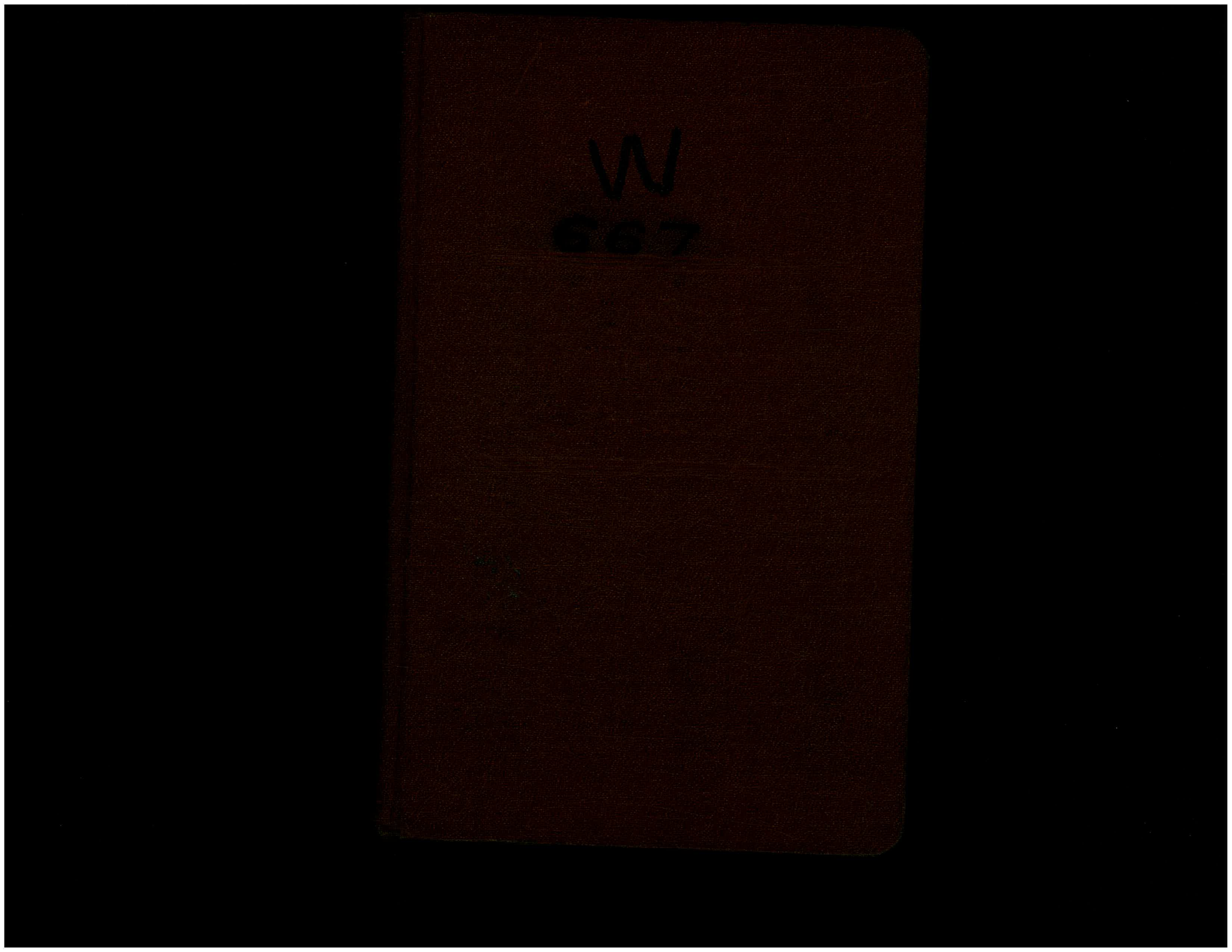
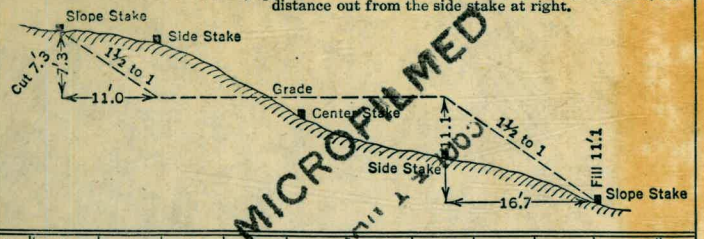

VV
667

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

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



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

KEUFFEL & ESSER CO., N. Y.

