ALIGNMENT CR343(3)

K+E

CR 343(3) Tenth West

Alignment Notes

1974

82 0020

Weatherproof Field Book

"Rite in the Rain" paper
32 pages

4⅝" x 7¼"

Keuffel & Esser Co., Morristown, N.J. 07960 Made in U.S.A.

CURVE FORMULAS

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

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

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

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

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

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

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

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

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

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

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

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.) 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 $0.574 d^2$, 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 =

$$\pm 0.6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$$

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

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

Index

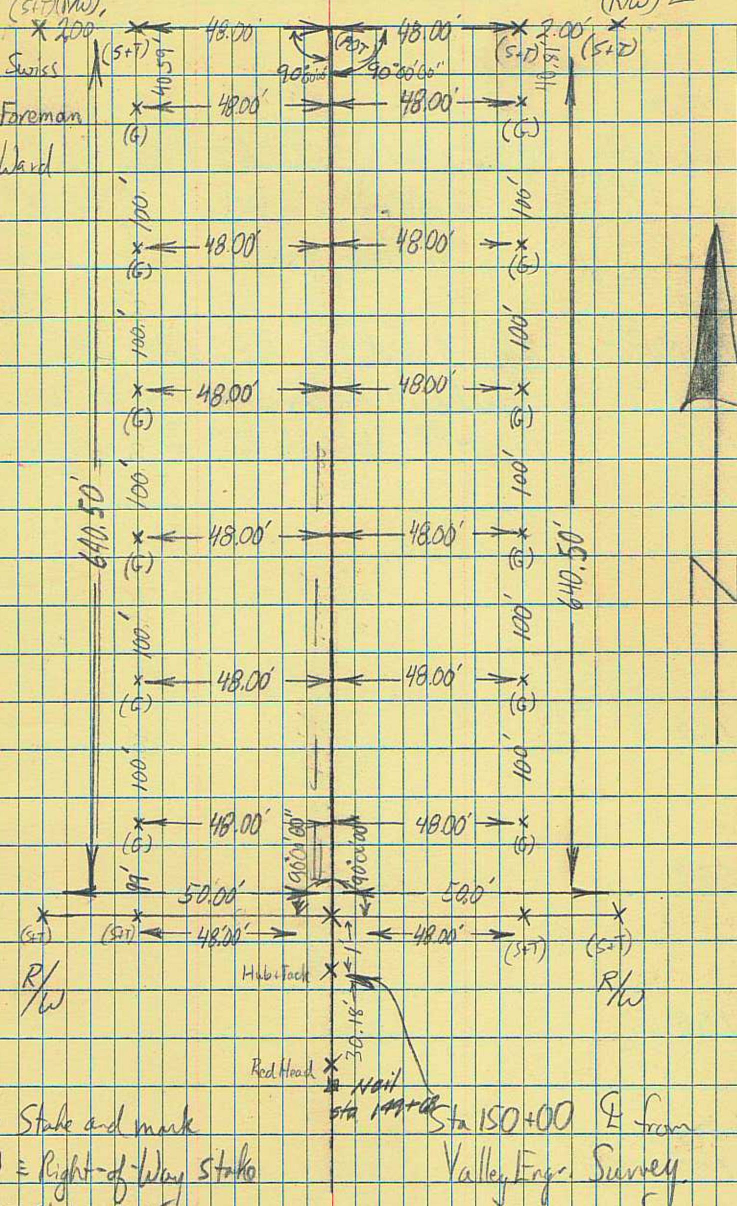
156+40^50	Set POT w/ 48' + 50' markers on West + East side
	Pot is X chiseled on old irrigation Pipe.
156	Note: 10 Sept 74. POT Reset in line
	from 150+00 to P.C. Sta 163+14^37
	No longer @ station 156+40^50
155	
154	
153	
152	
151	
150+01	R/W Marker
150+00	
149+69^82	Red head
149+65 (200 N St)	

This Book + survey were begun 3 Sept 1974 to locate the final line for the 10th West Roadway from 2nd N to 10th N. It retraces an earlier survey done by Valley Engineering

3 Sept 1974

(R/w) 2

R.E. Swiss
G.P. Foreman
P.B. Ward



S = Stake and mark
R/W ≡ Right-of-Way Stake
(S+T) ≡ Stake + Tack
(G) ≡ Guinnie + mark

163+14^{37} PC | R/w marker (Located P.C of Old Survey)
Continued line location using old P.C.
as starting point.

163

163+90^{00} | Note: 10 Sept 74 R.E.S, PBW. GPF.
Relocated all points from Sta 150+00 to
163+14^{37} Using old P.C. for line.

