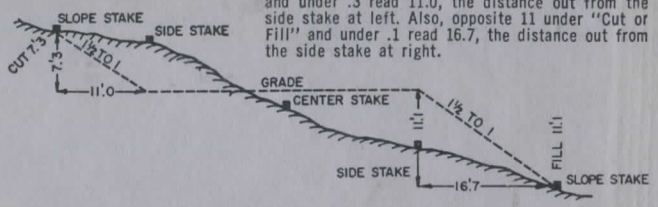
FIELD BOOK

82 0002

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.



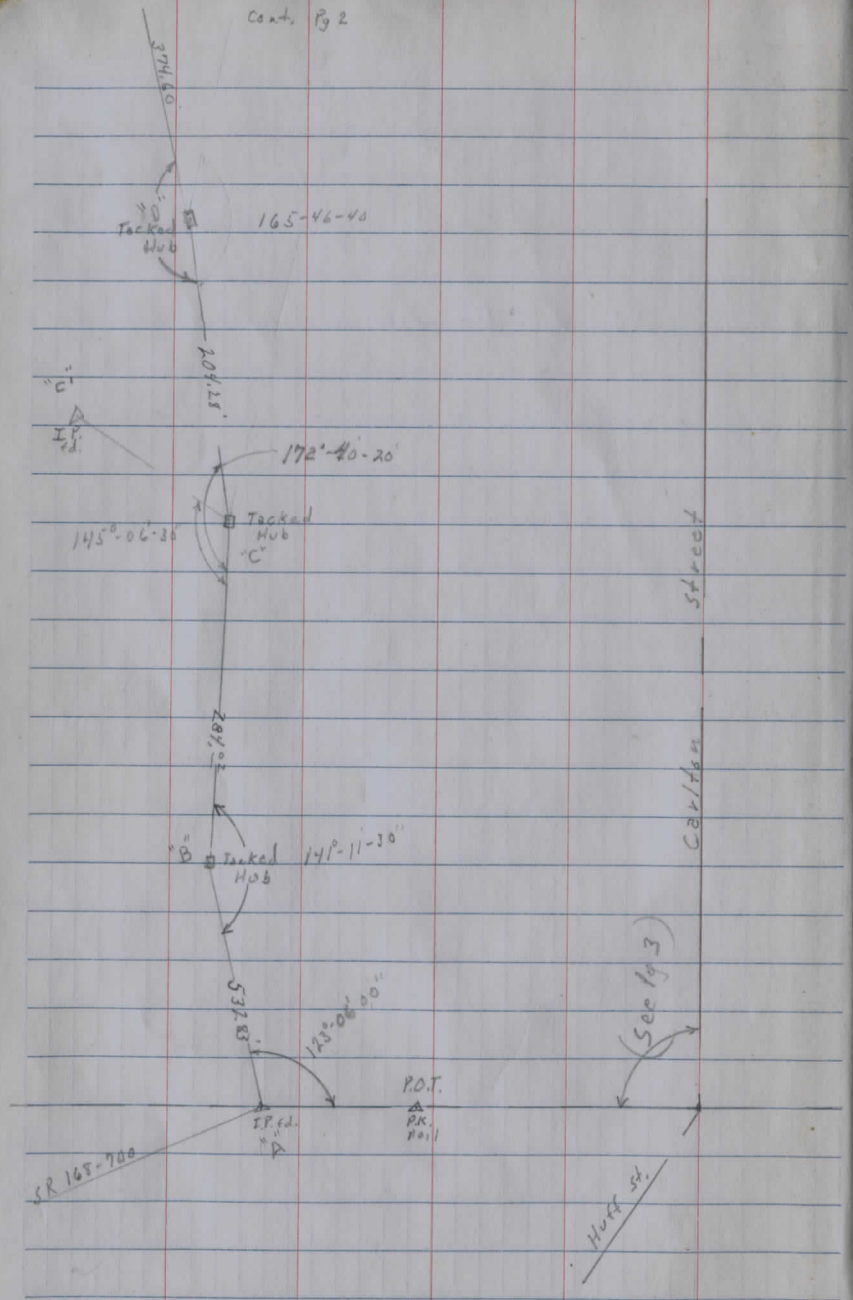
Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	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

For Curve Tables see end of book.

K&E The paper in this book is made of 100% high grade rag stock with a WATER RESISTING surface sizing.

KEUFFEL & ESSER CO.

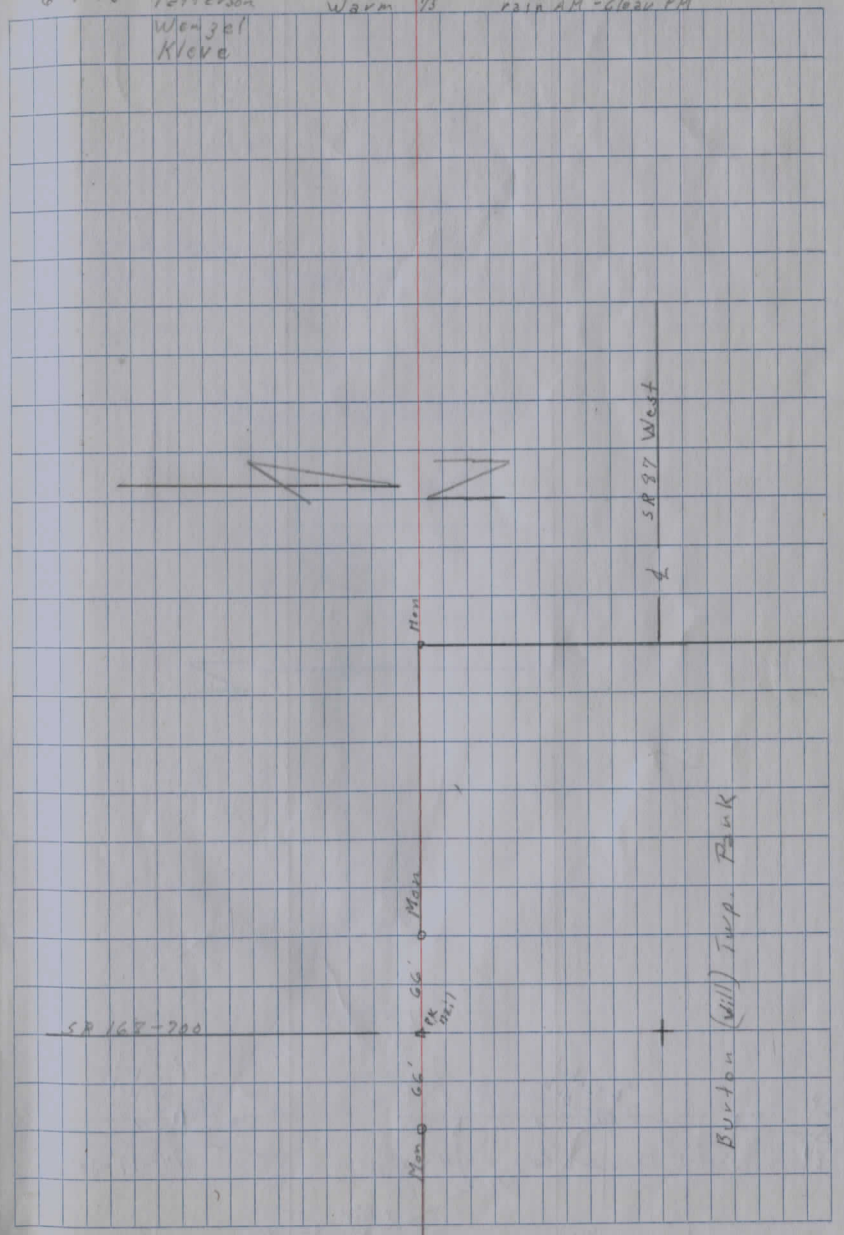
Cont. Pg 2

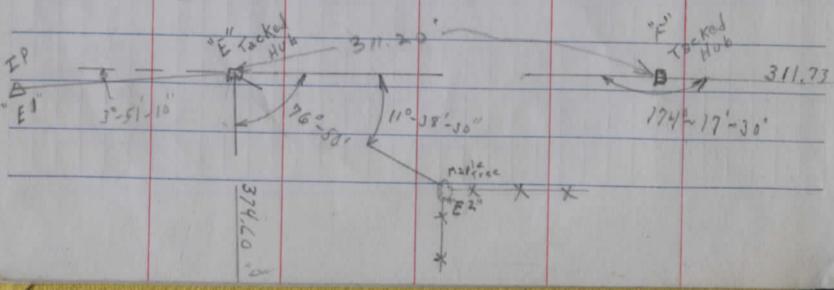


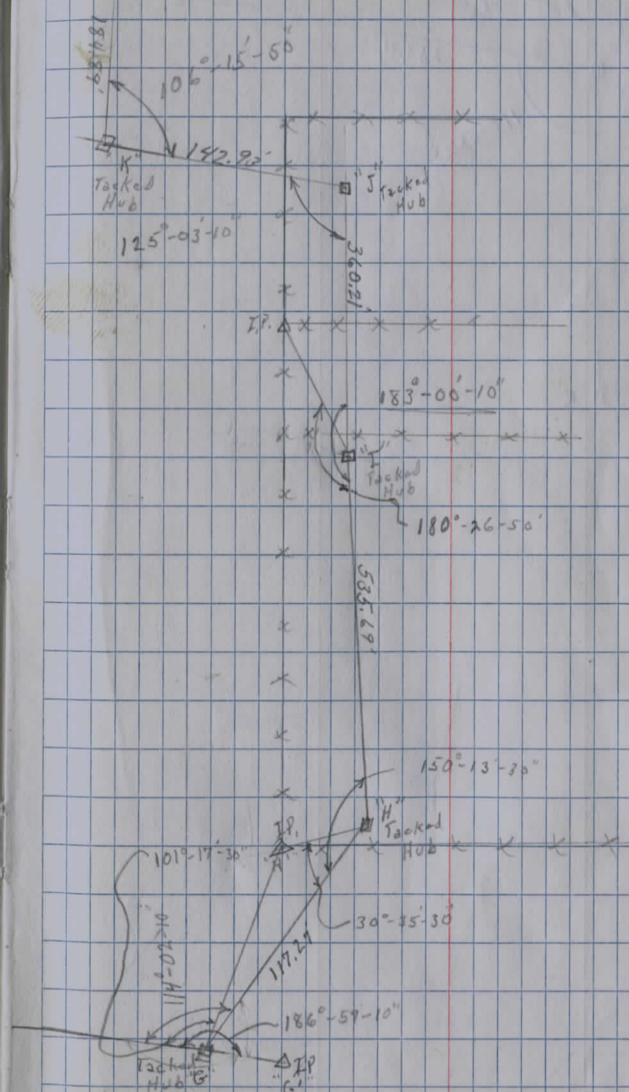
Burton Twp. Property Survey (1)

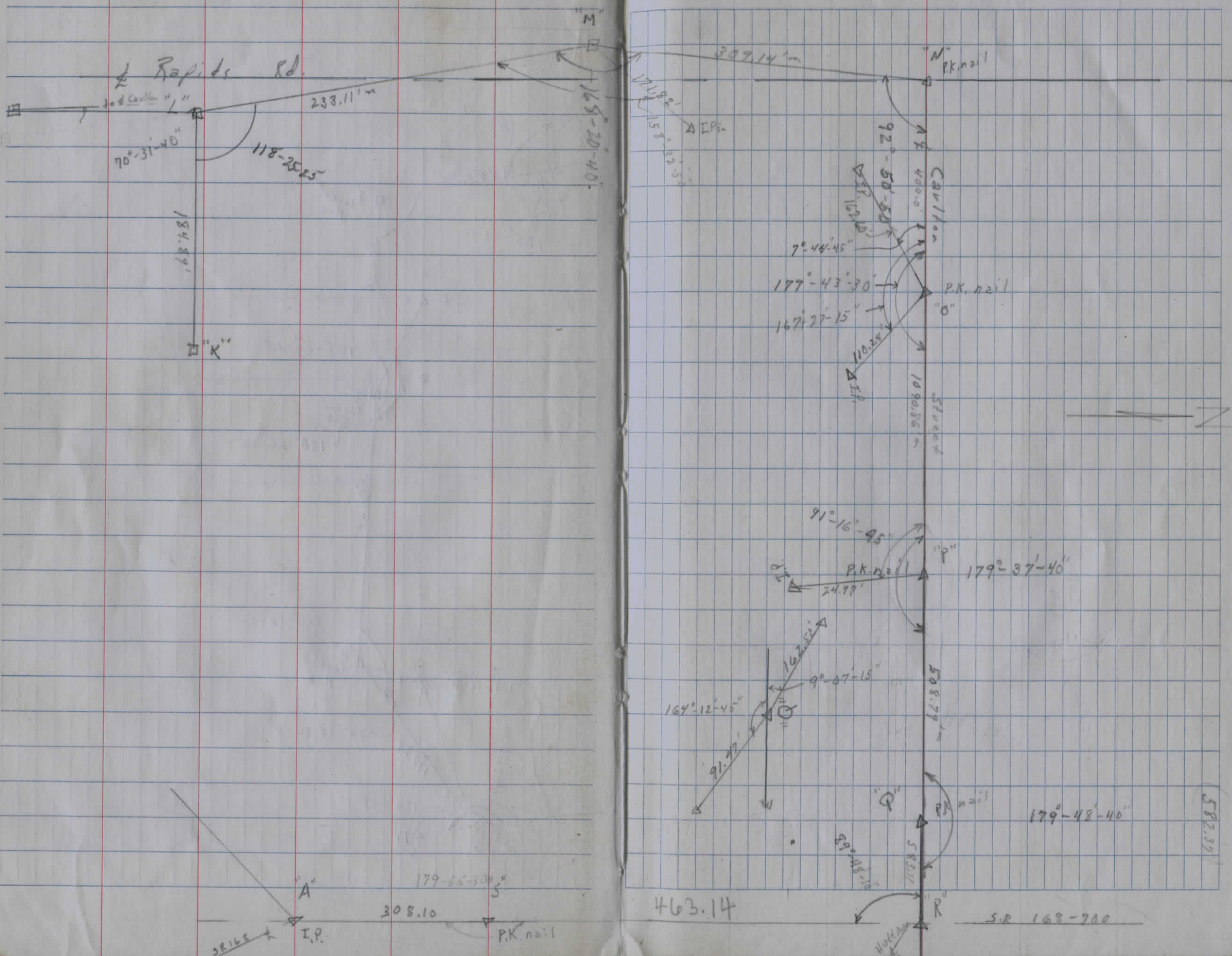
6-4-73 Patterson Warm 75° rain AM - Clear PM

Wengel
Kleve

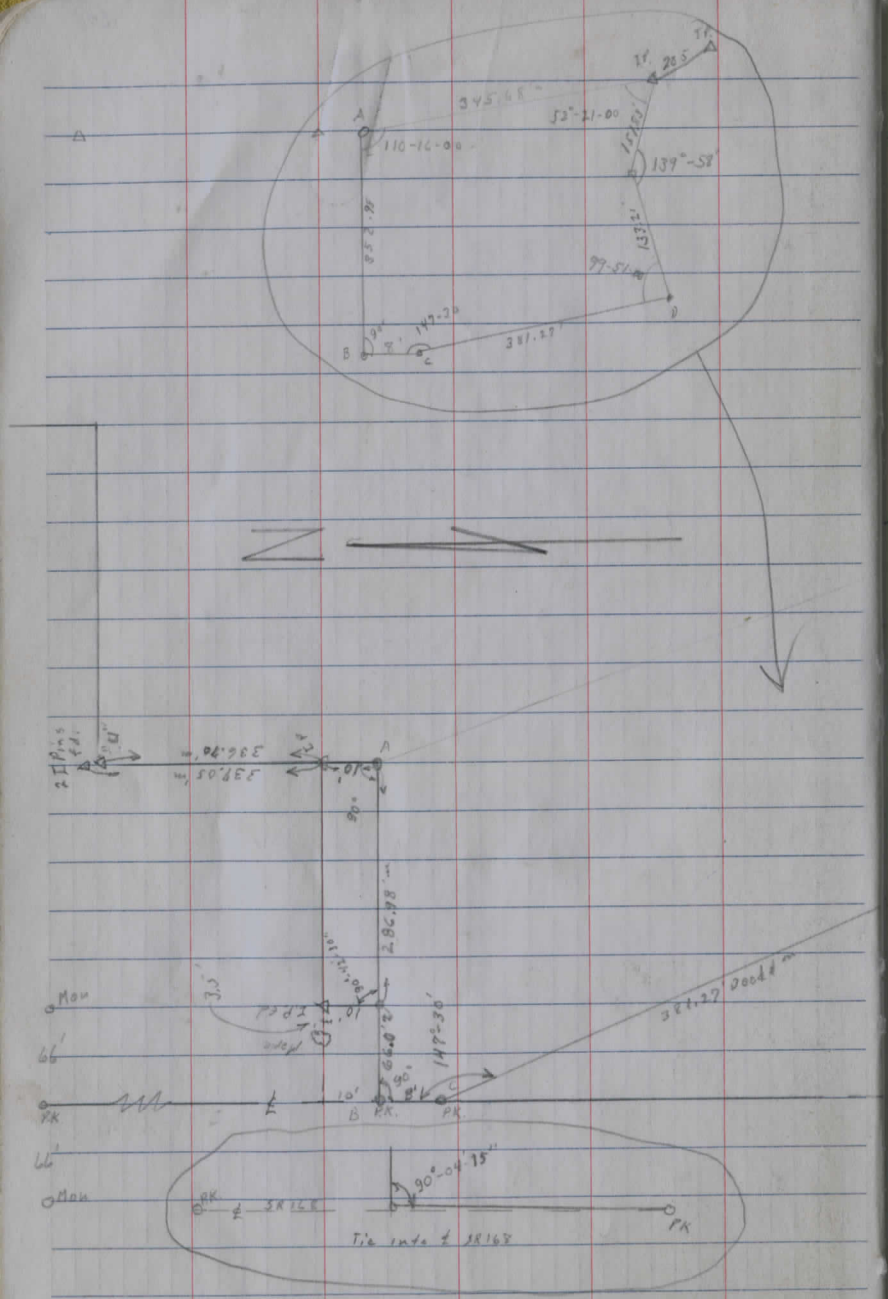



I.P.
"E1"
3°-51'-10"
"E" Tacked Hub
311.20'
"F" Tacked Hub
311.73
76°-53'
11°-38'-30"
174°-17'-30"
Maple tree
E2
374.60'