For Curve Tables see end of book.

667

The paper in this book **No. F363A** is made of **50%** high grade **rag stock** with a **WATER RESISTING** surface sizing.

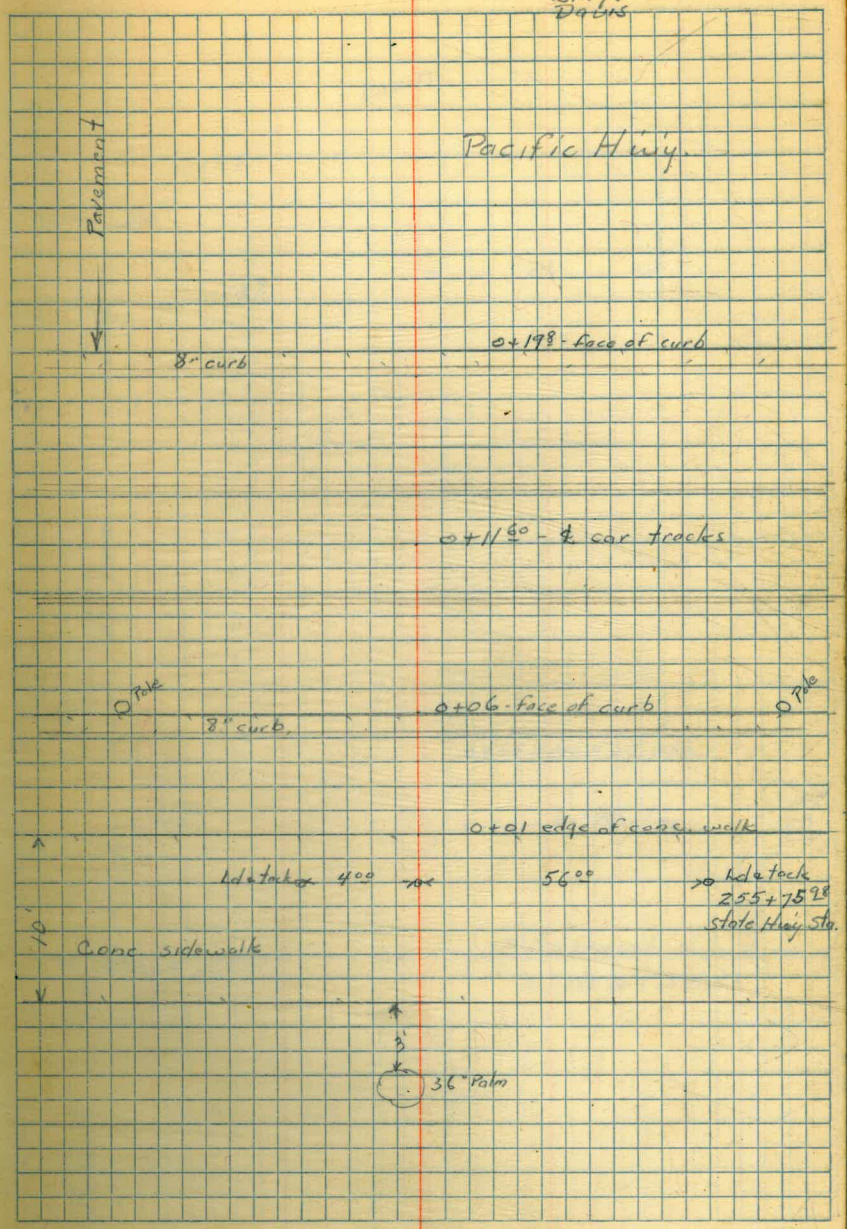
11.112. ks x, yc. kM.