162

161

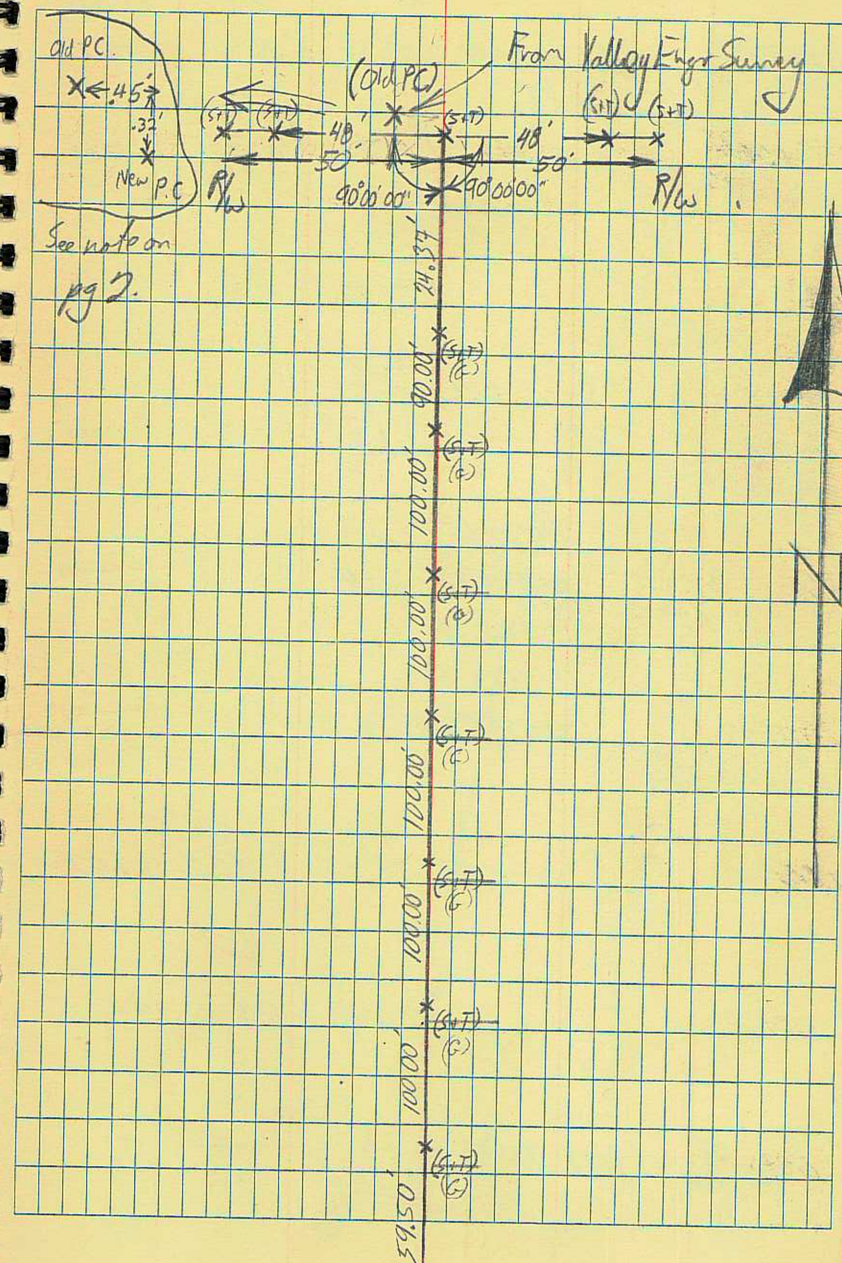
160

159

158

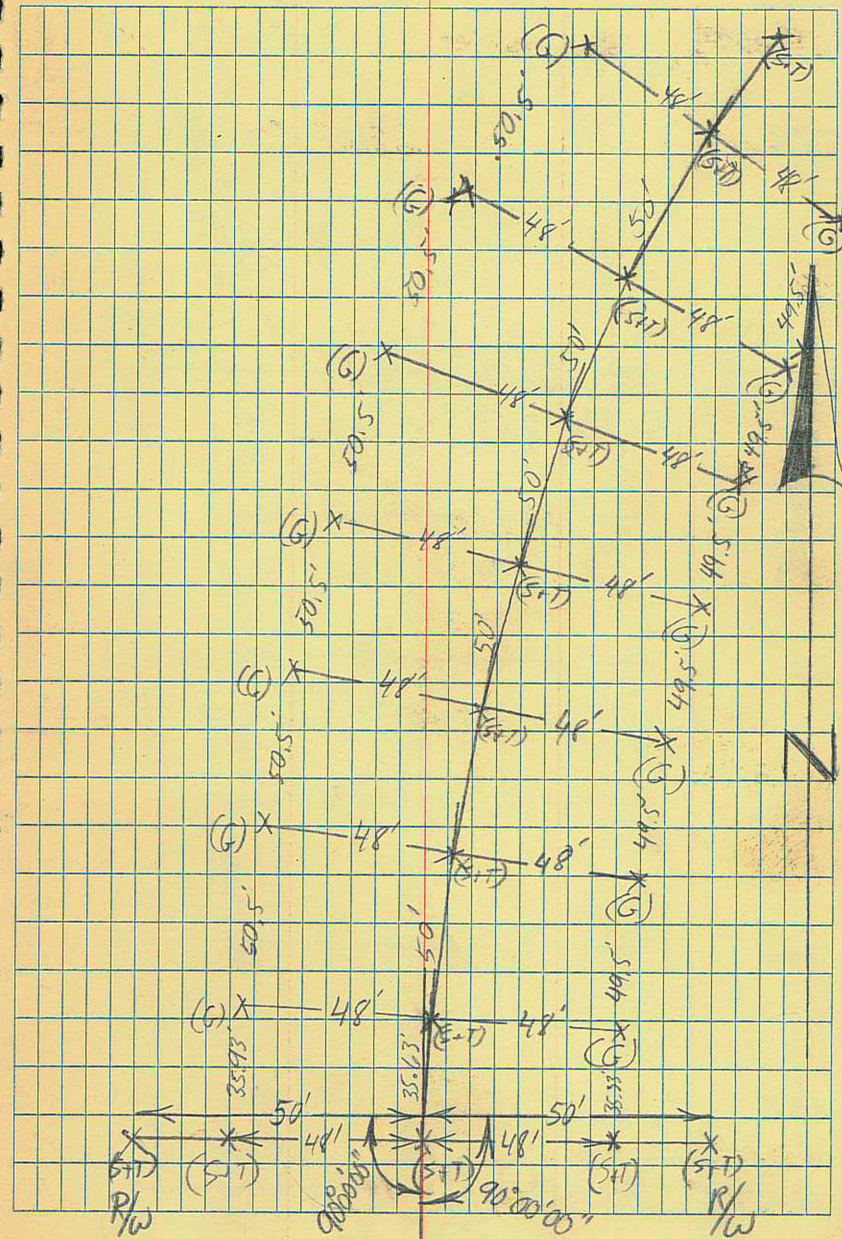
157

4 Sept 74 R.E. Swiss, G.P. Foreman, P.B. Wood



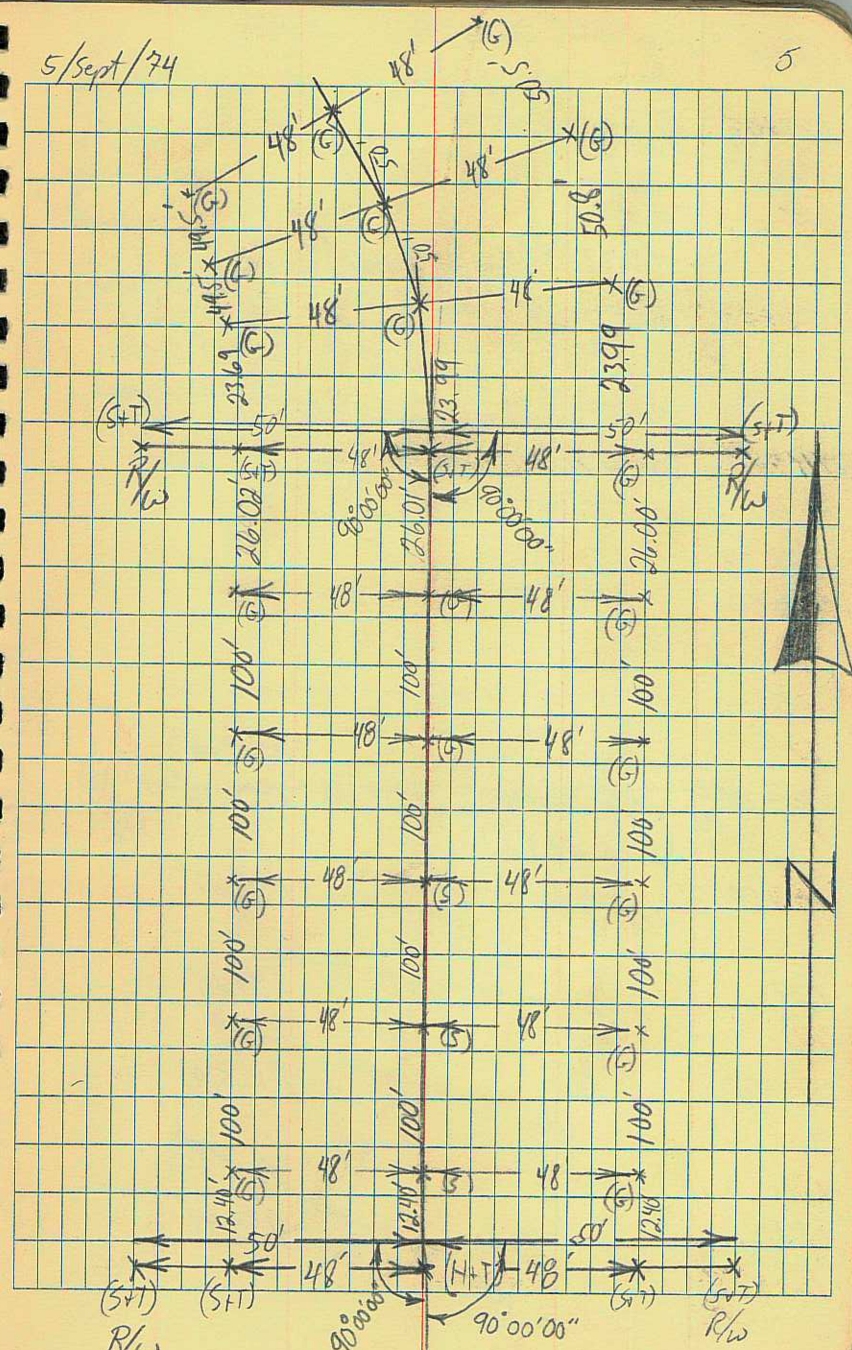
			Lt side Rt ∡	℄ Rt ∡	Rt side Rt ∡
166+87.60 PT	R/W marker (Found old PT)		2°08'17"	2°08'16"	2°08'19"
+50			1°55'23"	1°55'21"	1°55'22"
166-			1°38'12	1°38'10"	1°38'11"
+50			1°21'00"	1°20'59"	1°21'00"
		R=5000			
165		Δ=4°16'37"	1°03'48"	1°03'48"	1°03'49"
		T=186.70			
		L=373.23			
+50		D=1°8'45"	0°46'37"	0°46'37"	0°46'38"
164 –			0°29'26"	0°29'26"	0°29'27"
+50			0°12'14"	0°12'15"	0°12'16"
163+14.37 P.C.	(Found old P.C)				

5 Sept 1974 R.E.Swiss, C.P. Foreman, P.B. Ward.



				L+℄
+50				0°42'37"
172				0°25'26"
+50				0°8'15"
171+26.01 P.C.	R/W Marker (found old P.C.)			
171				
170				
169				
168				
167				
166+87.60 PT	R/W Marker			