189.18'
106°-15'-50"
142.92'
"K" Tacked Hub
"J" Tacked Hub
125°-03'-10"
360.21'
I.P.
183°-00'-10"
"I" Tacked Hub
180°-26'-50"
535.69'
150°-13'-30"
"H" Tacked Hub
I.P.
101°-17'-30"
111°-07'-40"
117.27
30°-35'-30"
186°-59'-10"
Tacked Hub "G"
I.P.
"G'"

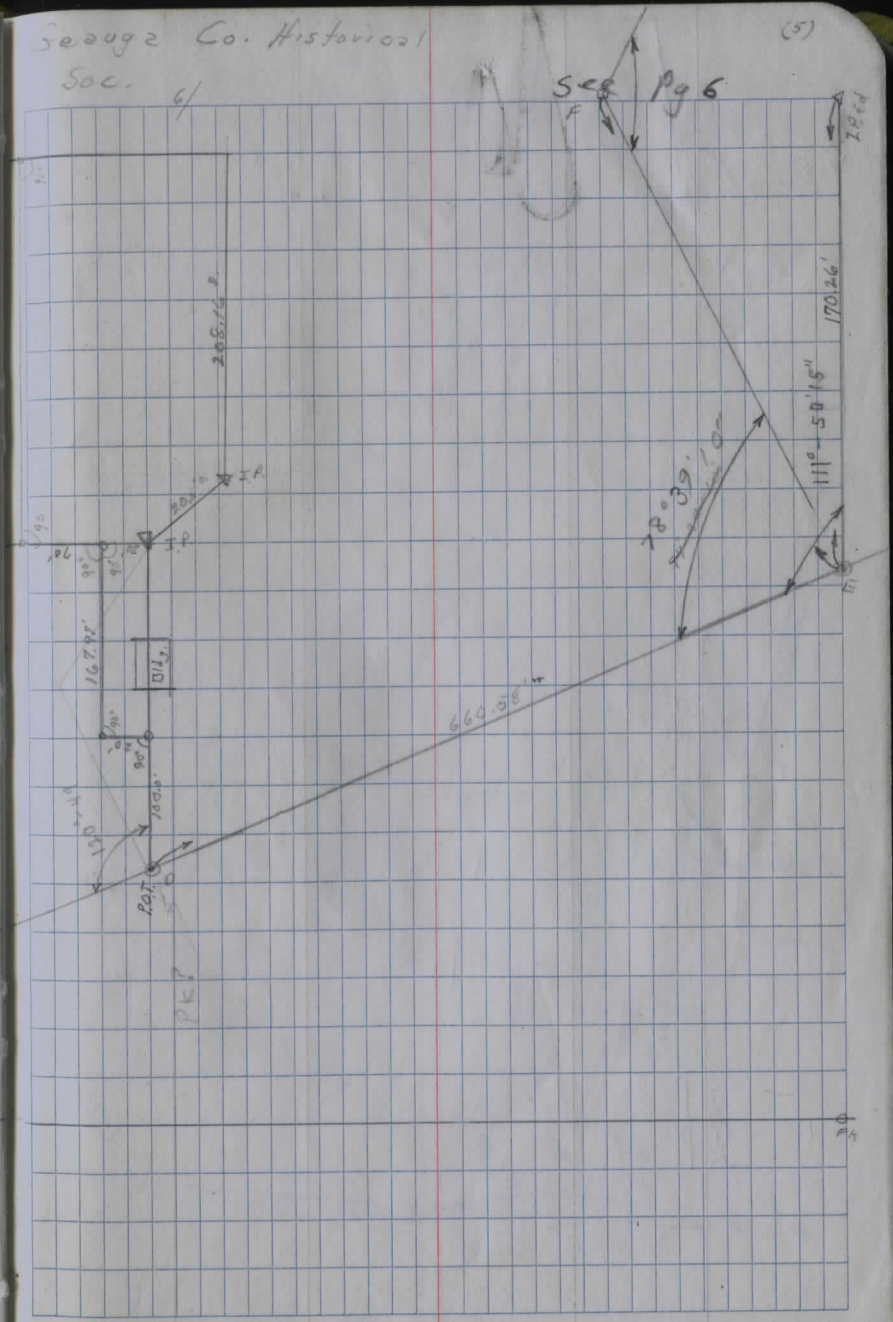


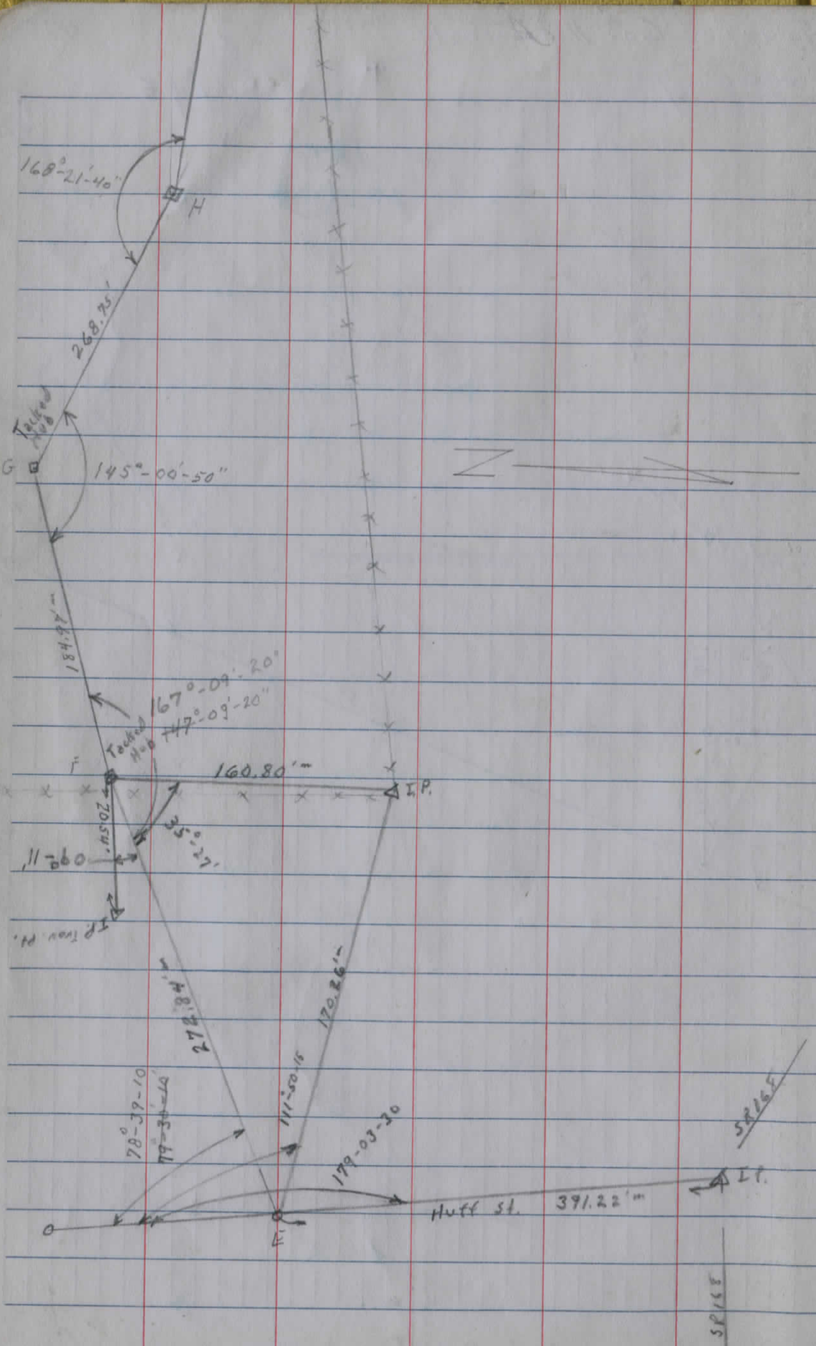
℄ Rapids Rd.
"M"
"N" P.K. nail
309.14'm
233.11'm
"L"
"K"
70°-31'-40"
118-25-25"
184.89'
165°-20'-40"
171.82'
I.P.
92°-50'-50"
℄ Carlton
400.0'
I.P.
7°-44'-45"
177°-43'-30"
P.K. nail
"O"
167°-27'-15"
110.24'
I.P.
1090.86'm
91°-16'-45"
"P"
P.K. nail
179°-37'-40"
24.97'
I.P.
9°-07'-15"
164°-12'-45"
91.47'
508.79'
"Q"
PK nail
179°-48'-40"
582.37
89°-48'-10"
"R"
463.14
S.R. 168-700
"A"
"S"
179-55-30"
308.10
I.P.
P.K. nail

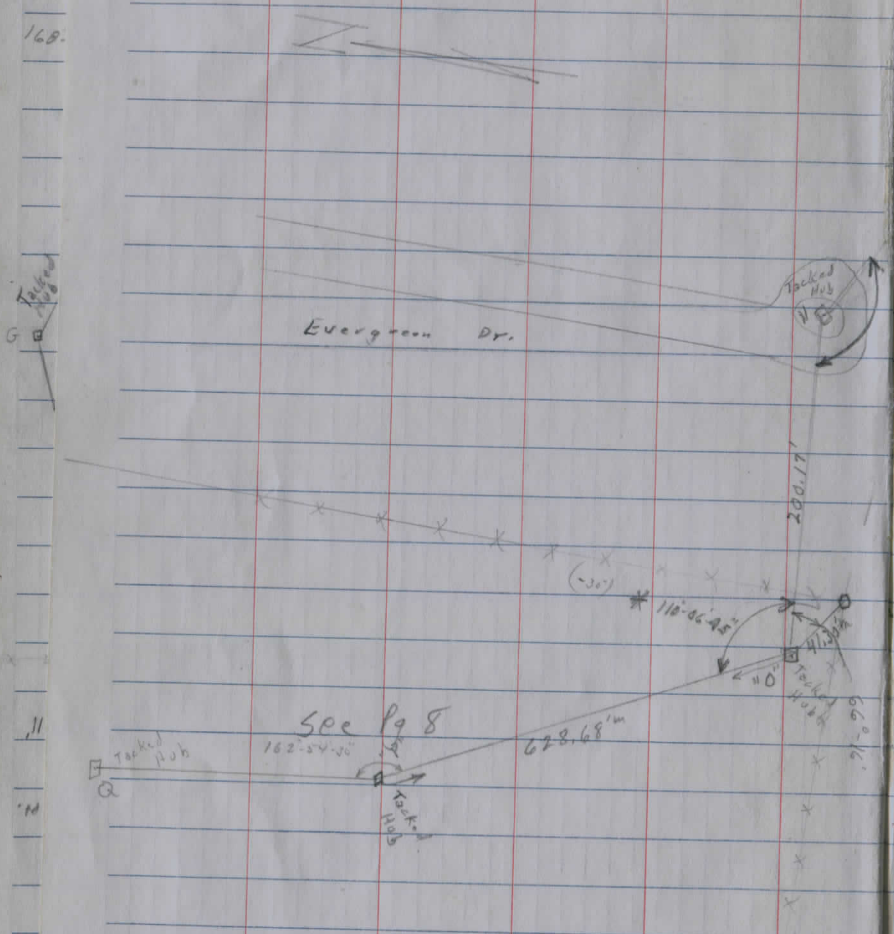


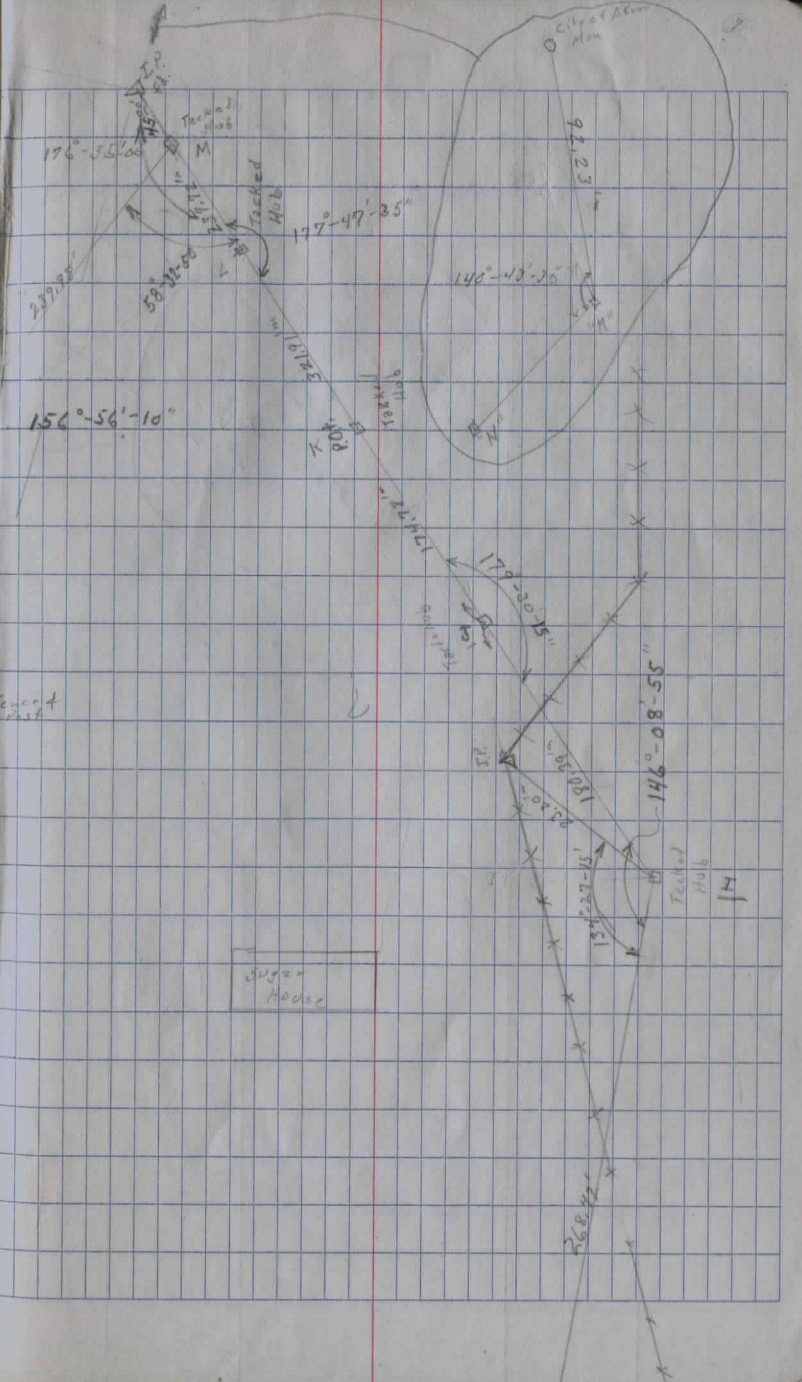
Seauge Co. Historical Soc. 6/

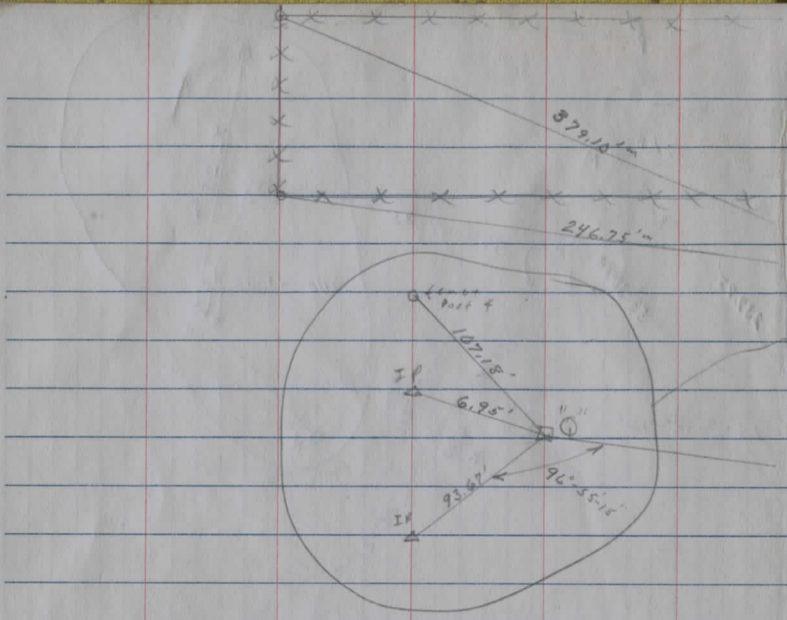
(5)