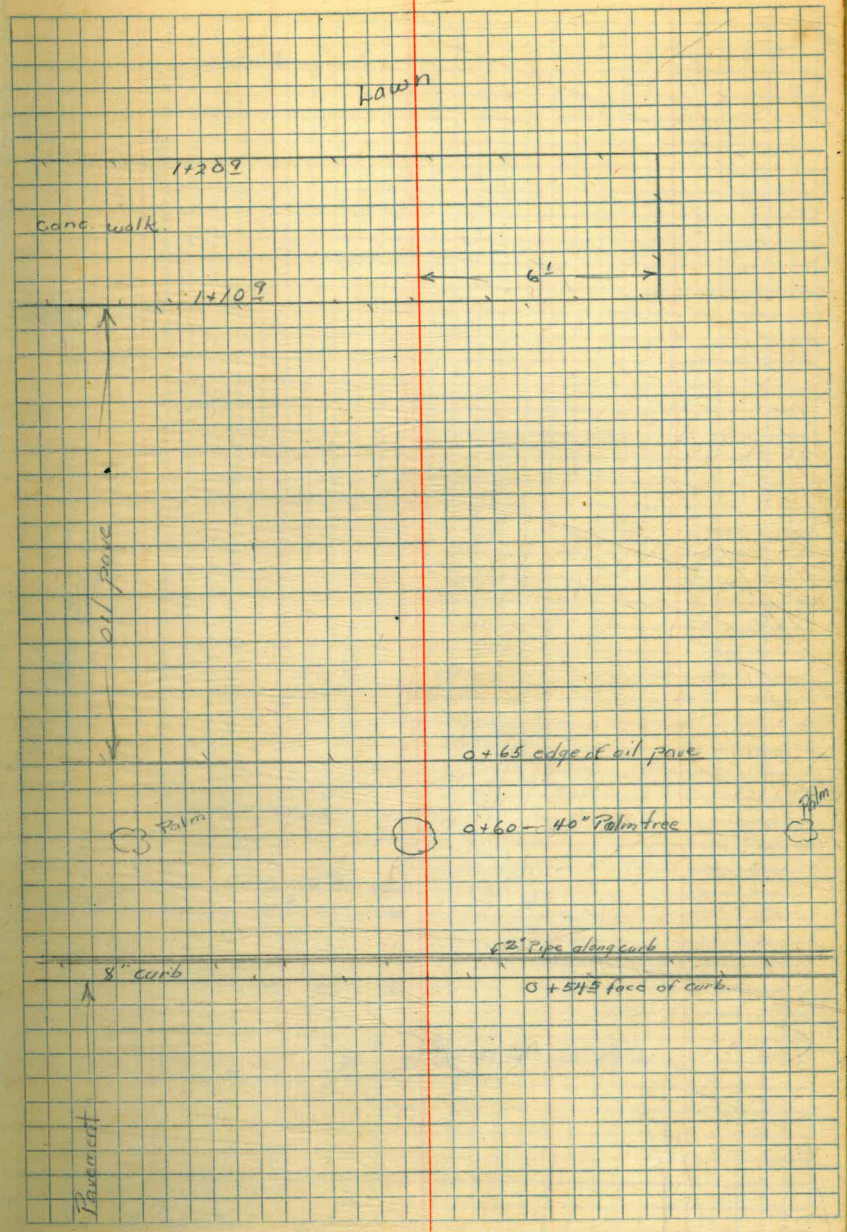
Index

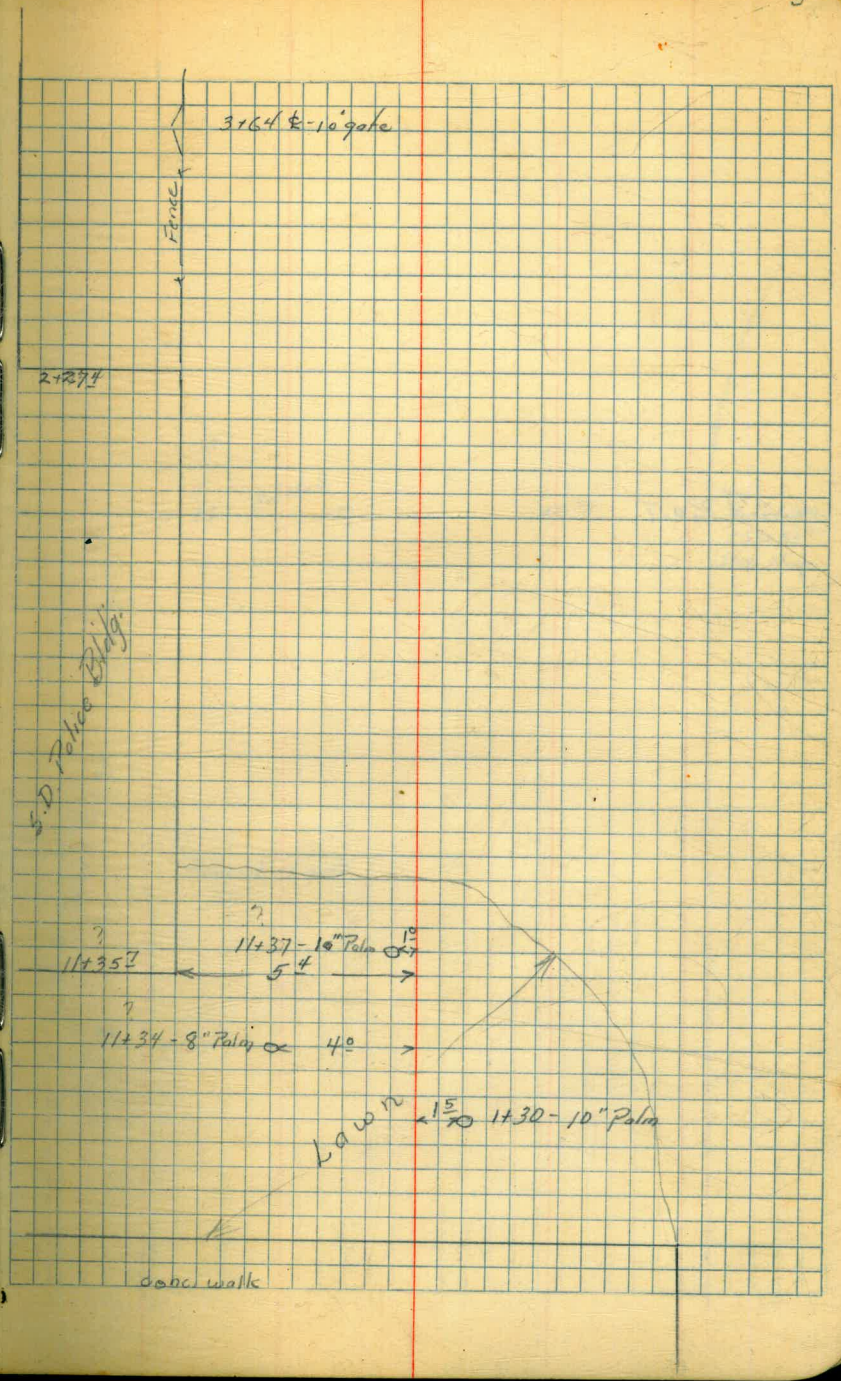
Alignment - Harbor Front Pipeline location
Southeast from Pacific Hwy. to Vesta St.