5/Sept/74

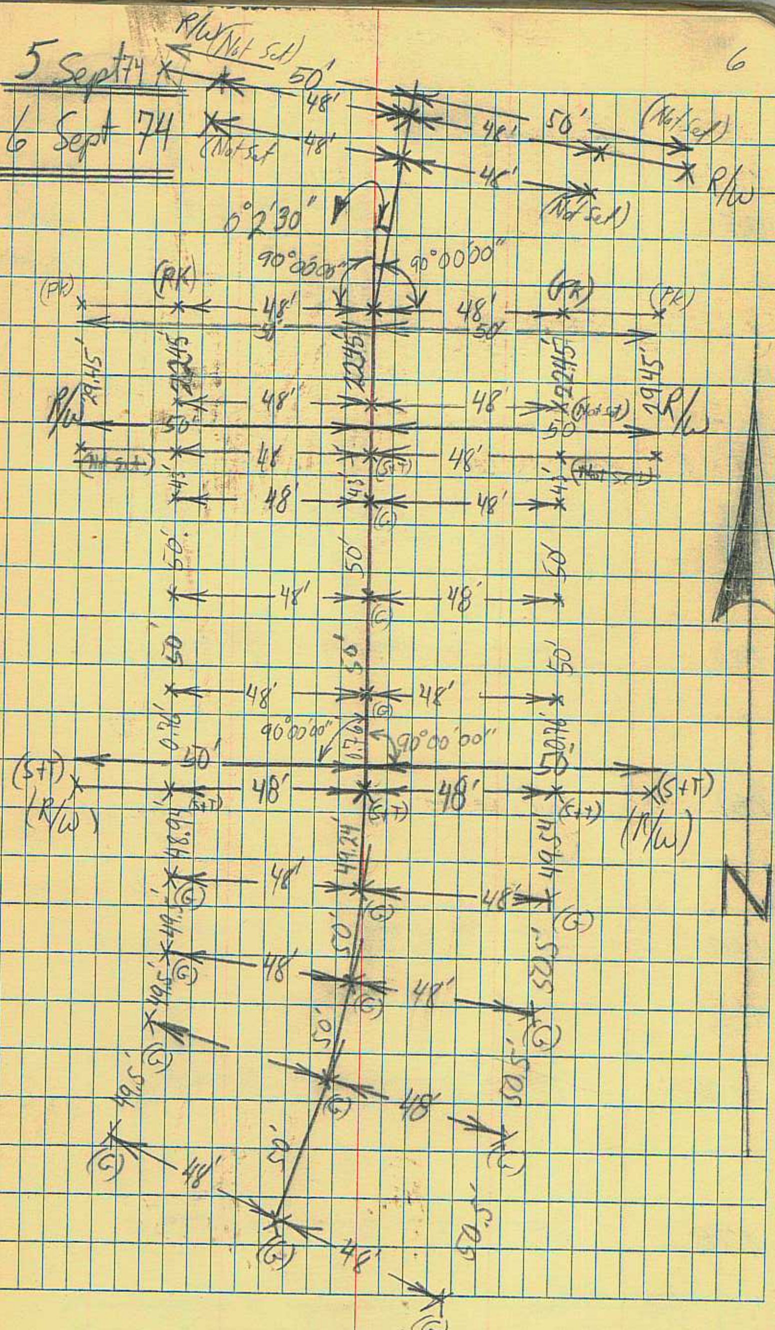


Note: R/w + 48' stakes @ ~~176+43~~, 177+03 were not set due to irrigation ditches.

177+03	R/w Marker			
177-	(not set, in irr. ditch)			
	176+72^45 (Measured Station of Road nail) Error of .72'			
176+73^17 Δ	Angle pt. Rt. 0° 0' 23" (Corrected) 600 "N" St — 61.62' East Tele. Pole; 55.93' West Tel. Pole (nail)		Turned new ∡ Rt 0° 2' 30"	
+50	(East 48' mark not set due to irr. ditch)			
176+43	R/w Marker			
176				
+50				
175				
			(2°10'00")	
174+99^29 P.T.	R/w Marker (Found old PT)	(373 26)	2°08'16"	66 16 49
+50			1°51'21"	
174			1°34'10"	
+50			1°16'59"	
173-			0°59'48"	

