigonometrical Functions

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							° ′
32	.5299	.6249	1.1792	1.887	1.600	.84805	58
10	.5324	.6289	1.1813	1.878	1.590	.84650	50
20	.5348	.6330	1.1835	1.870	1.580	.84495	40
30	.5373	.6371	1.1857	1.861	1.570	.84339	30
40	.5398	.6412	1.1879	1.853	1.560	.84182	20
50	.5422	.6453	1.1901	1.844	1.550	.84025	10
33	.5446	.6494	1.1924	1.836	1.540	.83867	57
10	.5471	.6536	1.1946	1.828	1.530	.83708	50
20	.5495	.6577	1.1969	1.820	1.520	.83549	40
30	.5519	.6619	1.1992	1.812	1.511	.83389	30
40	.5544	.6661	1.2015	1.804	1.501	.83228	20
50	.5568	.6703	1.2039	1.796	1.492	.83066	10
34	.5592	.6745	1.2062	1.788	1.483	.82904	56
10	.5616	.6787	1.2086	1.781	1.473	.82741	50
20	.5640	.6830	1.2110	1.773	1.464	.82577	40
30	.5664	.6873	1.2134	1.766	1.455	.82413	30
40	.5688	.6916	1.2158	1.758	1.446	.82248	20
50	.5712	.6959	1.2183	1.751	1.437	.82082	10
35	.5736	.7002	1.2208	1.743	1.428	.81915	55
10	.5760	.7046	1.2233	1.736	1.419	.81748	50
20	.5783	.7089	1.2258	1.729	1.411	.81580	40
30	.5807	.7133	1.2283	1.722	1.402	.81412	30
40	.5831	.7177	1.2309	1.715	1.393	.81242	20
50	.5854	.7221	1.2335	1.708	1.385	.81072	10
36	.5878	.7265	1.2361	1.701	1.376	.80902	54
10	.5901	.7310	1.2387	1.695	1.368	.80730	50
20	.5925	.7355	1.2413	1.688	1.360	.80558	40
30	.5948	.7400	1.2440	1.681	1.351	.80386	30
40	.5972	.7445	1.2466	1.675	1.343	.80212	20
50	.5995	.7490	1.2494	1.668	1.335	.80038	10
37	.6018	.7536	1.2521	1.662	1.327	.79864	53
10	.6041	.7581	1.2549	1.655	1.319	.79688	50
20	.6065	.7627	1.2577	1.649	1.311	.79512	40
30	.6088	.7673	1.2605	1.643	1.303	.79335	30
40	.6111	.7720	1.2633	1.636	1.295	.79158	20
50	.6134	.7766	1.2661	1.630	1.288	.78980	10
38	.6157	.7813	1.2690	1.624	1.280	.78801	52
10	.6180	.7860	1.2719	1.618	1.272	.78622	50
20	.6202	.7907	1.2748	1.612	1.265	.78442	40
30	.6225	.7954	1.2778	1.606	1.257	.78261	30
40	.6248	.8002	1.2808	1.601	1.250	.78079	20
50	.6271	.8050	1.2838	1.595	1.242	.77897	10

Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							° ′
39	.6293	.8098	1.2868	1.589	1.235	.77715	51
10	.6316	.8146	1.2898	1.583	1.228	.77531	50
20	.6338	.8195	1.2929	1.578	1.220	.77347	40
30	.6361	.8243	1.2959	1.572	1.213	.77162	30
40	.6383	.8292	1.2991	1.567	1.206	.76977	20
50	.6406	.8342	1.3022	1.561	1.199	.76791	10
40	.6428	.8391	1.3054	1.556	1.192	.76604	50
10	.6450	.8441	1.3086	1.550	1.185	.76417	50
20	.6472	.8491	1.3118	1.545	1.178	.76229	40
30	.6494	.8541	1.3151	1.540	1.171	.76041	30
40	.6517	.8591	1.3184	1.535	1.164	.75851	20
50	.6539	.8642	1.3217	1.529	1.157	.75661	10
41	.6561	.8693	1.3251	1.524	1.150	.75471	49
10	.6583	.8744	1.3284	1.519	1.144	.75280	50
20	.6604	.8796	1.3318	1.514	1.137	.75088	40
30	.6626	.8847	1.3352	1.509	1.130	.74896	30
40	.6648	.8899	1.3386	1.504	1.124	.74703	20
50	.6670	.8952	1.3421	1.499	1.117	.74509	10
42	.6691	.9004	1.3456	1.494	1.111	.74314	48
10	.6713	.9057	1.3492	1.490	1.104	.74120	50
20	.6734	.9110	1.3527	1.485	1.098	.73924	40
30	.6756	.9163	1.3563	1.480	1.091	.73728	30
40	.6777	.9217	1.3600	1.476	1.085	.73531	20
50	.6799	.9271	1.3636	1.471	1.079	.73333	10
43	.6820	.9325	1.3673	1.466	1.072	.73135	47
10	.6841	.9380	1.3711	1.462	1.066	.72937	50
20	.6862	.9435	1.3748	1.457	1.060	.72737	40
30	.6884	.9490	1.3786	1.453	1.054	.72537	30
40	.6905	.9545	1.3824	1.448	1.048	.72337	20
50	.6926	.9601	1.3863	1.444	1.042	.72136	10
44	.6947	.9657	1.3902	1.440	1.036	.71934	46
10	.6967	.9713	1.3941	1.435	1.030	.71732	50
20	.6988	.9770	1.3980	1.431	1.024	.71529	40
30	.7009	.9827	1.4020	1.427	1.018	.71325	30
40	.7030	.9884	1.4061	1.422	1.012	.71121	20
50	.7050	.9942	1.4101	1.418	1.006	.70916	10
	.7071	1.	1.414	1.414	1.	.70711	45

Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle



Solution of Right Triangles

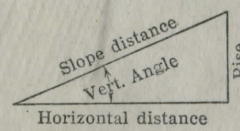
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a\sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c\sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90° - A, b = a \cot A, c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90° - A, a = b \tan A, c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90° - A, a = c \sin A, b = c \cos A,$

Solution of Oblique Triangles

Given	Required	
A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A}, C = 180° - (A + B), c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}, C = 180° - (A + B), c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180° - C, \tan \frac{1}{2}(A - B) = \frac{(a-b)\tan \frac{1}{2}(A+B)}{a+b}, c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{b\,c}}, \sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{a\,c}}, C = 180° - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2}$, area $= \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	area $= \frac{b\,c \sin A}{2}$
A, B, C, a	Area	area $= \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. From Table, Page IX. cos 5° 10′ = .9959. Horizontal distance = 319.4 × .9959 = 318.09 ft. Horizontal distance also = Slope distance minus slope distance times (1 — cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 — .9959 = .0041. 319.4 × .0041 = 1.31. 319.4 — 1.31 = 318.09 ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance $= 302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.