0+00

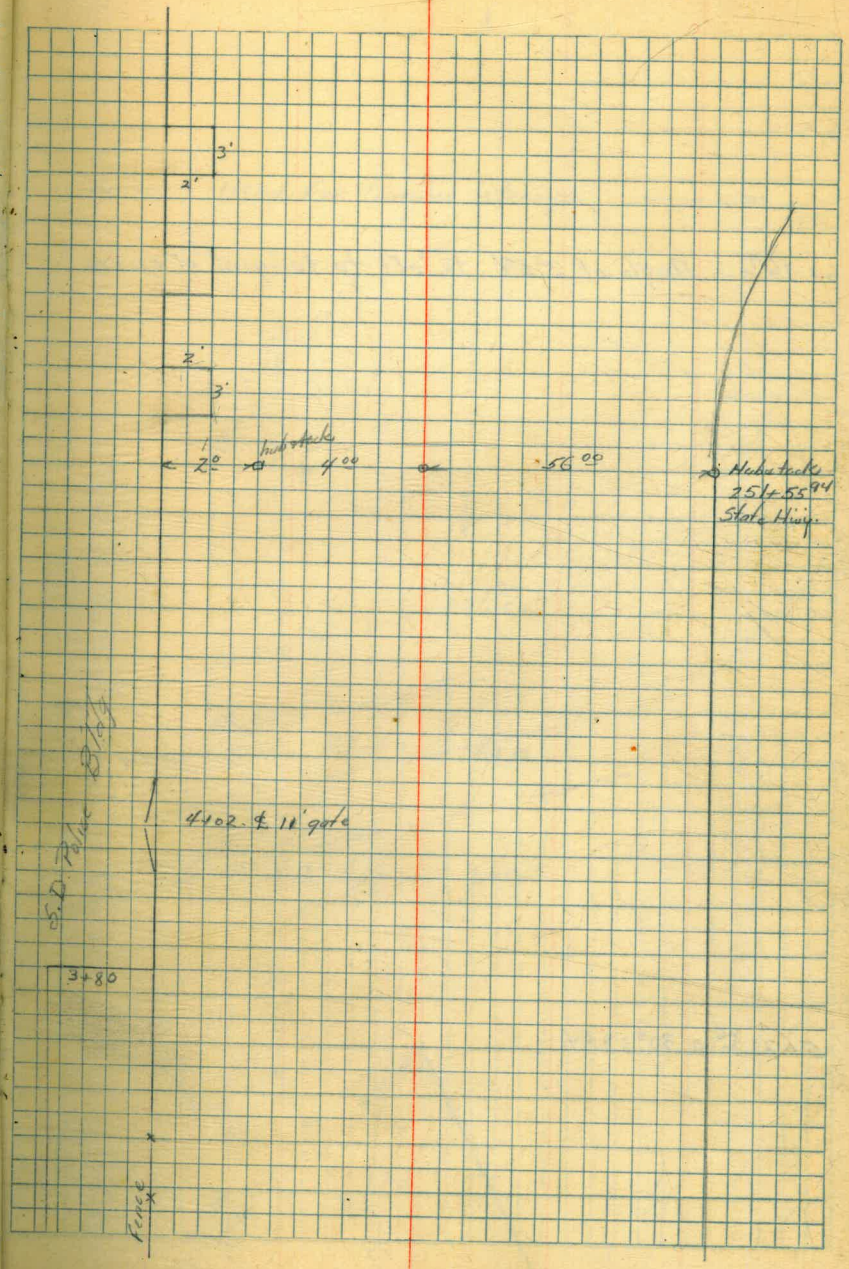
9/10/42
Hill
Super.
King
Davis




Lawn
1+28 ±
conc. walk.
1+10 ±
6'
oil pave
0+65 edge of oil pave
Palms
0+60 — 40" Palm tree
Palm
8" curb
0+54 ± face of curb.
Pavement