~~5 Sept 74~~

6 Sept 74



185

184

183

182

181

180

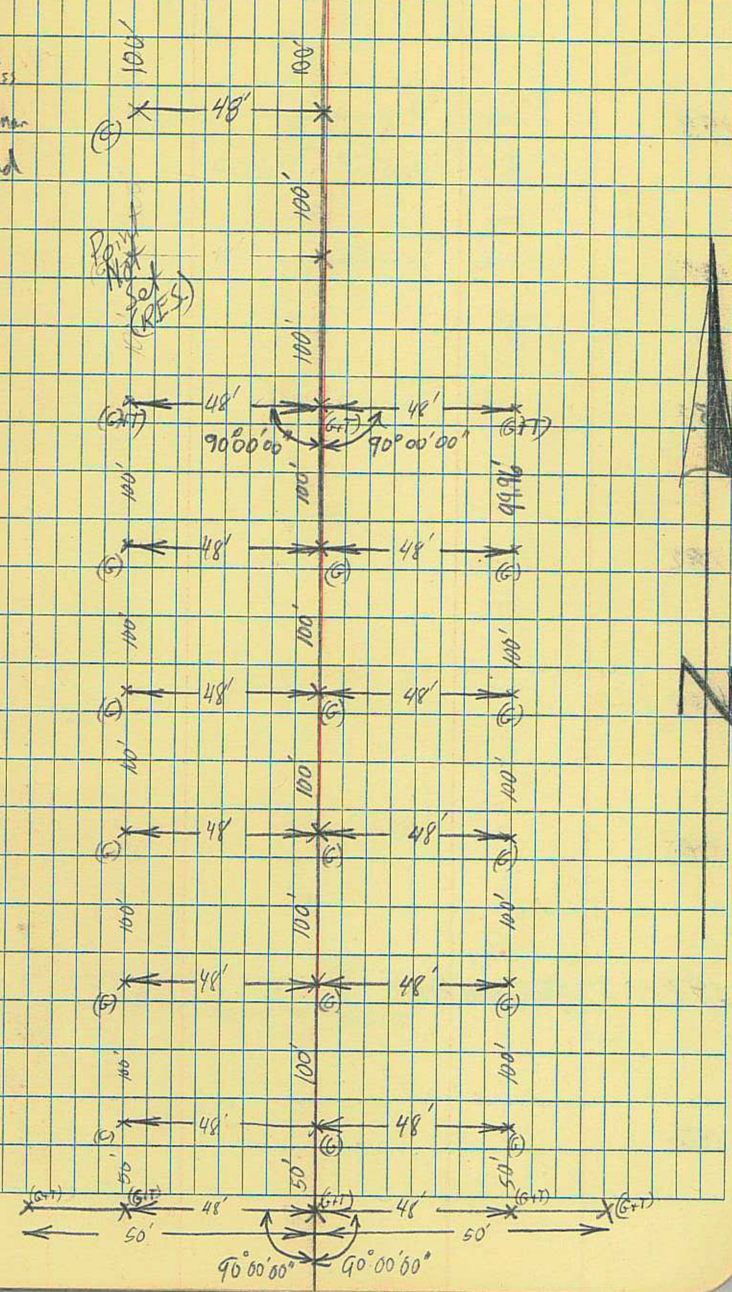
179

178

177+50

6 Sept 1974

R.E. Swiss
G.P. Foreman
P.B. Wood



193

192

191

190

189

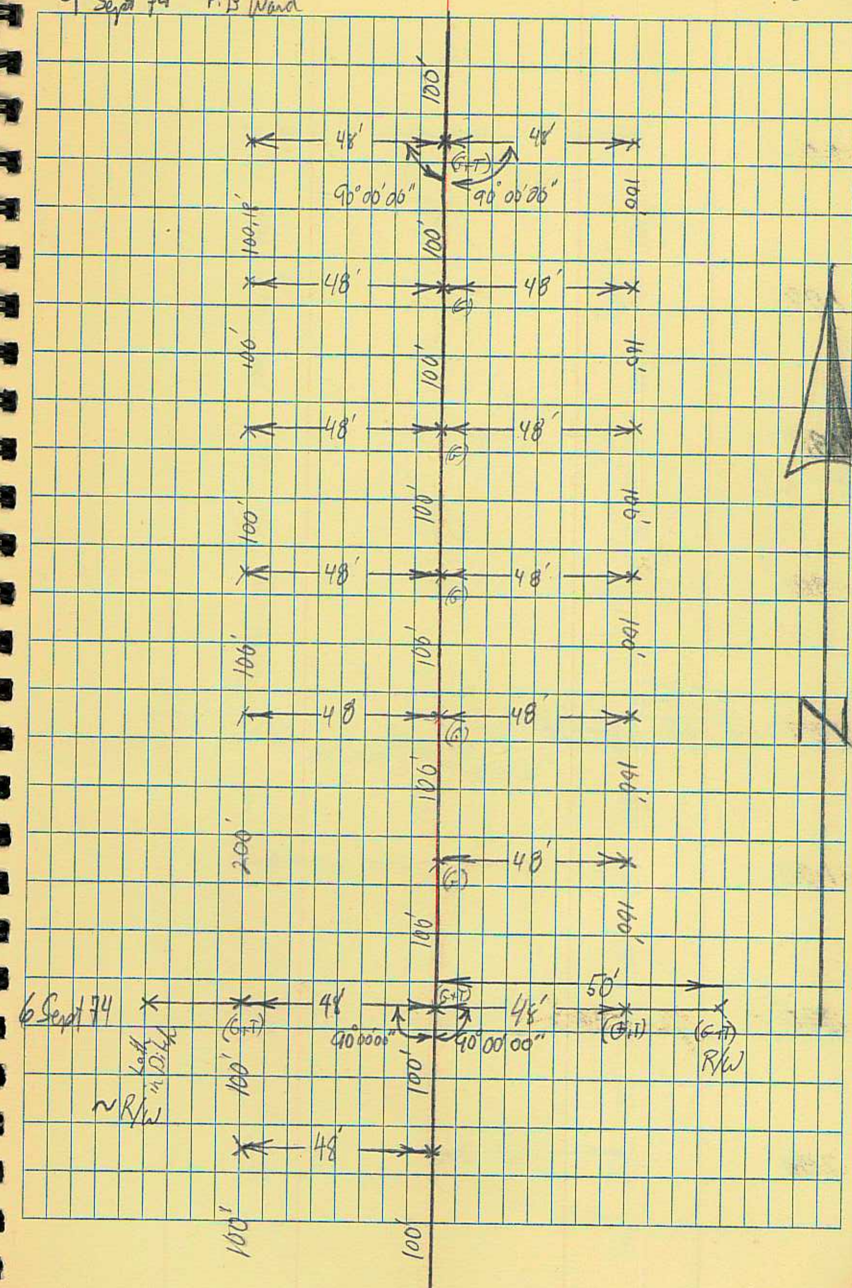
188

187 ~ R/W Marker

186

R.E. Swiss G.P. Foreman

9 Sept 74 P.B. Ward



201

200

199

198

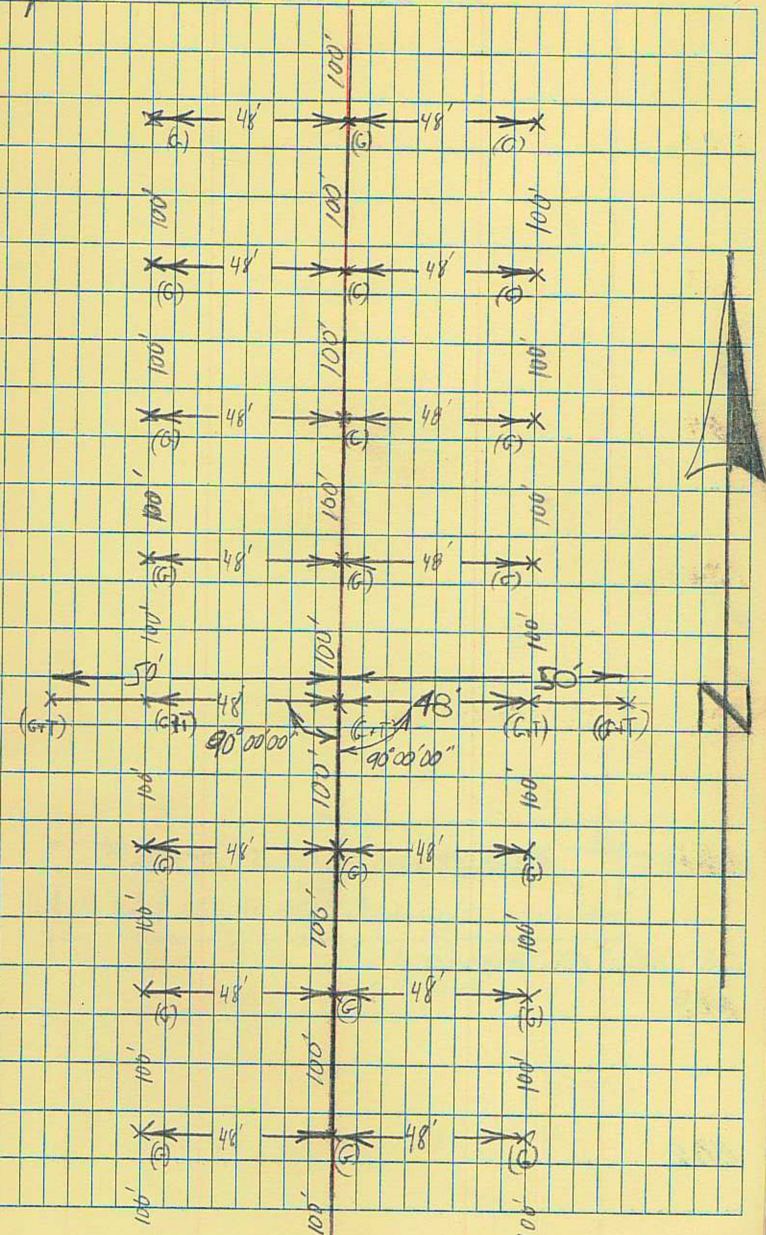
197+00 C/L Marker

196

195

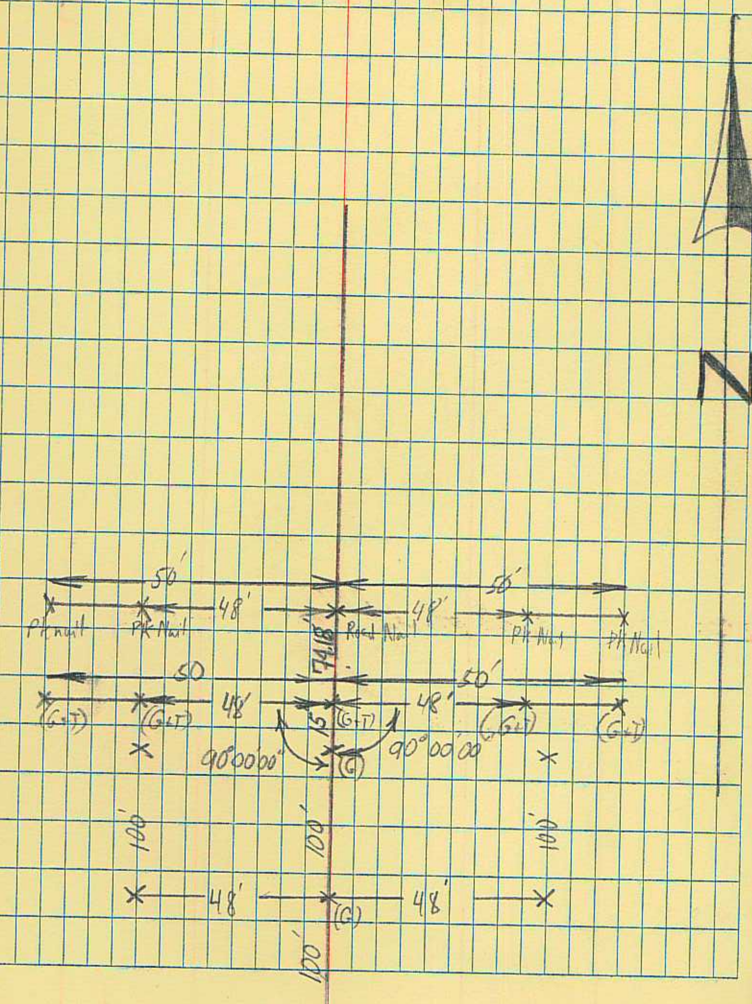
194

9 Sept 74



$203+88^{52}$ Δ	Angle Pt. Lt 0° 5' 03" Lt