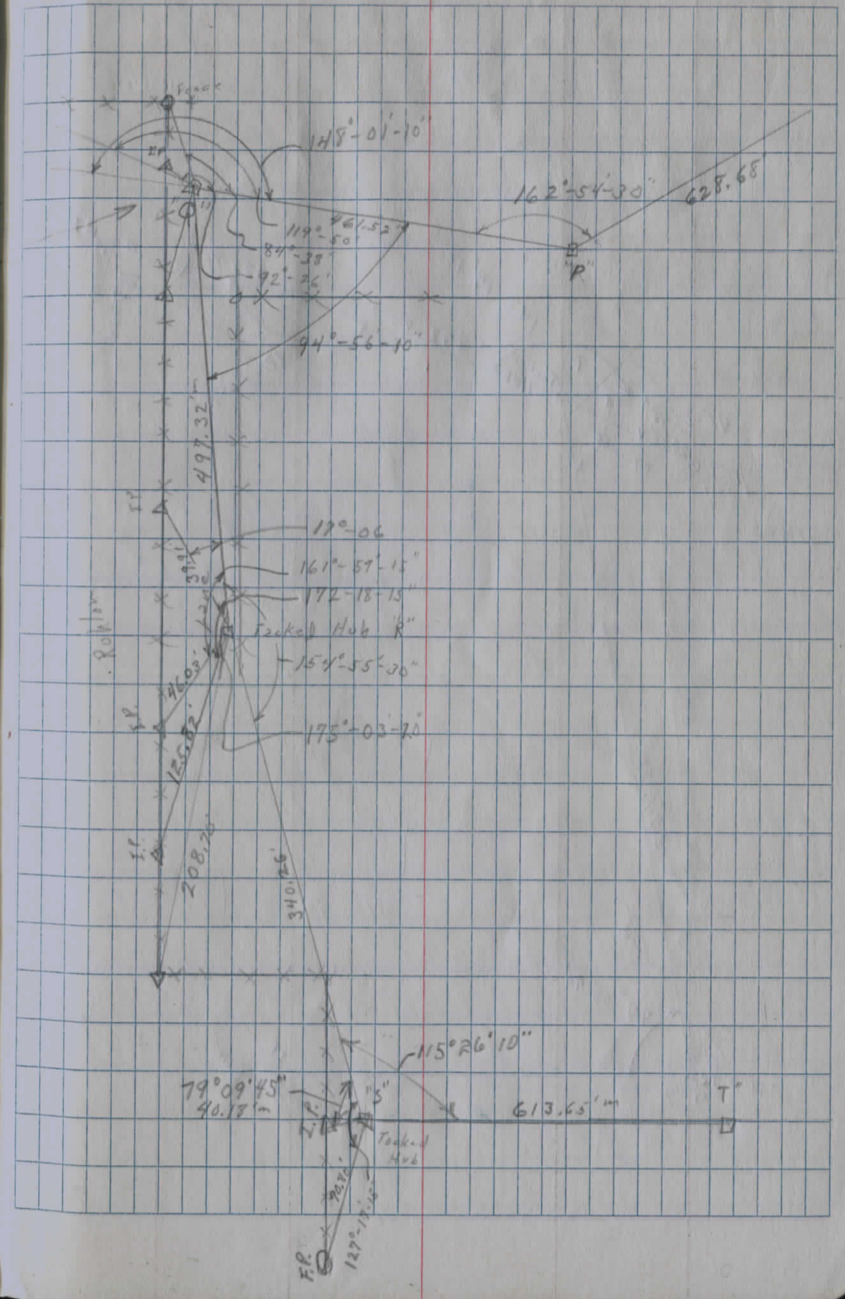


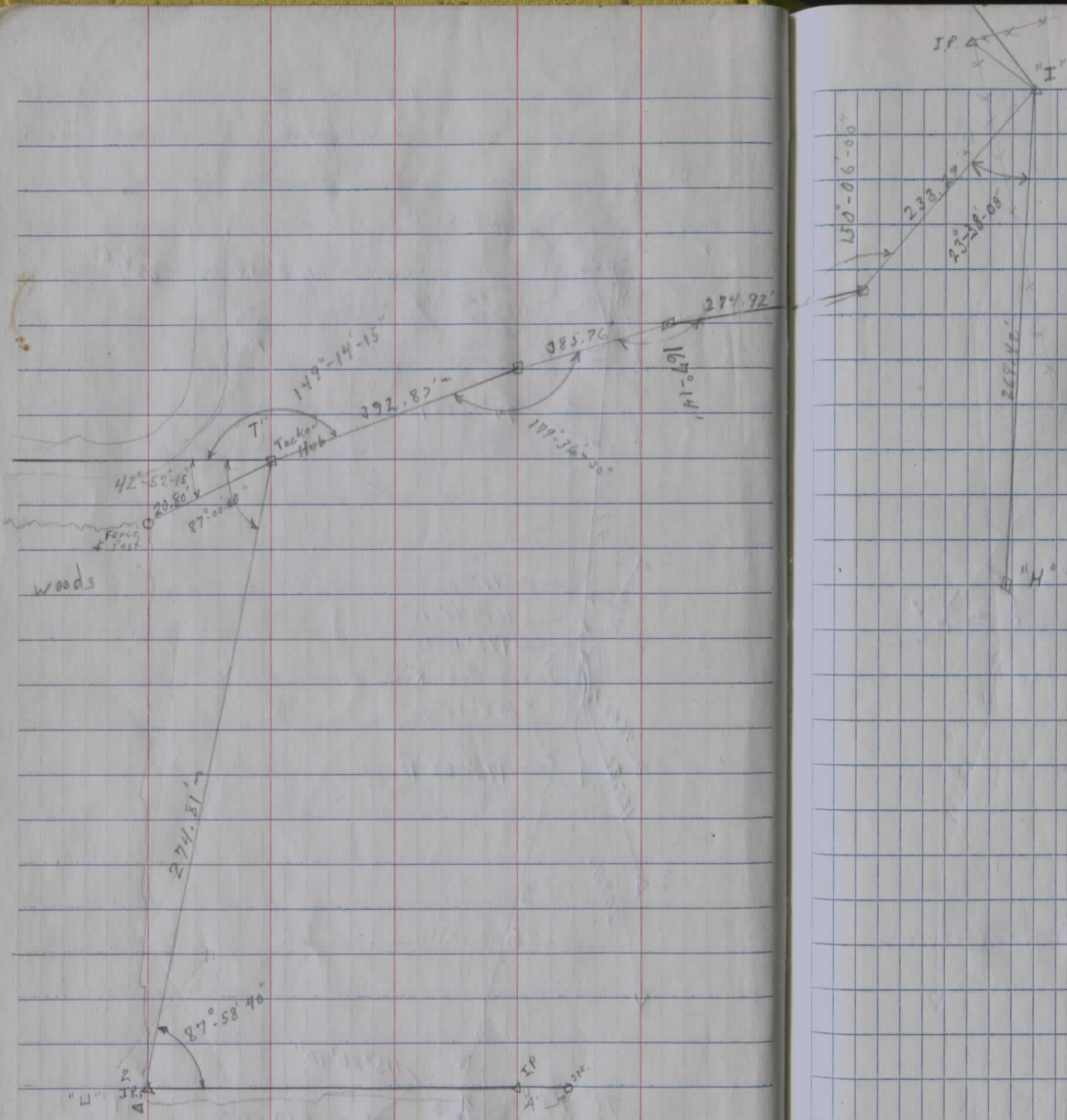

168°-21'-40"
H
268.75'
Tacked Hub
G
145°-00'-50"
167°-09'-20"
147°-09'-20"
Tacked Hub
F
160.80'
I.P.
35°-27'
I.P. Iron Pi.
272.84'
170.26'
78°-39'-10
111°-50-15
179-03-30
E
Hutt St.
391.22'
I.P.
SPIKE
SPIKE

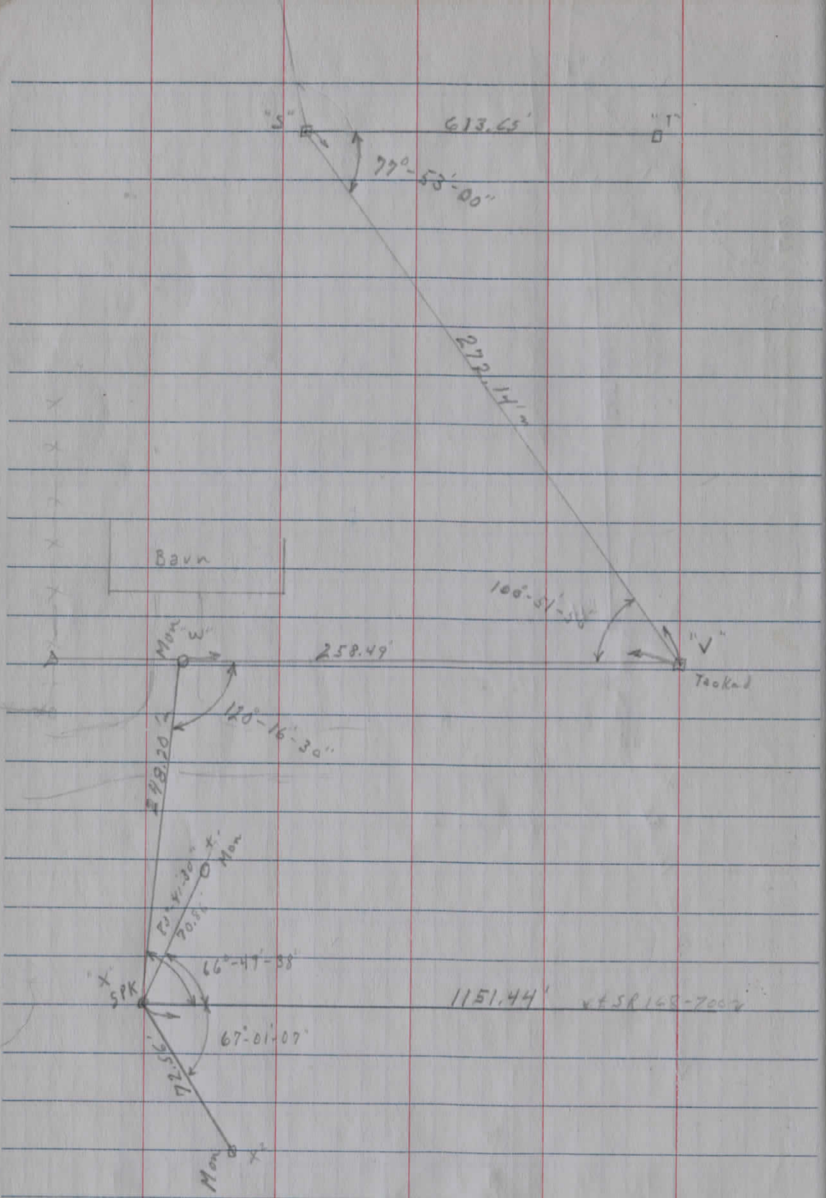

Evergreen Dr.
Tacked Hub
200.17'
110°-46'-45"
Fence Post
"O"
Tacked Hub
See Pg 8
628.68'm
162°-54'-30"
Tacked Hub
Q
G
Tacked Hub

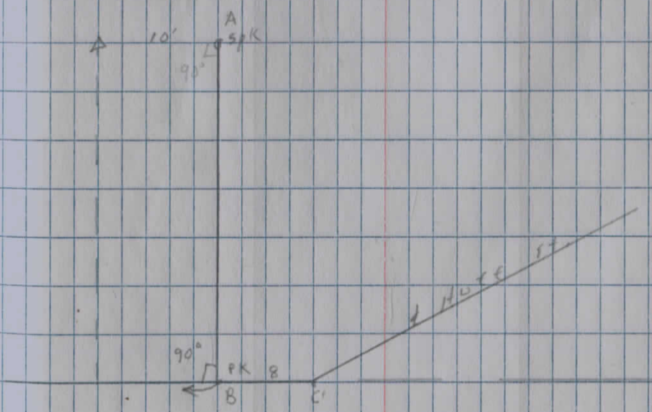

I.P.
Tacked Hub
M
176°-35'-00"
Tacked Hub
177°-47'-35"
239.88'
58°-32'-00"
156°-56'-10"
City of Akron Mon
92.23'
140°-48'-30"
"M"
N
K
179°-20'-15"
146°-08'-55"
I.P.
Tacked Hub
H
Sugar House
134°-27'-35"
568.42'


379.18'm
246.75'm
107.18'
I.P.
6.95'
93.47'
96°-55-15"
I.P.


Fence
I.P.
148°-01'-10"
162°-54'-30"
628.68'
461.52'
119°-50'
84°-33'
92°-26'
"P"
94°-56-10"
497.32'
17°-06
161°-59'-15"
172°-18'-15"
Tacked Hub "R"
154°-55'-30"
175°-03'-20"
46.03'
135.82'
208.70'
340.26'
115°26'10"
79°09'45"
40.18'm
"S"
613.65'm
"T"
Tacked Hub

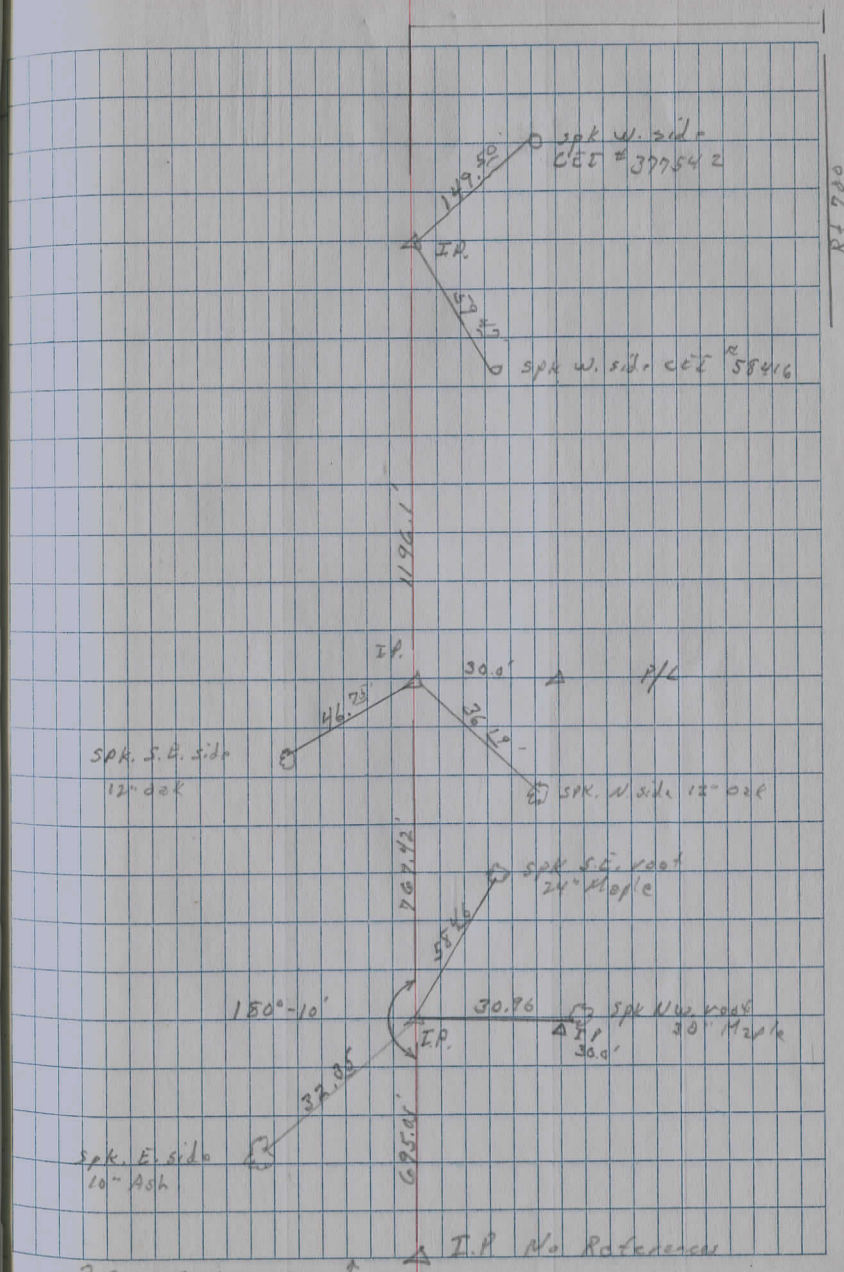

I.P.
"I"
150°-06'-00"
233.29'
23°-38'-08"
269.42'
"H"
274.92'
385.76'
169°-14'
149°-14'-15"
392.87'
179°-36'-30"
"T"
Tack in Hub
42°-52'-15"
20.80'
87°-00'-00"
Fence Post
woods
274.81'
87°-58'-40"
"E"
I.P.
"A"
Spk.


"S"
613.65'
"T"
77°-53'-00"
272.14'
Barn
"V"
Tacked
Mon "W"
258.49'
120°-16'-30"
248.20'
Mon
66°-47'-38"
"X"
SPK
1151.44'
67°-01'-07"
72.56'
Mon


A
SPK
10'
90°
PK
B
C'

Tilden Rd. @
Troy Twp.