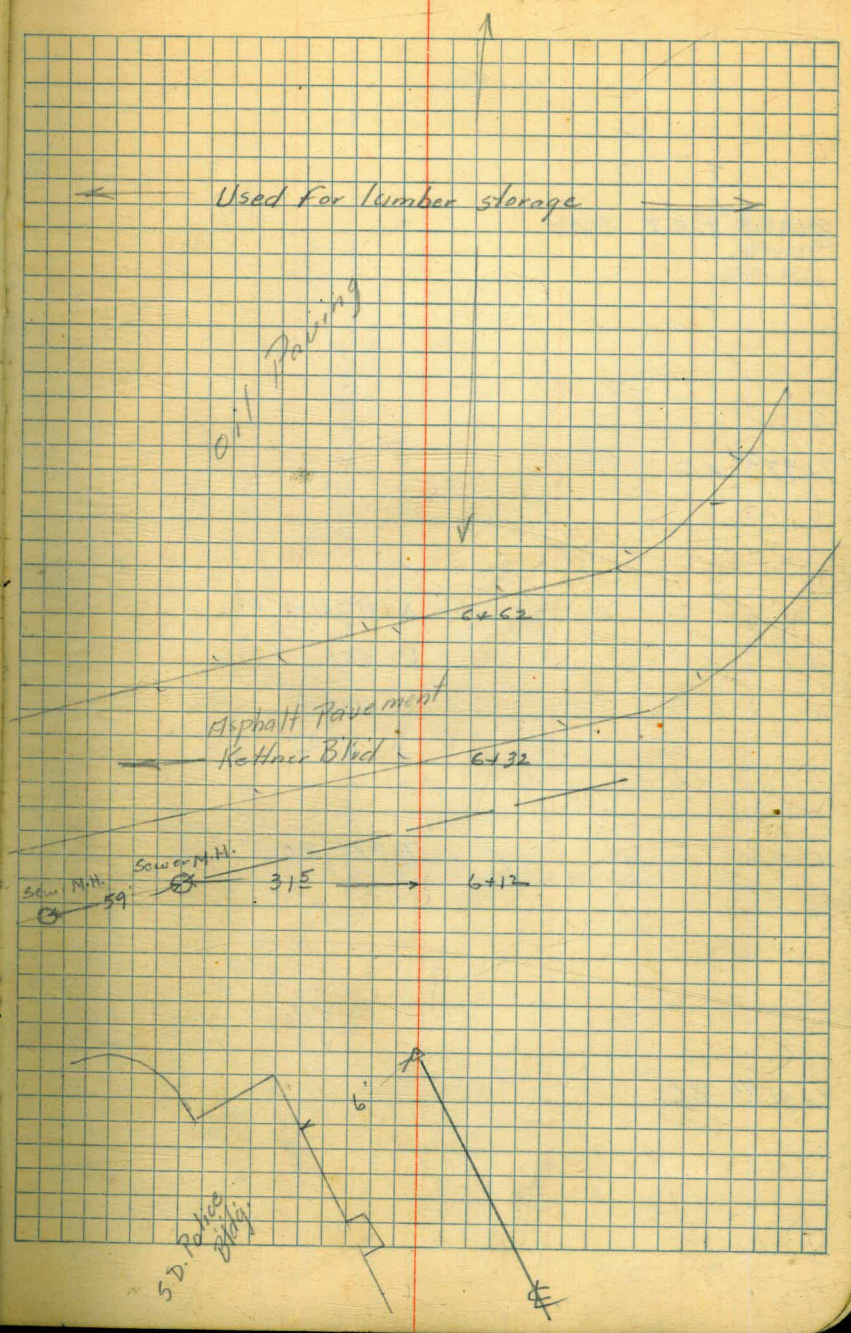

3+64 ± - 10' gate
Fence
2+27±
S.D. Police Bldg.
11+35?
11+37 - 10" Polin
11+34 - 8" Polin
4°
Lawn
15
11+30 - 10" Polin
conc walk

4122.79 P.O.T.


3'
2'
2'
3'
2°
4°00
56°00
Hubbard tracks
2514.55.94
State Hwy.
4402.4 11' gate
S.D. Rd. 8104
3+80
Fence

6+86.91 = Angle of 2°54' to left to tangent of curve

5+72.86 Δ 30°33' Rt



8+09 46 P.O.T

7+97 24 E.C.