	Measured 89.18' from Sta 203 to Angle Pt Nail
203+15	R/w Marker
203	
202	

9 Sept 74



343 (4)

2710.95 ∢ ~~90°19'5"~~

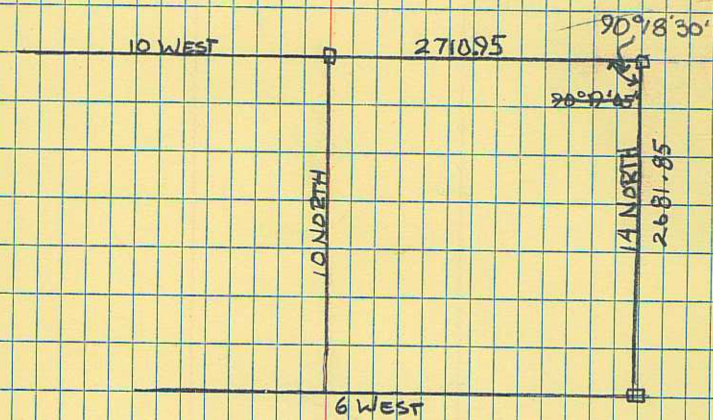
2681.85 90°18'30"

~~203+77~~

203+88 52

27 10 95

230+99 42



203 88.52
174 99.24
28 89.28

2888.66

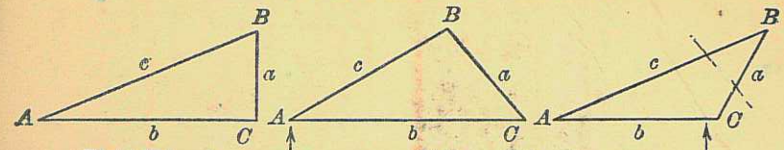
173,13

173+73 13

178+73 17
176 72 37
80

174+99 24
1 73 13
176.72 37

TRIGONOMETRIC FORMULAS



Right Triangle — Oblique Triangles

Solution of Right Triangles

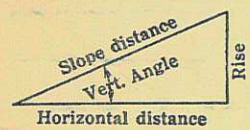
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

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	$s = \frac{a+b+c}{2},\ \sin\frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}},\ \sin\frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}},\ C = 180° - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2}$, area $= \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	area $= \frac{bc \sin A}{2}$
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′. Since 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.