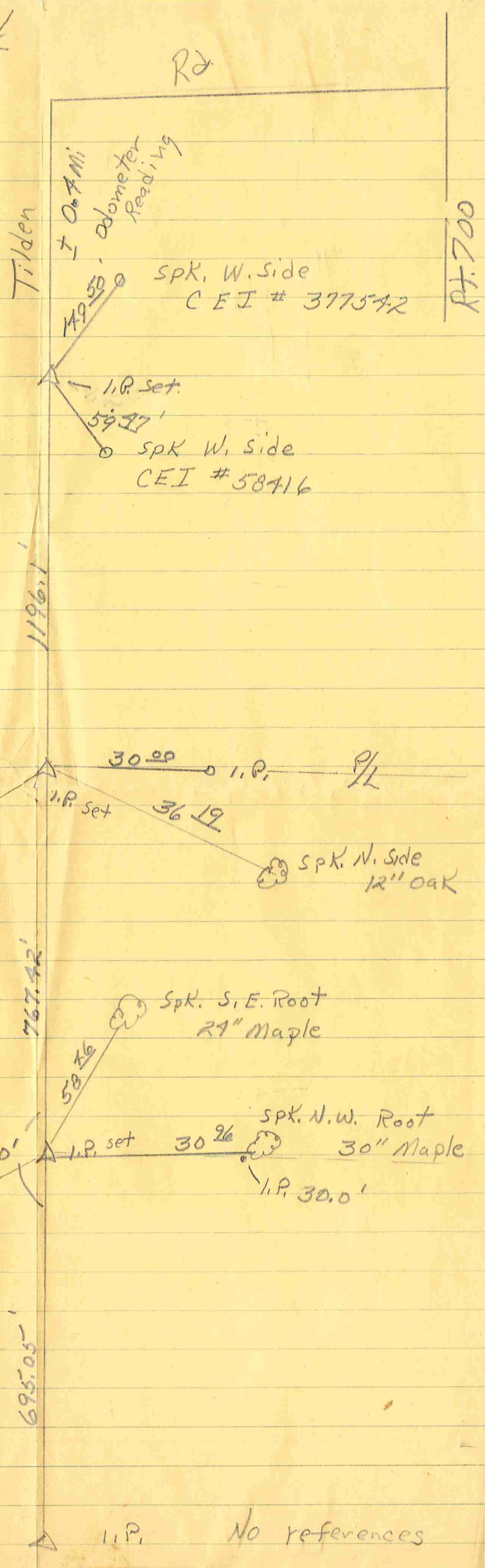
Copied from Jim Russell
Survey 1973
(See F.B. 160 Pg. 18 T.R. Root 1956)



Jim Russell
Oct, 1973

Tilden Rd. ℄ Troy Twp.

I.P. = 5/8" Reinforcing Rod.

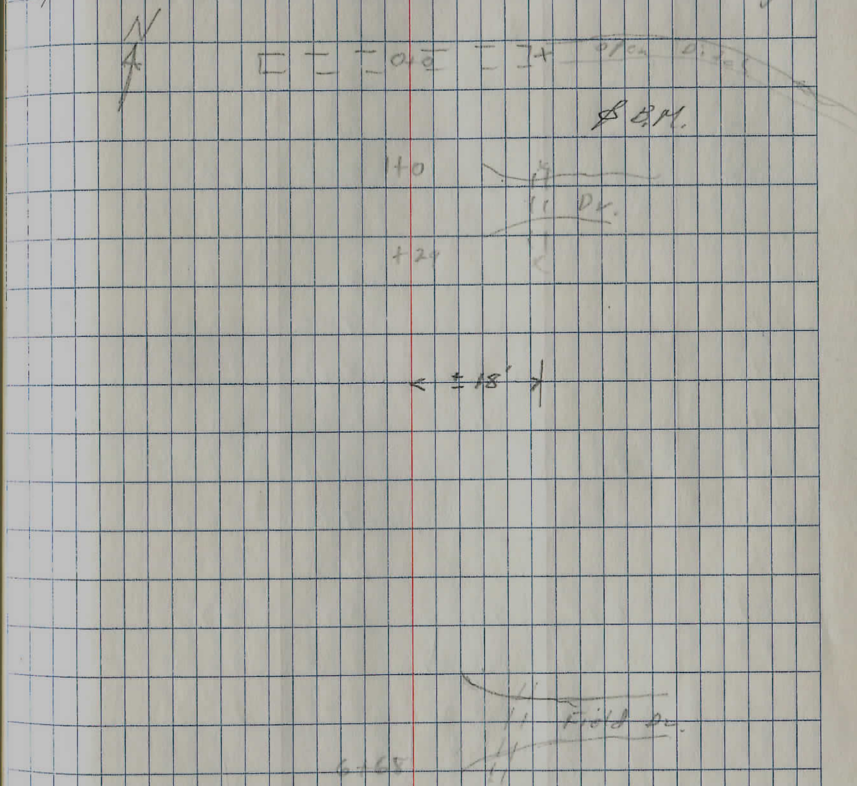


H. Patterson
L. Ballinger
7/21/75

#42 Ledge Road
Ditch Levels

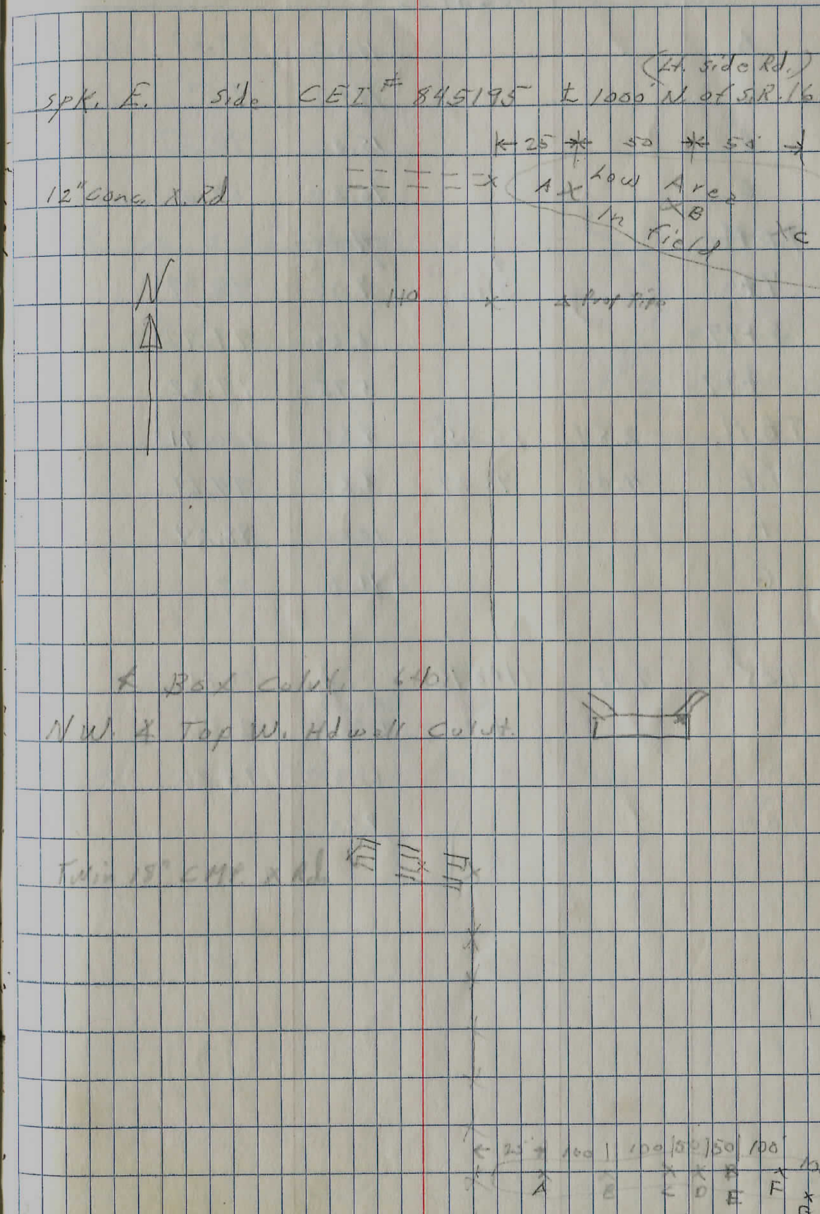
B.M.	7.49	107.49		100.00	
		℄	E. Ditch		
0+0		8.30	12.75		F/L of Ditch Not Pipe
1+0		7.90	Outlet 12" CMP 10.00		
+29			Inlet 12" CMP 9.85		
2+0		7.35	8.65		
3+0		6.45	7.50		
4+0		5.80	6.95		
5+0		4.90	5.90		
6+0		3.66	5.05		
7+0		2.45	3.15		
+68		2.00	5.05		F/L 18" Conc. Pipe
B.M.			7.49	100.00	

S pk. SW side CEI 587724 ± 600 S. of Stocking Rd (5th Pole) Lt.



H. Patterson #68 Williams Ditch Road Levels
L. Ballenger 7/21/75

	+			ELEV	
B.M.	2.57	102.57		100.00	
		℄ Rd.	E. Ditch	DITCH ELEV	
0+0		97.79 4.80	7.60	95.00	E/L offset
A			6.75	95.84	
B			7.60	94.99	
C		℄ ELEV	8.10	94.49	
1+0		97.79 4.80	6.90	95.69	
2+0		97.69 4.90	7.05	95.54	
3+0		96.14 6.45	8.60	93.99	
4+0		91.09 11.50	13.40	89.19	
T.P.	2.42	93.26	11.75	90.84	
5+0		87.56 5.70	7.10	86.10	
6+0		86.86 6.40	11.00	82.26	F/L
T.B.M #2	6.17	93.90	5.53	87.73	
T.P.	11.69	102.51	3.08	90.82	
B.M. #1	5.37	105.37	2.51	100.00	
	W. DITCH	℄ 95.17	E. DITCH		
0+0	12.80	[illegible]	12.85	92.52	
1+0		95.07 10.30	12.40	92.97	
2+0		95.27 10.10	12.10	93.27	
3+0		96.37 9.00	11.25	94.12	
4+0		97.72 7.65	10.20	95.17	
5+0		98.87 6.50	8.35	97.02	
6+0		99.12 6.25	8.45	96.92	
A			8.70	96.67	25'



		105.37			
B			11.50	93.87	100
C			14.00	91.37	100
D			15.30	90.07	50
E			16.30	89.07	50
~~T.B.M.~~			~~4.66~~		
7+0		± 100.22 5.15	7.00	98.37	
+77			5.65	99.72	
+97			5.75	99.62	
T.B.M	2.84	103.55	4.66	100.71	
T.P.	4.00	98.29	9.26	94.29	
F.			10.00	88.29	
G			11.30	87.00	
TBM	7.45	108.16		100.71	
		± 103.21 4.95	5.80	102.36	
			12.50	95.66	
TBM			7.45		

R.R. spk. 5. s.d. Tel. pl. 37X008

12" CMP. Dr. pipe?

12" " "

495' to 12" X Rd. culvert south

RR spk Tel pl. 37X008

12" CMP. x Rd. ± 1000 N. of above culvt (0.55 M.) from SR 166

D. Shannon
L. Bollinger 7/30/75 #491 Russell Lane Ditch Levels

	+	HI	−	℄ DITCH Elev	
TBM	0.57	100.57		100.00	
0+00			4.71	95.86	✓
0+00			7.23	93.34	
0+00			7.25	93.32	
0+00			7.35	93.22	
0+00			6.29	94.28	
0+00			4.76	95.81	
0+50			5.59	94.98	✓
1+00			6.70	93.87	✓
1+09			7.29	93.28	✓
1+39			7.56	93.01	✓
1+50			7.84	92.73	✓
2+00			9.04	91.53	✓
T.P.	0.50	94.57	6.50	94.07	
2+50			4.32	90.25	✓
2+55			4.63	89.94	✓
2+75			5.03	89.54	✓
3+00			5.42	89.15	✓
3+05			7.04	87.53	
3+50			6.12	88.45	✓
4+00			6.57	88.00	✓
4+50			6.77	87.88	✓
4+79			6.93	87.64	✓
5+00			7.04	87.53	✓

Page 1 of 3

℄ DITCH ≈ 10' SOUTH EDGE ROAD

Spk. 1' UP ON N. SIDE CEI pole #669471

TOP OF FRAME SOUTH SIDE CB @ 27+45

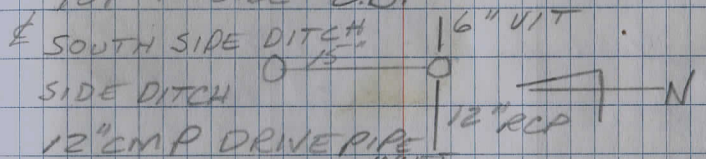
FLOW 15" RCP LATERAL INLET TO CB

FLOW 6" VIT. INLET TO CB

FLOW 12" RCP OUTLET TO CB

FLOW INLET 15" RCP LATERAL N. SIDE INLET

TOP N. SIDE C.B.



12" CMP DRIVE PIPE INLET

" " " OUTLET

12" RCP OUTLET 10' LT of ditch ℄

12" CMP DRIVE PIPE INLET

" " " OUTLET ℄

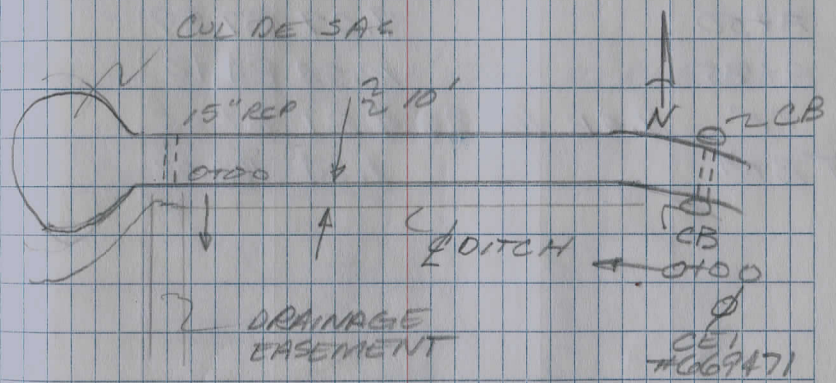
		94.57		
5+50			7.20	87.37 ✓
5+92			7.26	87.31
6+00			—	—
6+12			7.58	86.99
6+27			8.22	86.35
TP	9.87	100.46	3.98	90.59
TBM			0.47	99.99

8/1/75

DRAINAGE EASEMENT

	+	HI	−	ELEV
TBM	0.13	100.13		100.00
TP	4.81	94.66	10.28	89.85
0+50			8.34	86.32
1+00			8.51	86.15
1+50			8.94	85.72
DITCH LINE				
6+50			6.75	87.91 ✓
7+00			6.25	88.41 ✓

12" CMP INLET DRIVE PIPE
@ ℄ of DRIVE
12" CMP OUTLET DRIVE PIPE
15" RCP LATERAL OUTLET ⅓ ℄ drainage.



Spk IN CEI POLE #669471

FLOW drainage easement
" " "
" " "

℄ ditch 10' LT EDGE ROAD

		94.66			
7+20			6.70	87.96	✓
7+45			6.62	88.04	✓
7+50			6.61	88.05	✓
7+85			6.79	87.87	✓
8+15			6.63	88.03	✓
8+50			7.07	87.59	✓
8+85			10.54	84.12	✓
T.P.	11.41	101.26	4.81	89.85	
TBM			1.24	100.02	

12" CMP DRIVE PIPE INLET

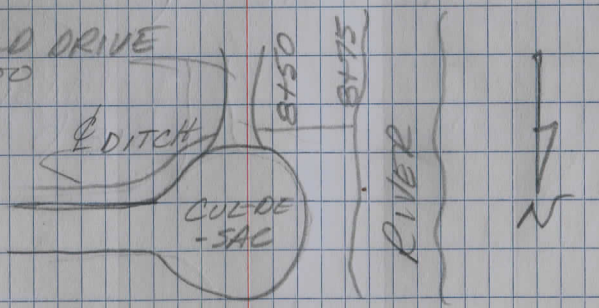
" " " OUTLET

CUL DE SAC DITCH BEGINS

BEGIN FIELD DRIVE (NO DRIVE PIPE)

END " "

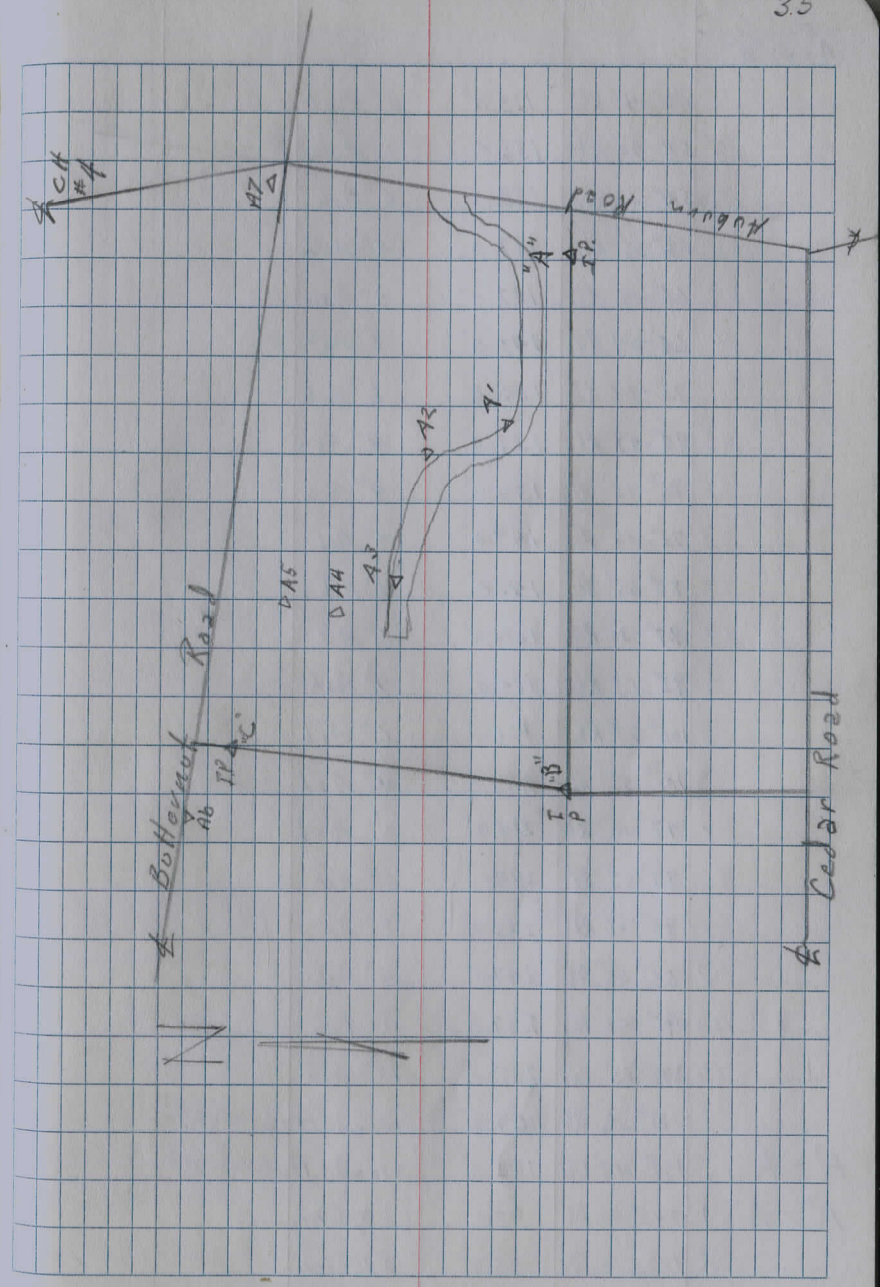
RIVER BANK (± 10' DROP TO RIVER)



10/27/75 Maple Hill Cemetery
H. Patterson Munson Twp.
I. Bollinger
Houtz & Stad. Dist.