Δ = 11°28'22" Rt

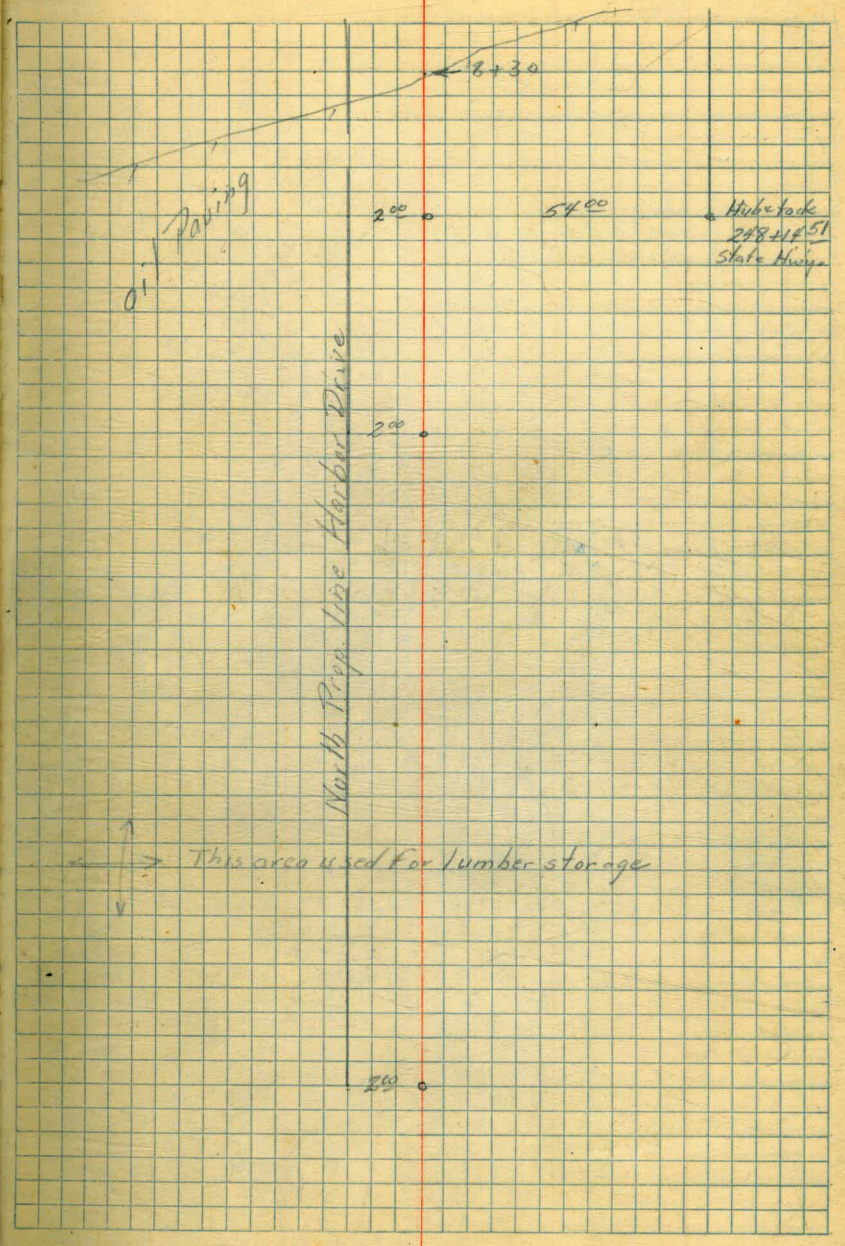
R = 551

L = 110.33