Set A-85."8"

1	0°-45' Rt	308.0'	12" Maple
2	3°-50' Rt	310.0'	6" Birch
3	4°-35' Rt	300.0'	6" Birch
4	0°-27' Rt	244.0'	C.E.I. Pole
5	6°-46' Rt	216.0'	8" Tulip
6	11°-28' Rt	161.0'	4" Ash
7	12°-03' Rt	126.0'	4" Ash
8	26°-28' Rt	105.0	5" Ash
9	27°-52' Rt	123.0	4" Ash
10	27°-32' Rt	133.0	5" Ash
11	26°-17' Rt	115.0	4" Ash
12	30°-01' Rt	141.0	8" Ash
13	30°-25' Rt	144.0	6" Twin Ash
14	38°-09' Rt	129.0'	8" Ash
15	41°-25' Rt	118.0'	5" Ash
16	40°-45' Rt	120.0'	4" Ash
17	39°-16' Rt	118.0	4" Ash
18	37°-40' Rt	123.0'	4" Ash
19	37°-52' Rt	113.0'	5" Ash
20	30°-10' Rt	91.0'	8" Ash
21	45°-18' Rt	78.0'	8" Ash
22	54°-28' Rt	88.0'	5" Ash
23	48°-37' Rt	120.0	4" Ash



"A" - BS "B"

24	48°-40' Rt.	122.0'	6" Ash
25	51°-20' Rt.	135.0'	5" Ash
26	54°-33 Rt.	128.0'	6" Ash
27	56°-55' Rt.	117.0'	5" Ash
28	66°-08' Rt.	112.0'	5" Ash
29	66°-54' Rt.	143.0'	8" Ash
30	75°-24' Rt.	106.0'	6" Ash
31	80°-49' Rt.	139.0'	4" Ash
32	76°-10' Rt.	134.0'	4" Ash
33	75°-12' Rt	149.0'	4" Ash
34	80°-55' Rt.	146.0'	4" Ash
35	87°-30' Rt.	154.0'	8" Ash
36	98°-13' Rt.	174.0'	4" Ash
37	100°-23' Rt.	161.0'	6" Ash
38	101°-55' Rt.	202.0'	6" Ash
39	97°-10' Rt	214.0'	5" Ash
40	87°-58' Rt.	240.0'	6" Ash
41	80°-52' Rt.	235.0'	8" Ash
42	86°-02' Rt.	247.0'	5" Ash
43	91°-45' Rt.	237.0'	4" Ash
44	100°-55' Rt	255.0'	10" Ash
	11°-56' Rt.	169.0'	Wood Hub = (A^1)
A' - A	121°-49' Lt.	102.0'	Wood Hub = (A^2)
A^2 - A' 1	242°-00 Rt	72.0	SEX Evergreens
2	226-36 Rt	36.0	Evergreen

A^2 - A1	3	197°-13' Rt	33.0'	8" Birch
	4	130°-47' Rt	25.0	Evergreen
	5	134°-16' Rt	56.0	"
		115°-47' Rt	113.0	Wood Hub (A^3)
A^3 - A^2	1	23°-05 Rt	54.0	10" Tulip
	2	60°-38 Rt	70.0	8" "
	3	73°-27 Rt	60.0	12" "
	4	74°-24 Rt	70.0	8" "
	5	80°-38 Rt	86.0	10" "
	6	89°-55 Rt	89.0'	10" "
	7	94°-10 Rt	81.0	Twin 12" "
	8	89°-50 Rt	71.0	10" "
	9	88°-06 Rt	102.0	10" Ash
	10	99°-40 Rt	80.0	10" "
	11	106°-10 Rt	106.0	10" Ash
	12	107°-16 Rt	85.0	10" "
	13	107°-16 Rt	83.0'	10" Ash
	14	99°-55 Rt	45.0'	8 Tulip
	15	123°-23 Rt	62.0'	Twin 12" Ash
	16	128°-22 Rt	101.0'	18" Ash
	17	141°-06 Rt	92.0'	10" "
	18	151°-24 Rt	98.0'	10" Ash
	19	159°-39 Rt	91.0'	24" Dead Tree
	20	156°-44 Rt	77.0'	10" Ash
	21	159°-01 Rt	69.0'	12" "

A3-A2

22	142°-47 Rt.	72.0'	Twin 12" Ash
23	140°-47 Rt.	68.0'	" " "
24	144°-06 Rt.	64.0'	18" Ash
25	139°-33 Rt.	59.0'	Twin 8" "
26	152°-53 Rt.	42.0'	8" Ash
27	128°-53 Rt.	200.0'	1 Pin S.W. & Prop.
28	125°-34 Rt.	180.0'	12" Ash
29	119°-08 Rt.	172.0'	28" Hickory
30	126°-34 Rt.	180.0'	12" Ash
31	128°-04 Rt.	174.0'	8" "
32	128°-10 Rt.	175.0'	~~10~~ Twin 8" Ash
33	129°-41 Rt.	165.0'	20" Hickory
34	133°-25 Rt.	160.0'	24" "
35	139°-05 Rt.	150.0'	14" "
36	141°-30 Rt.	150.0'	24" "
37	185°-43 Rt.	48.0'	10" Ash
38	302°-20 Rt.	36.0'	S.W. & Evergreen Grove
*	223°-24 Rt.	64.0'	Wood Hub A4
39	278°-42 Rt.	94.0'	12" ~~Ash~~ Tulip
40	281°-22 Rt.	90.0'	10" "
41	284-01 Rt.	122.0'	12" "
A4-A3 1	130-29 Rt.	58.0'	10" Ash
2	127-43 Rt.	41.0'	12" Tulip
3	109°-12 Rt.	57.0'	12" "
4	134°-15 Rt.	34.0'	8" "

A^4-A^3				
	5	144°-44 Rt.	45.0'	10" Tulip
	6	211°-42 Rt.	24.0'	8" "
	7	236°-15 Rt.	38.0'	10" "
	8	220°-56 Rt.	64.0'	8" "
	9	219°-26 Rt.	65.0'	10" "
	10	231°-00 Rt.	65.0'	12" "
	11	257°-14 Rt.	36.0'	10" Evergreen
		225°-44 Rt.	107.0'	Wood Hub A^5
A^5-A^4	1	337°-25 Rt.	7.0'	10" cherry
	2	53°-47 Rt.	11.0'	10" Tulip
	3	53°-05 Rt.	24.0'	15" "
	4	72°-10 Rt.	31.0'	10" "
	5	87°-10 Rt.	36.0'	Twin 8" "
	6	113°-31 Rt.	29.0'	" 12" "
	7	158°-40 Rt.	76.0'	8" Maple
	8	279°-05 Rt.	22.0'	10" Evergreen = W Line
	9	117°-12 Rt.	60.0'	12" Tulip
	10	117°-42' Rt.	18.0'	8" cherry
	11	168°-25 Rt.	60.0'	Evergreen
A^6-A^5		146°-07 Rt.	182.0'	Wood Hub A^6
	1	331°-25 Rt.	87.0'	I Pin N.W. & Prop.
	2	229°-11 Rt.	104.0'	CEI Pole
	3	324°-55' Rt.	167.0'	36" Apple
	4	330°-30 Rt.	150.0'	Evergreen
		317°-49 Rt.	560.0'	Wood Hub A^7

A7-A6

1	353°-26 Rt.	280.0	CEZ
2	348°-44 Rt.	284.0'	N.E. & Evergreen
3	338°-26 Rt.	110.0'	CEZ.
4	271°-41 Rt.	220.0	S.E. & I.Pin

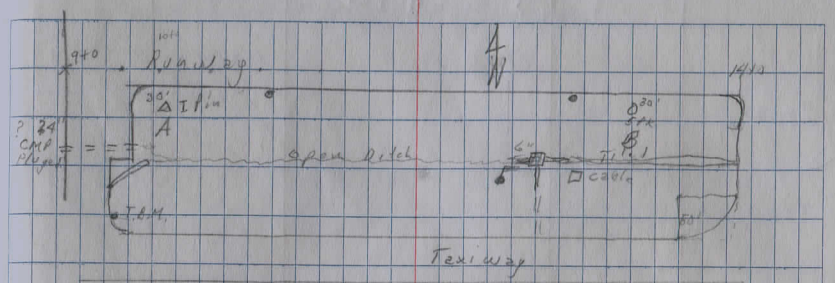
N. Patterson
T. Cydzik

12-4-78 Geo. Co. Airport

		Hort ∠	Dist	
Set B.S.				
A ~ B				
Inlet 3'x3' Conc.	Cable = 12" Cross s. (12" East)	9°40'	257.0'	73' off runway edge
Wind Sock		15°13'	222.0'	74' off taxiway
Outlet 12" Conc Pipe		100°35'	57.0	73' " "
Top Pipe		127°07'	93.0	
Top Pipe		131°07	110.0	
Runway light		344°05'	75.0	10' off runway edge
Runway light		355°53'	280.0	" " " "
Top 24" CMP		107°55'	48.0'	

12+88 & 87' South off runway = Cable line

	+	H	−	Elev.
B.M.	3.93	1184.40		1180.47
T.P.	4.48	1179.58	9.30	1175.10
T.B.M.	4.68	1179.58	4.68	1174.90
9+50			4.90	1174.68
10+00			4.70	1174.88
10+50			5.30	1174.28
11+00			5.70	1173.88
11+50			6.70	1172.88
12+00			7.70	1171.88
12+50			8.50	1171.08
13+00			9.80	1169.78
+50			11.00	1168.58
+50			11.50	1168.08
T.B.M.			4.68	1174.90



Top NE Bolt Marathon Sign

Lg spk edge SE Rad. Wall x over

edge of Taxiway radius

50' feet W. of Taxiway

TBM	2.88	1177.29		1174.90
9+50				
10+0				
10+50				
11+0				
11+50				
T.P.	6.44	1175.70	8.53	1169.26
12+0				
+50		65.80		63.80
Top Grate		9.90	Flr. 12" E.	11.90
13+0				
+50				
14+0				
T.P.	9.33	1178.58	6.45	1169.25
TBM			3.63	1174.95

BASE LINE = S. EDGE RUNWAY

						72.7	72.5		
						5.1	5.3		
						87	100		
72.4	71.5	70.4	68.6	69.2	71.5	73.2	74.0		
5.4	6.3	7.4	9.2	8.5	6.3	4.6	3.8		
4	55	70	75	80	84	93	112		
71.8	70.7	70.0	67.2	68.6	69.9	72.6	73.2		
6.0	7.1	7.8	8.6	9.7	7.9	5.2	4.6		
0	44	64	69	73	78	86	100		
71.0	69.9	68.8	67.6	69.6	72.3	72.7	72.8		
6.8	7.9	9.0	10.2	8.2	5.7	5.1	5.0		
0	44	67	73	80	85	91	100		
70.8	69.0	68.2	66.8	68.1	71.3		72.3	72.6	
7.5	5.8	9.0	11.0	9.7	6.0		5.5	5.2	
0	44	67	72	78	87		100	115	
69.9	68.1	66.9	66.0	66.9	71.1		71.6	71.7	
6.0	7.6	8.8	9.7	8.8	4.6		4.1	4.0	
0	44	68	72	76	87		100	130	
68.9		65.8	65.1	66.7	70.2		70.6	70.7	70.3
6.9		9.9	10.6	9.0	5.5		5.1	5.0	5.4
0		70	71	77	88		100	139	142
67.9	66.9	65.8	65.3	66.7		68.6	69.1		
7.8	8.8	9.9	10.4	11.0		7.1	6.6		
0	30	63	68	71		84	100		
67.3	66.0	64.4	63.8	65.7		67.7	68.1		
8.4	9.7	11.3	11.9	10.0		8.0	7.6		
0	36	67	70	79		87	100		
	66.4					66.5			
	9.0					8.2			
	30					84			

R.E. HERSHBERGER
D. LAMOREAUX

TAXIWAY LEVELS
T-HANGER AREA

W.18 APRIL 1979
FAIR NE 16 MPH 54°F 52

STA.	BACKSIGHT (+)	HI	FORESIGHT (−)	ELEV.	
'78 B.M.	3.10	1174.50		1171.40	Top Bolt SE Trans. Pad 25' N. of Shop Bldg
TBM Hub 15+00			5.26	1169.24'	T.P.
	2.12	1171.36'			
TBM Hub 12+00			7.81	1163.55'	T.P.
	5.07	1168.62'			
20+50			6.1	62.52'	
17.8 L			9.1	59.52'	DITCH ℄
33.5 L			6.8	~~62.8~~ 61.82'	EDGE TAXI
48.0 L			6.8	~~62.8~~ 61.82'	℄ TAXI WAY
63.5 L			7.1	61.5'	EDGE TAXI
75.0 L			8.2	60.4'	TOP DITCH
95.0 L			12.6	56.0'	℄ DITCH
168.5 L			10.8	57.8'	EDGE BLVD
20+00			5.3	63.3'	
			8.8	59.8'	DITCH ℄
			6.5	62.1'	EDGE TAXI
			6.4	62.2'	℄ TAXIWAY
			6.8	~~62.8~~ 61.82'	EDGE TAXI
			7.9	60.7'	TOP DITCH
			12.5	56.1'	℄ DITCH
			10.5	58.1'	EDGE BLVD
19+50			5.1	63.5'	
			8.2	60.4'	DITCH ℄
			6.1	62.5'	EDGE TAXI
			6.0	62.6'	℄ TAXI

+	℄	−	ELEV.	
	1168.62	6.6	62.0'	EDGE TAXI
		7.6	61.0'	TOP DITCH
		11.8	56.8'	℄ DITCH
		10.0	58.6'	EDGE RUNWAY
19+00		5.5	63.1'	
		8.2	60.4'	℄ DITCH
		5.9	62.7'	EDGE TAXI
		5.8	62.8'	℄ TAXIWAY
		6.3	62.3'	EDGE TAXI
		7.3	61.3'	TOP DITCH
		11.8	56.8'	℄ DITCH
		9.5	59.1'	EDGE RUNWAY
18+50		5.7	62.9'	
		7.8	60.8'	℄ DITCH
		5.4	63.2'	EDGE TAXI
		5.3	63.3'	℄ TAXIWAY
		5.7	62.9'	EDGE TAXIWAY
		6.9	61.7'	TOP DITCH
		10.9	57.7'	℄ DITCH
		8.8	59.8'	EDGE RUNWAY
18+00		5.5	63.1'	
		7.2	61.4'	℄ DITCH
		5.0	63.6'	EDGE TAXI
		4.8	63.8'	℄ TAXIWAY
		5.1	63.5'	EDGE TAXI

	+	A	-	ELEV.	
		1168.62			
			6.0	62.6'	TOP DITCH
			10.5	58.1'	℄ DITCH
			8.1	60.5'	EDGE RUNWAY
17+50			4.7	63.9'	
50' R			2.4	66.2'	
100' R			0.9	67.7'	
150' R			0.0	68.6'	
L			6.9	61.7'	℄ DITCH
L			4.6	64.0'	EDGE TAXI
L			4.3	64.3'	℄ TAXIWAY
L			4.7	63.9'	EDGE TAXI
L			5.5	63.1'	TOP DITCH
L			10.0	58.6'	℄ DITCH
L			7.4	61.2'	EDGE RUN
17+00			1.9	66.7'	
L			4.0	64.6'	EDGE TAXI
			4.0	64.6'	℄ TAXIWAY
			4.5	64.1'	EDGE TAXI
			9.4	59.2'	℄ DITCH
			6.7	61.9'	EDGE RUN.
TBM Pro			5.06	1163.56'	0.01 ERROR
	10-04	1173.60'			
17+00			5.1	68.5'	R 50'
			4.1	69.5'	100

END OF TIME

CO. AIRPORT
T. HANGERS CT'D.

	+	H	−		
		1173.60			
			3.9	69.7'	R 150'
16+50			4.3	69.3'	
R 50			3.5	70.1'	
100			3.3	70.3'	
150			3.5	70.1'	
			3.28	1170.32	FF EGS
			8.7	64.9'	EDGE TAXI
			8.6	65.0'	℄ TAXIWAY
			9.0	64.6'	EDGE TAXI
			9.8	63.8'	EDGE DITCH
			OVER ROD		℄ DITCH
			10.8	62.8'	EDGE RUNWAY
16+00			4.4	69.2'	
			8.3	65.3'	EDGE TAXI
			8.3	65.3'	℄ TAXIWAY
			8.5	65.1'	EDGE TAXI
			9.2	64.4'	EDGE DITCH
			13.8	60.8'	℄ DITCH
			10.0	63.6'	EDGE RUNWAY
16+00 HUB I.B.M.			4.23	1169.37'	T.P.
	3.59	1172.96'			
15+90			2.9	~~70~~ 69.1'	R 10'
			2.8	~~70~~ 69.3'	50'
			2.6	~~70~~ 69.4'	100

	+	=	–	ELEV.	
		1172.96			
15+40			2.8	70.2'	R 10'
			2.7	70.3'	50'
			2.8	70.2'	100'
15+50			3.8	69.2'	
			7.5	65.5'	EDGE TAXI
			7.3	65.7'	℄ TAXIWAY
			7.5	65.5'	EDGE TAXI
			8.3	64.7'	EDGE DITCH
			11.6	61.4'	℄ DITCH
			8.5	64.5'	EDGE RUNWAY
15+00			4.1	68.9'	
L 25.0'			6.4	66.6'	EDGE TAXI
			6.9	66.1'	℄ TAXIWAY
			7.4	65.6'	EDGE TAXI
			8.0	65.0'	EDGE DITCH
			11.1	61.9'	℄ DITCH
			7.7	65.3'	EDGE RUNWAY
R 10'			3.2	69.8'	EDGE T HANGAR
HUB 15+00			3.77	1169.19'	TP .05 LOW
	2.86	1172.05'			
14+85			2.6	69.4'	R 10'
			2.1	69.9'	50'
			1.9	70.1'	100'
			4.3	67.7'	

EDGE OF PAVEMENT

STA	+	X	-	ELEV.	
		1172.05			
			4.68	67.37'	EDGE TAXI
			4.80	67.25'	
			5.02	67.03'	EDGE TAXI
			5.26	66.79'	
			3.48	68.57'	CONC. PAD GAS PUMP
T.P.			4.14	1167.91'	
	5.20	1173.11'			
			5.28	1167.83'	C.B. GRATE
					C.B. GRATE
			3.67	1169.44'	T.P. C.B.
	5.11	1174.55'			
			5.51	1169.04'	CB GRAT
B.M.			3.20	1171.35'	(0.05 LOW)

PAVEMENT
TAXIWAY &
PAVEMENT
TAXIWAY

GRATE

STA.	+ BACKSITE	π H.I.	− FORESITE	ELEVATION	NOTES
78 B.M.	11.37	1182.77		1171.40	TOP OF BOLT
8+50			6.1	76.7'	BASE LINE
			6.1	76.7'	37'R.
			4.8	78.0'	56'R
			4.3	78.5'	59'R
			2.7	80.1'	100'R
9+00			6.9	75.9	
			6.9	75.9'	15'R
			6.2	76.6'	51'R
			4.3	78.5'	57'R
			3.5	79.3'	100'R
			2.9	79.9'	150'R
			2.5	80.3'	200'R
			1.9	80.9'	250'R
			1.9	80.9'	300'R
			1.9	80.9'	350'R
			3.1	79.7'	400'
9+50			7.2	75.6'	
			7.3	75.5'	15'R
			7.1	75.7'	51'R
			4.6	78.2'	57'R
			4.6	78.2'	100'
			4.6	78.2'	150'
			3.7	79.1'	200'
			3.3	79.5'	250

R.E. HERSHBERGER π ♡
D. LAMOREAUX ⌽

CO. AIRPORT LEVELS
BORROW AREA

TH. 19 APRIL 1979
FAIR, N 14 MPH 53°F.

NE COR. OF TRANSFORMER PAD 25' N OF SHOP BLDG.

℄ DITCH

BASE OF SLOPE

TOP OF SLOPE

BLDG IS 9.5' W OF THIS POINT

–

OFF EDGE OF PAVEMENT

TOE OF SLOPE

TOP OF SLOPE

FENCE IS ± 40' BEYOND

STA	+	↑	→	↓	
9+50		1182.77	3.2	79.5 6.	300' R
			4.5	78.3	350'
			3.7	79.1	400
10+00			7.5	75.3	
			8.0	74.8	15' R
			7.4	75.4	51'
			6.9	75.9	57
			6.6	76.2	100'
			6.2	76.6	150
			6.7	76.1	200
			5.2	77.8	250
			5.4	77.4	300'
			5.3	77.5	350'
			3.2	79.6	400'
10+50			8.0	74.8	
			8.1	74.7	15' R
			VIEW BLOCKED		51
			VIEW BLOCKED		57
			7.4	75.4	100
			6.9	75.9	150
			7.8	75.0	200
			6.8	76.0	250
			7.1	75.7	300
			5.3	77.5	350
			3.7	79.1	400
78 BM			11.36	1171.41	0.01 HIGH

FENCE IS ±35' BEYOND

FOR PARK AREA

OFF PAVEMENTS

±33' TO FENCE

±29' TO FENCE

STA.	+	=	-	ELEV.	NOTES
78 B.M.	6.94	1178.34		1171.40	
11+00			4.1	74.2'	15'R
			4.3	74.0'	24'R
			5.3	73.0'	24'R
			4.4	73.9'	31' R
			4.3	74.0'	50' R
			3.8	74.5'	100'R
			3.8	74.5'	150'R
			4.0	74.3'	200
			3.7	74.6'	250'
			2.1	76.2'	300
			0.3	78.0'	350
			-.5	78.8'	398
11+50			5.1	73.2'	
			5.3	73.0'	15'R
			5.5	72.8'	24'R
			6.0	72.3'	24'R
			5.4	72.9'	31'
			5.0	73.3'	50
			4.0	74.3'	100
			4.2	74.1'	150
			4.7	73.6'	200
			3.7	74.6'	250
			1.5	76.8'	300
			0.8	77.5'	350

OFF EDGE OF PAVEMENT
℄ DITCH ON DRIVEWAY
FLOW LINE
BACK OF DITCH

FENCE

FLOW LINE

42' TO FENCE

12+00		1178.34	5.9	72.4'		
			6.1	72.2'	15'R	OFF EDGE OF PAVEMENT
			7.2	71.1'	24'R	℄ DITCH
			6.4	71.9'	31'	TOP OF DITCH
			6.0	72.3'	50'	
			5.4	72.9'	100	
			5.5	72.8'	150	
			5.3	73.0'	200	
			3.9	74.4'	250	
			2.3	76.0'	300	
			1.9	76.4'	350	40' TO FENCE
12+50			7.0	71.3'		
			7.3	71.0'	15'R	
			7.58	1170.76	24	NO DITCH C.B. GRATE ±10' E.
					31	
			6.8	71.5'	50	EDGE OF GRAVEL PARKING LOT
			6.7	71.6'	100	EDGE OF GRAVEL PARKING LOT
			6.8	71.5'	150	170'R, 18'E CB GRATE 9.22 1169.12
			6.3	72.0'	200	2' W TO TOP OF CUT
			5.1	73.2'	250	TOP OF CUT
			3.7	74.6'	300	±12' TO CUT TOP
			2.6	75.7'	350	+ 35' TO FENCE
FLOW LINE			8.6	69.7'	200'R	DRAINAGE SWALE - ±15' E of TOP
			8.2	70.1'	250'	±20' E of TOP
			7.8	70.5'	300'	±44 E of TOP
78 BM			3.5	74.8'	356'	TOP OF CUT ±42' E.
			6.94	1171.40	GOOD	

TOPO of Norton Property
SANDGATE CIRCLE
CHESTER TWP. GEAUGA CO.

STA	RI	DIST	HORIZ ∠	VERT ∠	ELEV.
1	0.76	76.00	71°45'	-0°25'	1000.00
2	1.58	157.91	179°00'	+1°22'	1004.32
3	.82	77.65	285°17'	+13°19'	1023.79
4	.77	71.22	"	+11°11'	1014.63
5	.60	57.10	"	+12°42'	1013.42
6	.30	30.00	"	-0°30'	1000.29
7	.17	16.94	"	-3°30'	999.52
8	.16	14.63	"	-17°02'	996.07
9	.10	7.42	"	-30°30'	996.18
10	.06	5.60	"	-14°58'	999.06
11	.73	68.63	297° ~~287°~~ 30'	+14°10'	1017.88
12	.64	60.95	"	+12°37'	1014.20
13	.54	51.38	"	+12°44'	1012.16
14	.26	26.00	"	+0°15'	1000.67
15	.18	17.97	"	-2°20'	999.82
16	.15	13.99	"	-15°03'	996.79
17	.10	7.22	"	-31°47'	996.07
18	.06	5.52	"	-16°30'	998.92
19	.52	48.67	333°12'	+14°39'	1013.28
20	.36	32.37	"	+18°30'	1011.39
21	.21	20.80	"	+5°35'	1002.59
22	.15	14.67	"	-8°35'	998.34
23	.14	12.16	"	-21°15'	995.83
			"		

℄ GAM
1 DWS
☐ GAM

℄ @ (1000.555)
HI 4.96 (1005.515)

CLOUDY, COOL 70°F
25 AUG 81

62

REMARKS

MON BOX 1ST P.C. SANDGATE CIRCLE
" " 1ST PT " "
TOP OF GRADE

TOP DITCH
BOTTOM DITCH
BOTTOM DITCH
TOP DITCH
TOP GRADE

TOP BANK
BOTTOM DITCH
"
TOP BANK
TOP GRADE

TOP BANK
BOTTOM DITCH

TOPO NORTON PROP (CON'T)

STA	R I	DIST	HORIZ ∠	VERT ∠	ELEV
24	.10	6.94	333°12'	-33°35'	995.94
25	.04	3.91	"	-8°50'	999.95
26	.52	50.51	352°30'	+9°45'	1009.23
27	.40	37.86	"	+13°25'	1009.56
28	.24	23.67	"	+6°45'	1003.36
29	.17	16.14	"	-13°00'	996.83
30	.16	14.30	"	-19°00'	995.63
31	.12	8.66 ~~6.48~~	"	-31°50'	995.18
32	.08	6.48	340°00'	-25°50'	997.42
33	.76	75.90	45°47'	+2°02'	1003.36
34	.23	23.00	"	+0°34'	1000.78
35	.18	15.98	"	-19°35'	994.87
36	.17	13.96	49°30'	-25°02'	994.04
37	.16	14.88	70°60'	-15°20' ~~+15°21~~	996.48
38	.10	10.00	122°40'	+1°15'	1000.77
39	.88	88.00	54°44'	-0°15'	1000.18
40	.79	78.94	54°38'	-1°40'	998.26
41	.52	51.88	63°22'	-2°46'	998.05
42	.36	35.80	62°27'	-4°15'	997.89
43	.30	28.70	63°25'	-12°00'	994.45
44	.56	55.99	70°45'	-0°38'	999.93

REMARKS

BOTTOM DITCH

TOP DITCH

TOP of GRADE

BOTTOM DITCH

" "

TOP of BANK

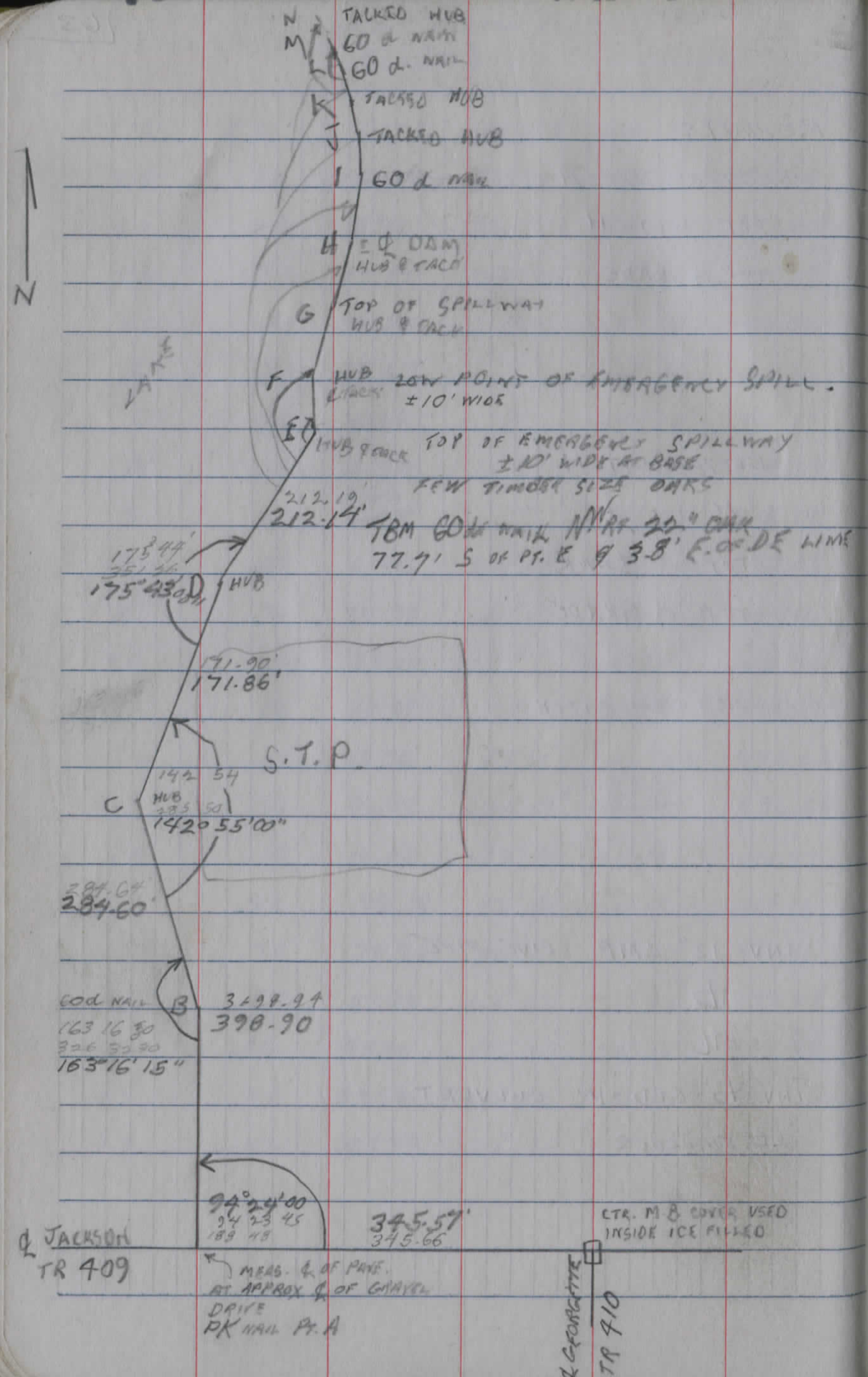
TOP of GRADE

BOTTOM DITCH

INV 12" CMP DRIVE PIPE

INV. TO GRD IN CULVERT

RD. SHOULDER

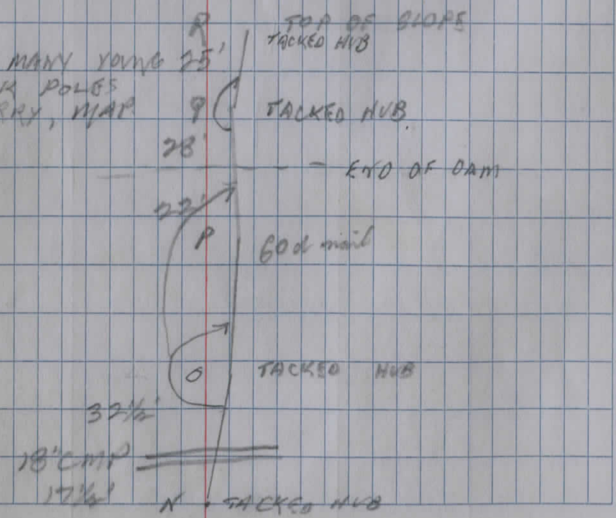


R.E. HERSHBERGER
G.L. KOVACH
D.W. SEWELL

BURTON LAKE DAM
PROFILE, X.S., LOCATION

29 JANUARY 1982
FAIR, BREEZE 19°F

SPILLWAY COULD BE BUILT BETWEEN D & E W/O DAMAGING GOOD TIMBER.



4

		Stadia		Chain
DEF	124°32'00"	7.11 7.02 6.93	18'	17.5'
DEG	124°44'00"	6.30 5.69	51	
DEH	135°56'00"	6.49 6.00 5.50	99	
DEI	138°35'00"	7.31 6.58 5.82	149	
DEJ	138°06'00"	7.13 6.13 5.13	200	
DEK	137°37'30"	6.91 5.68 4.42	249	
DEL	136°01'00"	6.32 3.33	299	
ILM	174°58'00"	5.54 5.49 5.03	51	
ILN	171°18'30"	4.87 4.37 3.87	100	
ILO	170°30'00"	4.58 3.08	150	
LOP	171°03'00"	4.16 3.91 3.66	50	
LOQ	175°15'30"	2.08 1.58 1.09	99	
OPR	219°07'30"	3.65 3.53 3.41	24	

A.E. HERSHBERGER JR
G.L. KOVACH
D.W. SEWELL

BURTON LAKE DAM
CTD

1 FEBRUARY 1982
13° P.C., WINDY
65

B.S.+ H.I. H.S.−

TBM	2.98		102.98				1112.7	100.00 ASSUMED
E	51.3 / 6.4	44.1 / 3.8	15.4 / 3.7	0 / 3.7	5.1 / 2.2		41.9 / 3.9	
	96.6 1109.3	99.2 1111.9	101.3 1119.0	99.3 1112.0	100.8 1113.5		99.1 1111.8	
F	18.1 / 6.4			0 / 6.0	33.0 / 7.9	33.9 / 10.4	64.2 / 11.0	
	97.6 1109.3			97.0 1109.7	99.8 1107.8	95.6 1105.3	97.0 1104.7	
G	17.6 / 6.4	21.7 / 5.4	9.1 / 4.6	0 / 5.1	15.7 / 4.6	30.5 / 10.2	49.2 / 10.8	
	96.6 1109.3	97.6 1110.3	98.9 1111.1	97.9 1110.6	98.9 1111.1	92.8 1105.50	92.2 1104.4	
H	9.1 / 6.4		7.6 / 4.9	0 / 5.0	5.9 / 5.8	25.5 / 10.6	42.2 / 11.1	
	96.6 1109.3		98.1 1110.8	98.0 1110.7	97.2 1109.9	92.4 1105.1	91.0 1103.9	
I	11.0 / 6.4		8.4 / 5.4	0 / 6.2	9.5 / 6.4	26.6 / 10.6	47.6 / 11.0	
	96.6 1109.3		97.6 1110.3	96.8 1109.5	96.6 1109.3	92.9 1105.1	92.6 1104.7	
J	12.4 / 6.4		10.1 / 5.2	0 / 6.4	11.0 / 6.6	39.4 / 11.6	55.1 / 11.9	
	96.6 1109.3		97.8 1110.5	96.6 1109.3	96.4 1109.1	96.4 1104.1	91.1 1103.8	
					3.01		99.97	

DISTANCE
ROD
NOTE:

	+	π	−	
TBM	2.45	102.45.		100.00
TP 1			5.10	97.35.
	5.24	102.59.		
TP 2			2.38	100.21.
	4.81	105.02.		
TP 3			8.48	96.54.
	5.24	101.75.		
TBM			1.74	100.01.

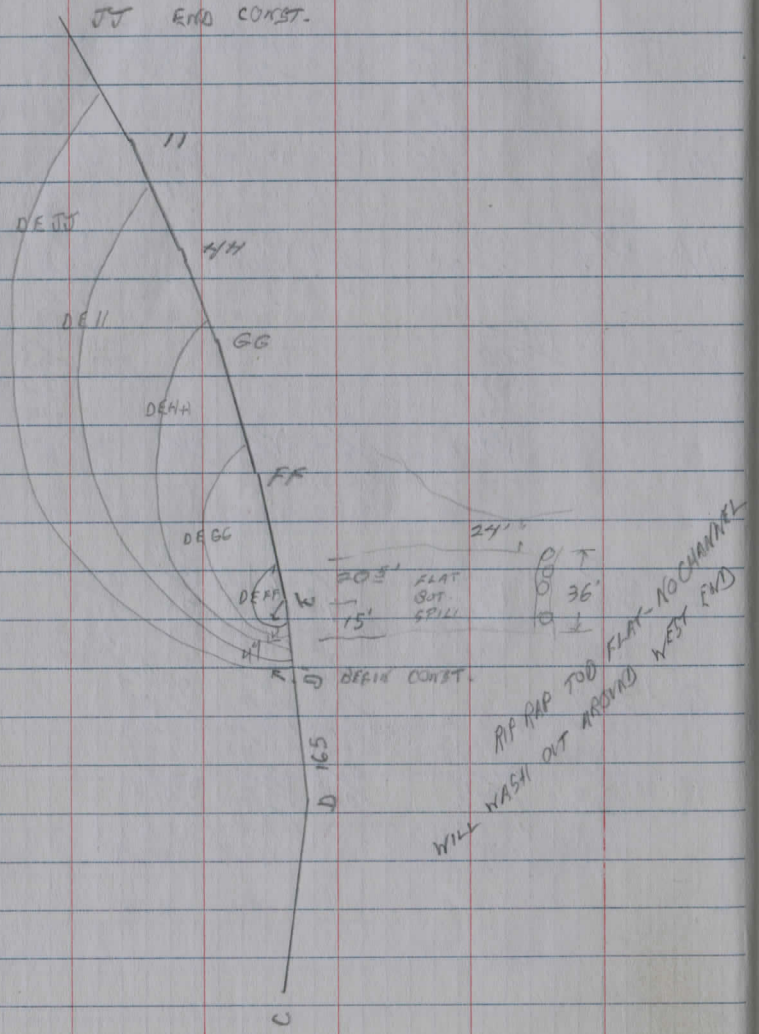
R.E. HERSHBERGER IV
G.L. KOVACH
D.W. SEWELL

BUXTON LAKE DAM
CTD.

2 FEBRUARY 1982
32°, CLOUDY, BREEZE

66

	LAKE					SWAMP
K	15.4 / 5.4	12.2 / 4.6	0.0 / 5.7	11.6 / 5.6	23.0 / 10.4	41.4 / 11.2
	97.0 1109.7	97.8 1110.5	96.8 1109.5	96.9 1109.6	92.0 1104.7	91.2 1103.9
L	16.4 / 5.0	5.8 / 4.0	0.0 / 4.9	10.6 / 7.3	22.1 / 12.0	44.0 / 11.5
	97.6 1110.3	98.6 1111.3	97.7 1110.4	95.3 1108	99.6 1103.3	91.1 1103.8
M	13.6 / 6.0	9.4 / 4.6	0.0 / 5.2	15.0 / 5.9	25.5 / 11.5	47.0 / 11.6
	96.8 1109.3	98.0 1110.7	97.4 1110.1	96.7 1109.4	91.1 1103.8	91.0 1103.7
N	12.9 / 6.0	9.0 / 3.4	0.0 / 4.4	19.2 / 4.8	34.9 / 11.4	57.2 / 11.6
	96.6 1109.3	99.2 1111.9	98.2 1110.9	97.9 1110.5	91.2 1103.9	91.0 1103.7
18"CMP IN	19.0 / 5.00				OUT	21.6 / 7.51
	97.59 1110.29					95.08 1107.78
O	19.1 / 6.0	13.3 / 4.9	0.0 / 3.7	9.5 / 5.1	25.6 / 11.2	50.0 / 11.8
	96.6 1109.3	99.7 1112.4	98.9 1111.6	97.5 1110.2	91.8 1104.1	90.8 1103.5
P	23.0 / 8.3	13.5 / 4.8	0.0 / 4.8	6.1 / 5.0	18.1 / 7.6	80.0 / 11.7
	95.7 1109.4	100.2 1113.9	100.2 1113.9	100.0 1113.7	92.4 1110.1	93.3 1106
Q	101.0 / 8.3	25.5 / 7.4	0.0 / 4.8	19.8 / 7.6	90.0 / 10.7	
	96.7 1109.4	102.6 1115.3	103.2 1115.9	102.4 1115.1	94.3 1107	
R	104.9 / 8.3	23.8 / 8.4	0.0 / 10.7	20.4 / 2.2	90.0 / 11.8	
	96.7 1109.4	104.6 1117.3	104.3 1117	102.8 1115.5	93.2 1105.9	



LAKE SWAMP

1+48 1112.68 TBM

JJ	1108.9 / 28±	1112.6 / 1.6 / 13.4	1112.6 1.6	1109.6 / 4.5 / 12.8	
II	1108.9 / 17±	1111.6 / 2.6 / 9.7	1111.4 2.8	1103.8 / 10.4 / 24°	
HH	1108.9 / 20±	1111.4 / 2.8 / 8.2	1111.1 3.1	1106.0 / 8.2 / 18.4	
GG	1108.9 / 17±	1111.3 / 2.9 / 5.6	1111.2 3.0	1104.7 / 9.5 / 20±	
FF	1108.9 / 18°	1111.5 / 2.7 / 8.7	1111.3 2.9	1105.3 / 8.9 / 24±	
E	1108.9 WATER EDGE / 5.8 / 48'	1109.8 / 4.4 / 43°	1109.5 4.7	1108.6 / 5.6 / 69° TOP RIP RAP	1106.0 / 8.0 / 82± BASE RIPRAP
D'		1112.1 / 2.1 / 21°	1112.1 2.1	1110.9 / 3.3 / 54°	

1+46 1114.16 1112.70 TBM
H1

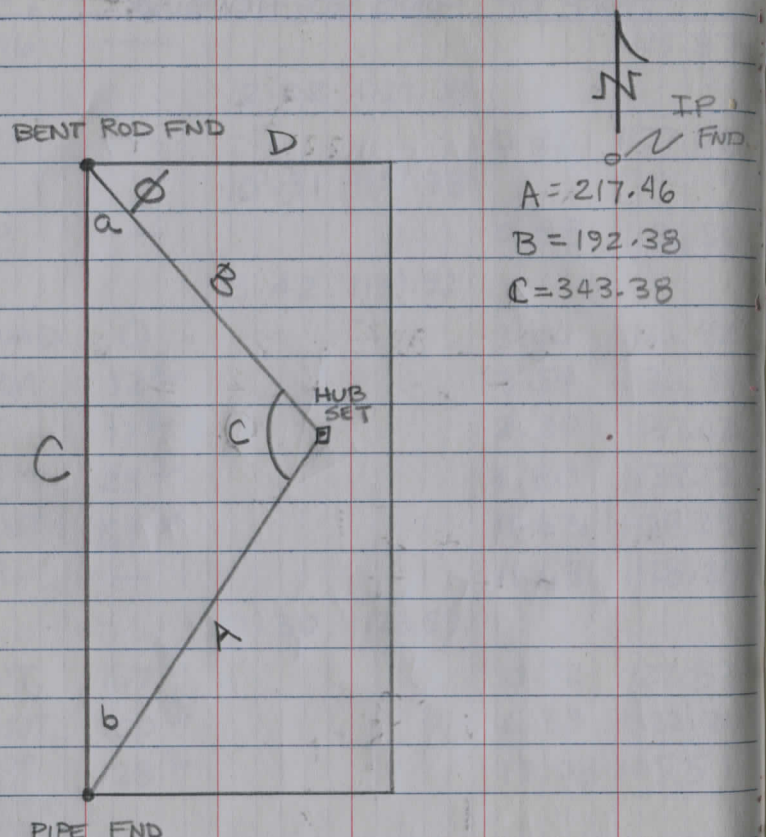
	Δ		STADIA
D E FF	141°31'30"	5.5 4.5	100.'
D E GG	139 58 30	6.01 4.	201
D E HH	137 15 %	6-55 3.5	305
D E II	134 10 30	3	400
D E JJ	131 01 90	3.53 5.0 MID 2.5	503

BURTON LAKES DAM TH. 17 JUNE 1982
75° P.C., BREEZY 68

PROFILE AT EAST PROPERTY LINE OF K. HANISH OFF OF POND RD. - NEWBURY

6/18/82 WEN GAM

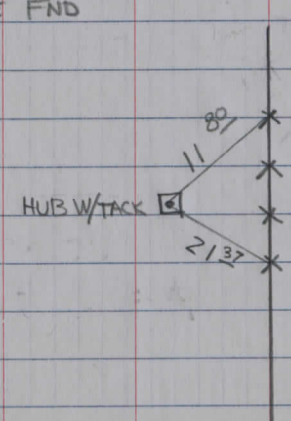
REF.	DIST FROM ℄	BS	HI	FS	ELEV.
BM 1816	—				1125.37
		2.02	1127.39		
TP	—			0.32	1127.07
		10.31	1137.38		
TP	—			0.88	1136.50
		3.42	1139.92		
℄ ROAD	0			3.00	1136.92
BERM	12 Rt			3.54	1136.38
TOP	17 Rt			2.30	1137.62
POINT	25 Rt			4.80	1135.12
POINT	61 Rt			11.63	1128.29
TP	—			11.63	1128.29
		0.30	1128.59		
POINT	67 Rt			0.72	1127.87
POINT	100 Rt			6.39	1122.20
EDGE OF SWAMP AND WATER LEVEL	128 Rt			13.08	1115.51



A = 217.46

B = 192.38

C = 343.38



SURVEY FOR NEW CHESTER FIRE HOUSE

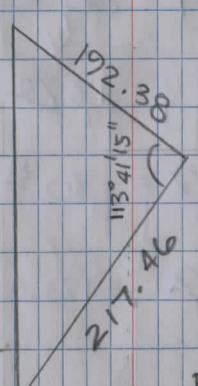
7/13/82

W.E. NYMAN
G.A. MOHNACSKY
M STONE

⊖		113° 41′ 00″
		227° 22′ 30″
⊖ AVG		113° 41′ 15″

A	$99^{05} + 99^{29} + 19^{17}$	=	217.51
	$99^{70} + 99^{18} + 18^{54}$	=	217.42
		AVG	217.46

B	$98^{71} + 93^{63}$	=	192.34
	$99^{30} + 93^{11}$	=	192.41
		AVG	192.38



$C^2 = A^2 + B^2 - 2AB\cos c$

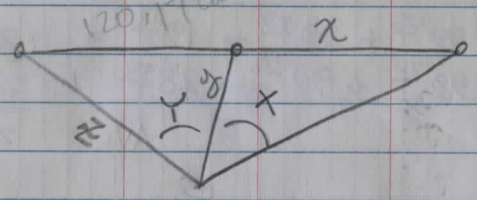
C = 343.38

BY LAW OF SINES

a = 35.4509°

ϕ = 54° 32′ 57″

D 99.60 + 23.40
= 123.00



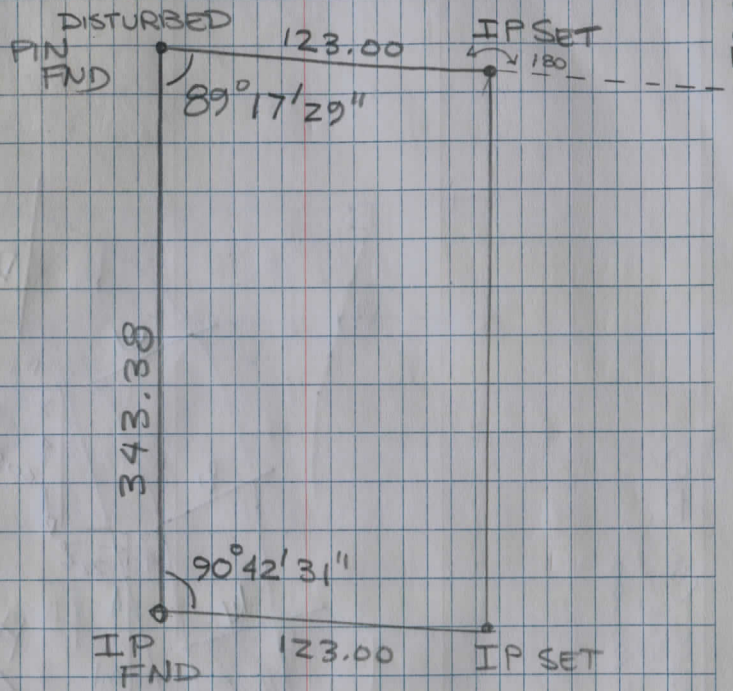
X = 77° 18' 00"
Y = 88° 25' 00"

y = 13.78

Z = 30.88 + 88.88
= 119.76

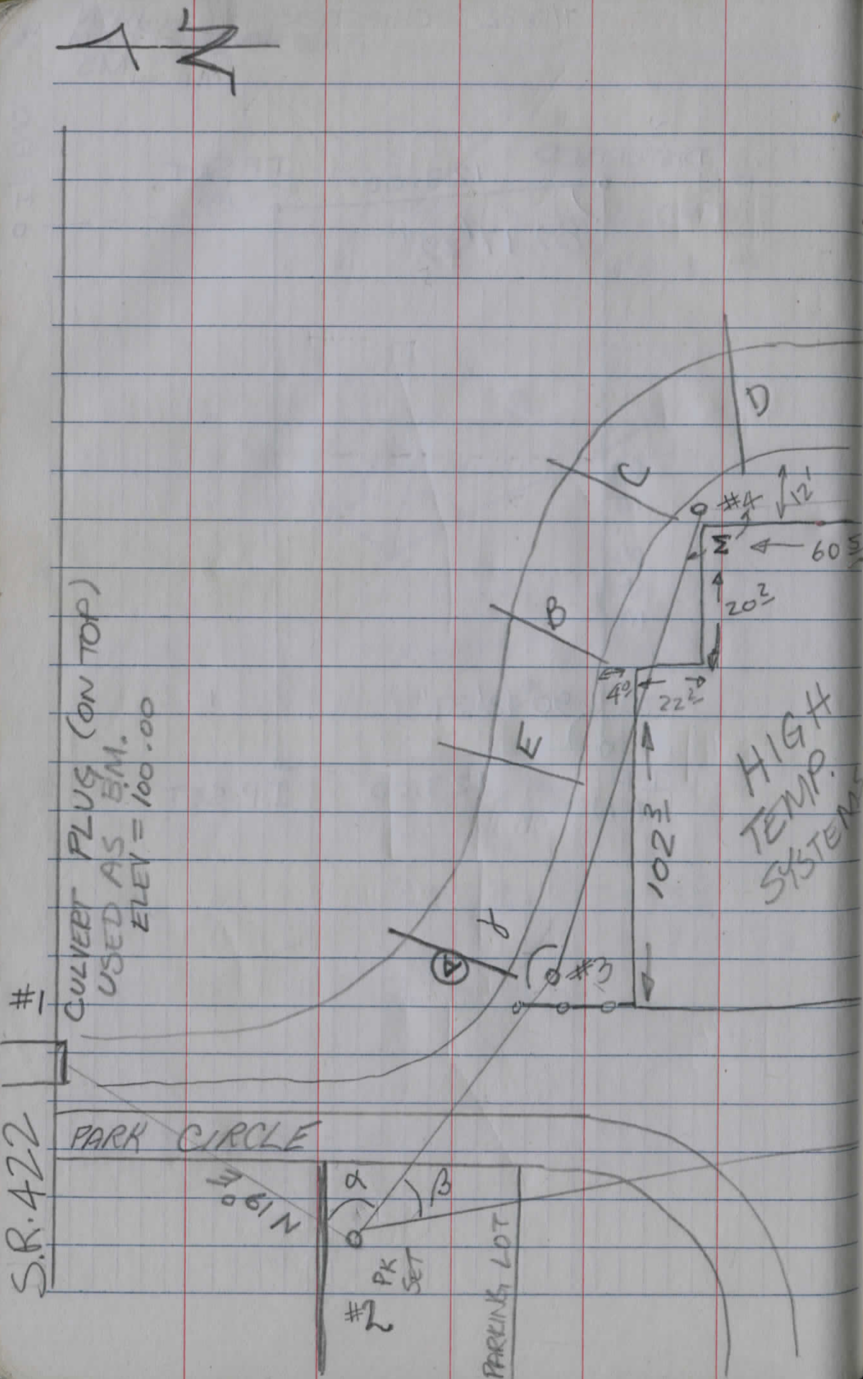
x = 123.00

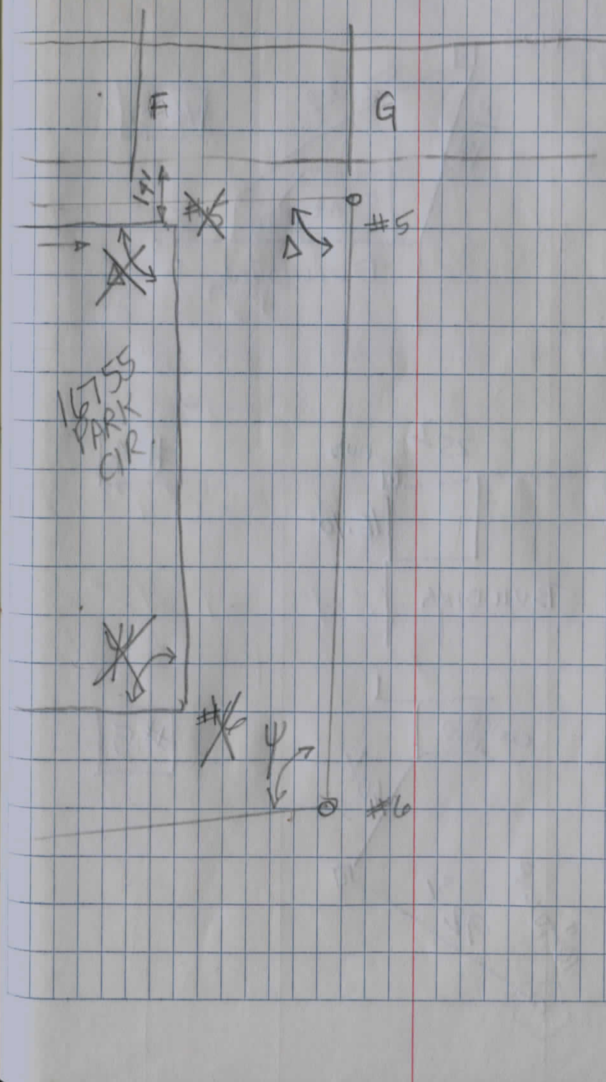
7/13/82 CHESTER FIREHOUSE WEN GAM MS 71

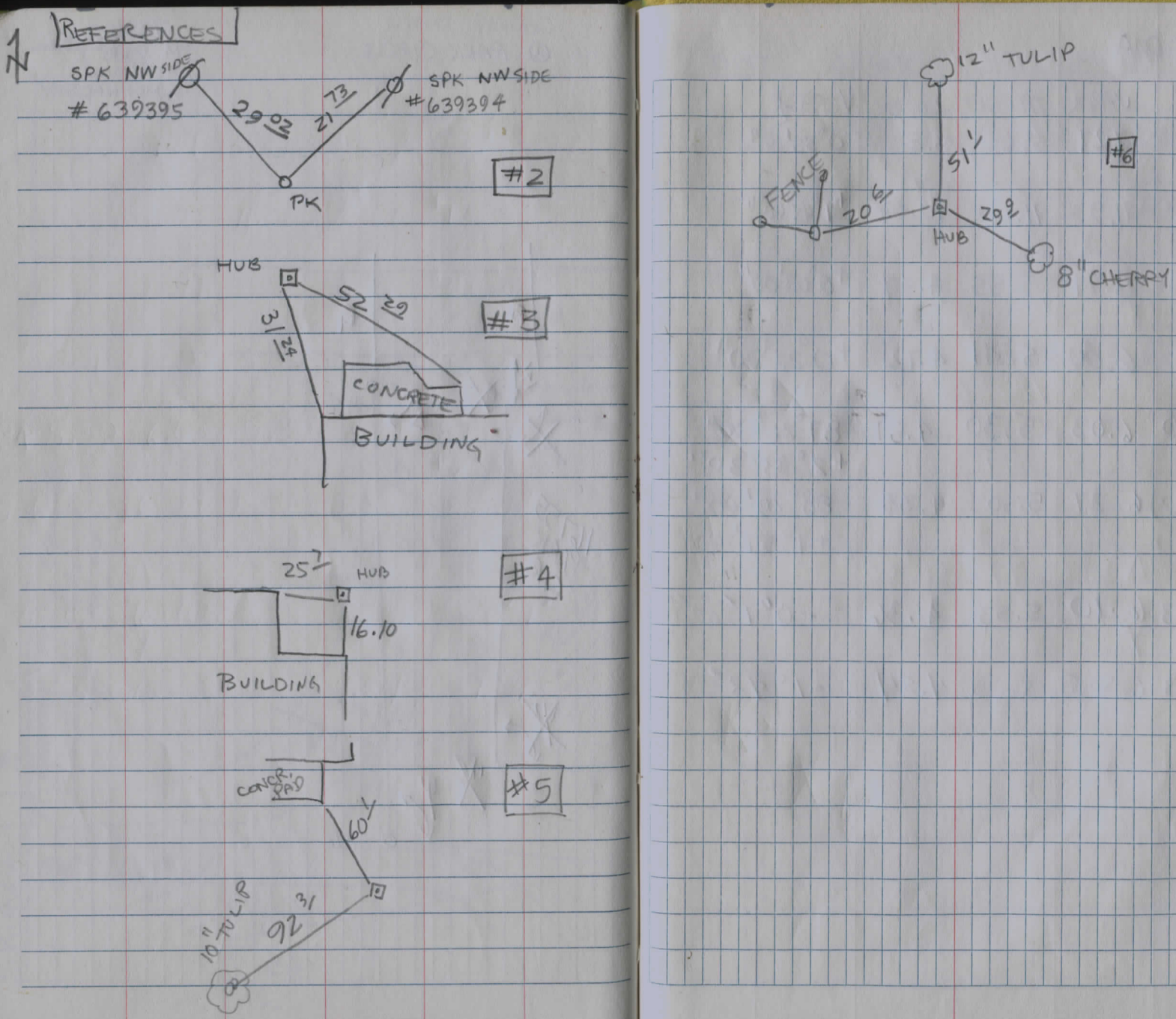


COUNTY DITCH
@ PARK CIRCLE

7/29/82
M. STONE
W. NYMAN
G. MOHNACSKY






REFERENCES
N
SPK NW SIDE
#639395
29.02
21.73
SPK NW SIDE
#639394
PK
#2
HUB
52.29
31.24
CONCRETE
BUILDING
#3
25.2
HUB
16.10
BUILDING
#4
CONCR. PAD
60.1
10" TULIP
92.31
#5
12" TULIP
51.1
FENCE
20.67
HUB
29.9
8" CHERRY
#6

STADIA

	HI	UPPER	TARGET	LOWER	VERT ∠
2-1	5.55	7.27	5.55	3.83	-0°35'00"
2-3	5.55	11.93	11.00	10.07	+1°45'00"
2-6	5.55	6.71	5.55	4.37	+0°03'00"
3-4	5.41	6.09	5.41	4.72	+0°22'00"
5-4	5.30	6.03	5.30	4.57	~~87°26'30"~~ +2°33'30"
5-6	5.30	6.27	5.30	4.33	~~88°09'00"~~ +1°51'00"
6-2	5.53	6.70	5.53	4.36	-0°1'00"
6-5	5.53	6.505	5.53	4.54	-1°42'30"

DIST	ΔELEV	
343.96	-3.50	ELEV 2 = 103.50
185.83	+.23	ELEV 3 = 103.73
234.00	+.20	ELEV 6 = 103.70
136.99	+.88	ELEV 4 = 104.61
145.71	+6.51	ELEV 5 = 98.10
193.80	+6.26	
234.00	-.07	
196.33	-5.86	

ANGLES

α 105° 29' 00"

β 44° 01' 30"

D 88° 03' 30" AVG 44° 01' 45"

γ ~~183° 02' 30"~~

D 364° 03' 00"

182° 01' 00" AVG 182° 00' 45"

Σ D 109° 19' 00" 109° 18' 30"

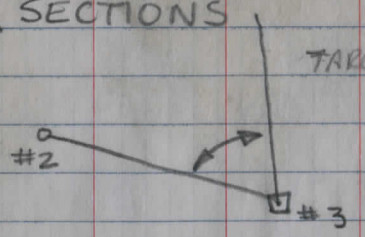
218° 37' 30"

Δ 77° 56' 00"

Ψ 130° 44' 30"

X SECTIONS

(A)



TARGET @ 5.41

~~HI~~

STA	HORIZ	VERT	ROD INT	DIST	ELEV	
3						
	X @ 3 ; HI =					
	51° 03′					
	~~52° 30′~~	-3° 40′	.09	8.96	-.57	103.16
	69° 25′	-25° 11′	.20	16.38	-7.70	96.03
	68° 52′	-29° 15′	.26	19.79	-11.08	92.65
℄	68° 10′	-28° 31′	.27	20.85	-11.33	92.40
	74° 41′	-20° 31′	.31	27.19	-10.18	93.55
	83° 42′	+4° 27′	.415	41.25	-3.21	100.52
	83° 57′	+4° 1′	.48	47.76	-3.35	100.38
	X @ 4 BS 5 TARGET @ 5.35					
(B)						105.40 CORNER of BLDG
	108° 31′	+1° 45′	0.26	25.98	+.79	105.89 " "
	60° 16′	+2° 32′	0.29	28.94	+1.28	105.75 " " "
	20° 05′	+4° 06′	0.16	15.92	+1.14	105.33 TOP of Bank
	117° 34′	+1° 35′	0.26	25.98	+.72	98.68 CHANGE IN GRD
	135° 03′	-12° 32′	0.28	26.68	-5.93	91.69 " " "
	144° 08′	-21° 25′	0.38	32.92	-12.92	88.44 TOE of Slope
	148° 38′	-25° 10′	0.42	34.40	-16.17	

STA	HORIZ ∠	VERT ∠	RF.	DIST	ELEV
	151°55'	-22°15'	0.54	46.26	-18.92
	163°36'	-11°34'	0.54	51.83	-10.61
	165°13'	-1°10'	0.57	56.98	-1.16
Ⓒ	π @ 4	BS 5	TARGET @ 5.38		
				1.0	0.00
	197°52'	-29°38'	0.12	9.07	-5.16
	202°26'	-34°51'	0.25	16.84	-11.72
	210°53'	-34°03'	0.38	26.09	-17.63
	210°04'	-34°16'	.40	27.32	-18.61
	208°19'	-25°52'	.42	34.01	-16.49
	205°40'	-16°37'	.44	40.40	-12.06
	206°23'	-08°30'	.46	45.00	-6.72
	π @ 4	BS 5	TARGET @ 5.38		
Ⓓ				1.0	0.00
	287°43'	10°36'	.62	59.90	-11.21
	287°14'	16°58'	.61	55.81	-17.03
	290°41'	20°50'	.54	47.17	-17.95
	292°38'	26°39'	.54	43.14	-21.65
	294°17'	29°21'	.42	31.90 / 33.52	-17.94 / -22.21
	295°58'	29 42	.44	33.20	-18.94
			.24	18.11	-10.33

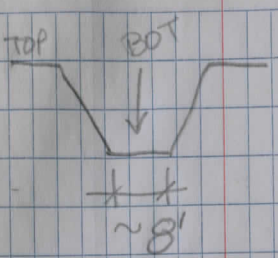
REMARKS

85.69 TOE OF SLOPE
94.00 CHANGE IN GRD
103.45 TOP of Bank

104.61
99.45 CHANGE IN GRD
92.89 CHANGE IN GRD
86.98 TOE OF SLOPE
86.00 ℄
88.12 TOE OF SLOPE CAVE IN MATERIAL
92.55 CHANGE IN GRADE
97.89 TOP OF GRADE

104.61
93.40 TOP OF SLOPE
87.58 TOP SLOPE CAVE IN AREA
86.66 TOE OF SLOPE
82.96 ℄
~~82.40~~ 86.67 TOE OF SLOPE FLAT BOTTOM
~~85.67~~ CHANGE IN GRADE
~~94.28~~

STA	HORIZ	VERT	RI		
(E)	T@4	BS 5		TARGET @ 5.38	
	110°17'				
	~~0°04'~~	-0°45'	.54	53.99	-.71
	129°28'	-16°09'	.60	55.36	-16.03
	150°14'	+0°30'	.72	71.99	+.63
(F)	T@5	BS6		TARGET @ 5.30	
	80°50'	5°4'30"	.655	64.99	+5.77
	95°54'30"	-3°32'30"	.665	65.25	-4.04
	105°59'30"	-13°53'30"	.78	73.50	-18.18
	107°40'30"	-14°58'30"	.81	75.59	-20.22
	109°35'30"	-13°59'30"	.83	78.15	-19.47
	119°52'	-5°14'	.89	88.26	-8.08
(G)	T@5	BS6		TARGET 5.30	
	154°23'	-5°51'	.75	74.22	-7.60
	155°26'30"	-9°49'30"	.63	61.17	-10.59
	156°1'	-13°0'	.61	57.91	-13.37
	154°16'	-26°34'	.59	47.20	-23.60
	153°8'	-28°40'	.535	41.19	-22.52
	152°7'	-31°59'	.48	30.94	-19.32
	74°8'30"	+4°59'30"	.10	9.92	+.87



103.90 TOP
88.58 BOT.
105.24 TOP

103.87 TOP (BY BUILDING)
94.06 CHANGE OF GRD
79.92 TOE OF SLOPE
77.88 ℄ CREEK
78.63 TOE OF SLOPE
90.02 TOP OF BANK

(AWAY FROM BUILDING)
90.50 ABOVE TOP OF BANK
87.51 TOP OF SLOPE
84.73 TOP OF CAVE IN
74.50 TOE OF SLOPE
75.58 ℄ CREEK (MUCH DEBRIS)
78.78 TOE OF SLOPE
98.97

272.14'

100° - 52' - 00
201 - 43' - 30
302 - 35 - +
403 - 27 -
100 - 51 - 52

207
210

77° - 53' -
135° - 46'
233° - 37 - +
311 - 33 - 30
77 - 53 - 22

213

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. 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 External: 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.

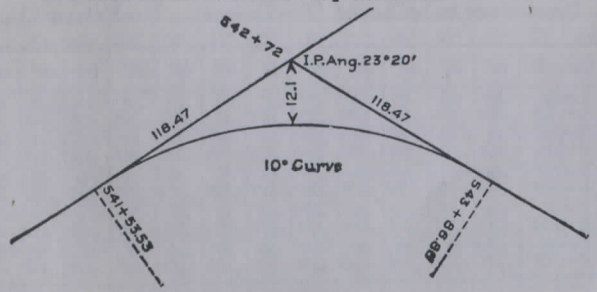


TABLE I. — Tangents and Externals to a 1° Curve. Chord = 100 ft.

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	333.91	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	.06	.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	1.06	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

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	3503.2
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=.220	.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	30	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	3.05	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	$\frac{\frac{1}{2}\text{ sub chord}}{R}$ = sin of ½ def. angle				Length of arc for 100 ft.
	sin. ½ def. ang.	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

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

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

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

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

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

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

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

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

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

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

Tan. def. = ½ 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 $0.574d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{2}{3}d^2$. The combined correction is 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 upon request. This handy booklet, 3⅜x6 in., has about 190 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, etc.

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	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

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

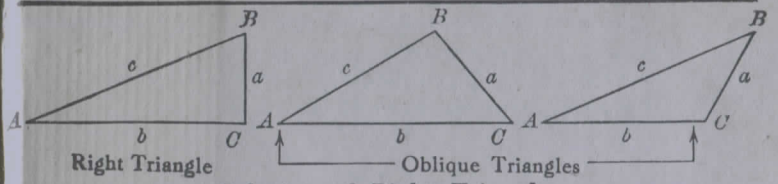
Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							
16	.2756	.2867	1.0403	3.628	3.487	.96126	74
10	.2784	.2899	1.0412	3.592	3.450	.96046	50
20	.2812	.2931	1.0423	3.556	3.412	.95964	40
30	.2840	.2962	1.0429	3.521	3.376	.95882	30
40	.2868	.2994	1.0438	3.487	3.340	.95799	20
50	.2896	.3026	1.0448	3.453	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	.2420	.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	.90383	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

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

TRIGONOMETRIC FORMULÆ



Solution of Right Triangles

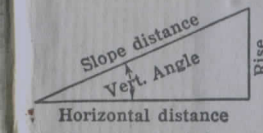
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

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	$s = \frac{a+b+c}{2},\ \text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{b\,c \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

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.