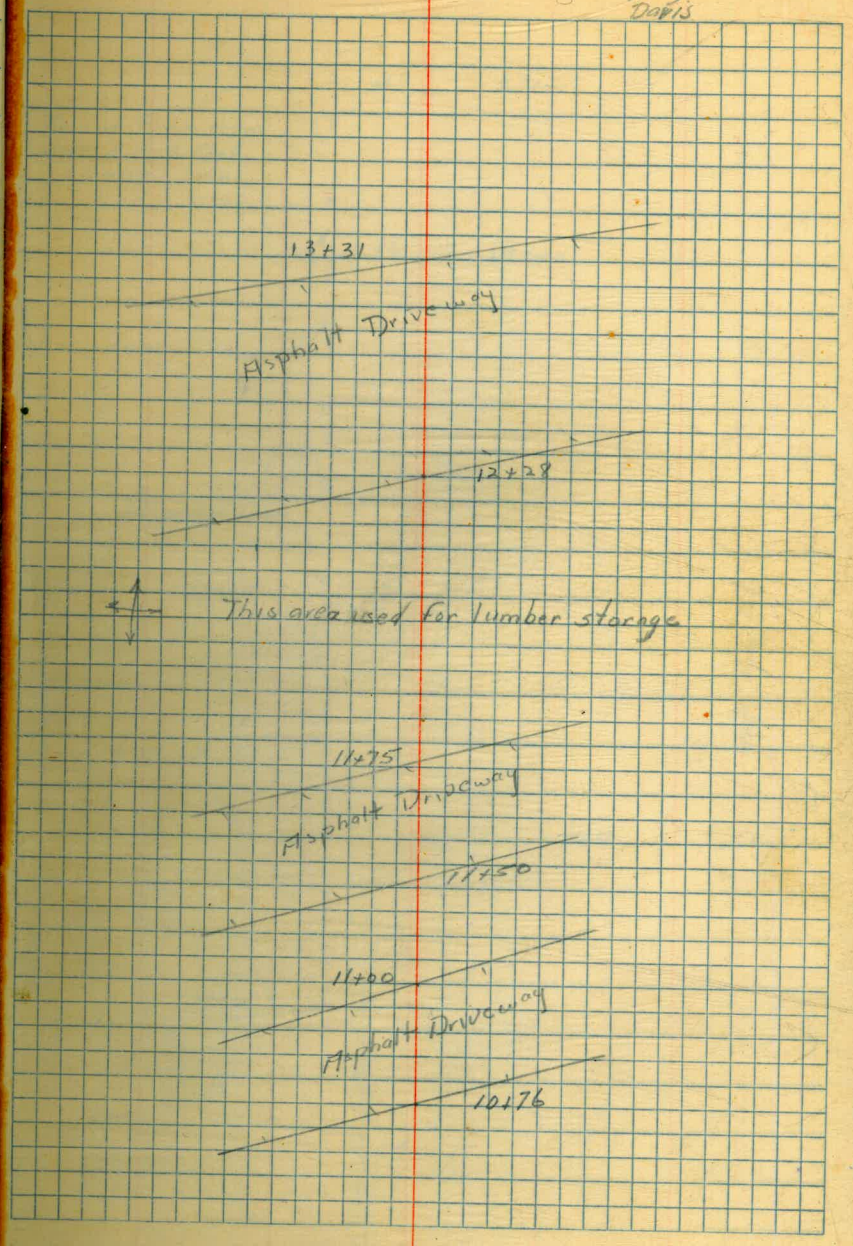
T = 55 34

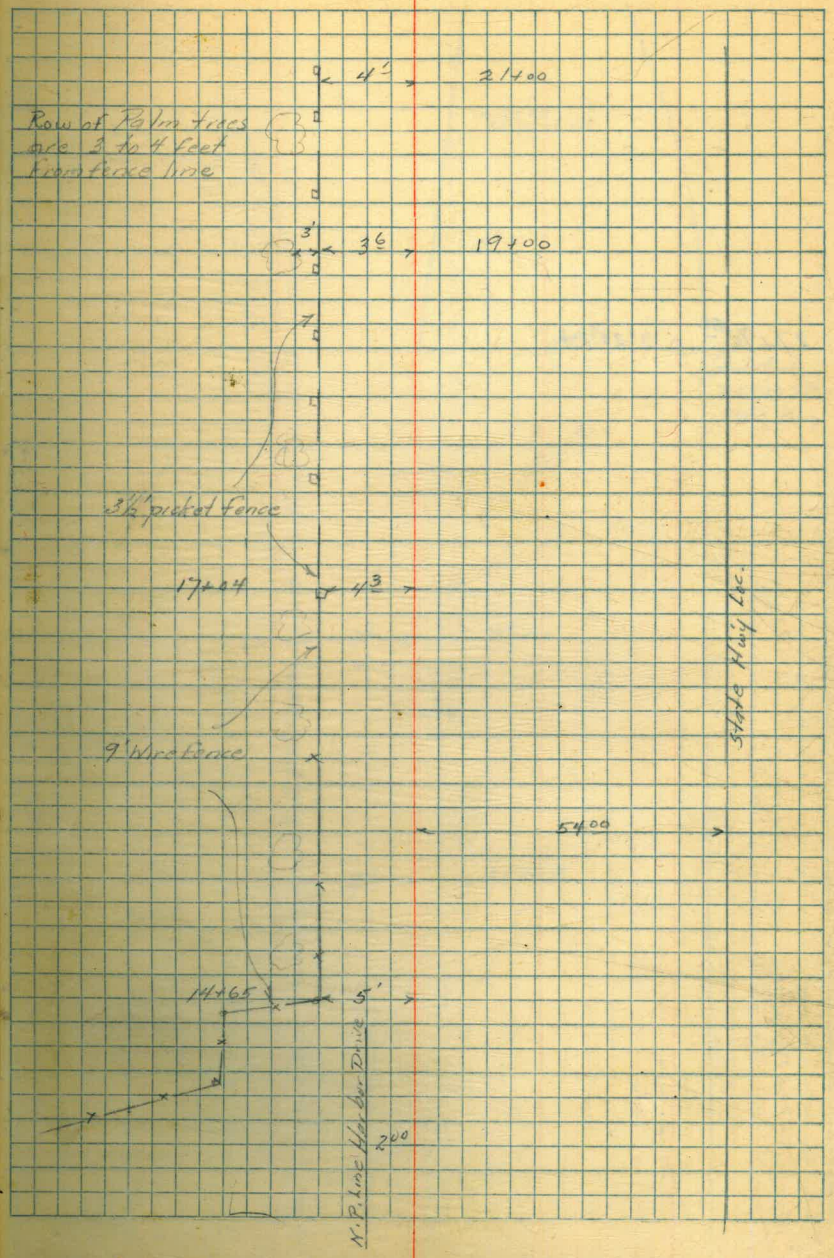
7+97 24 E.C.

C+86 91 B.C.

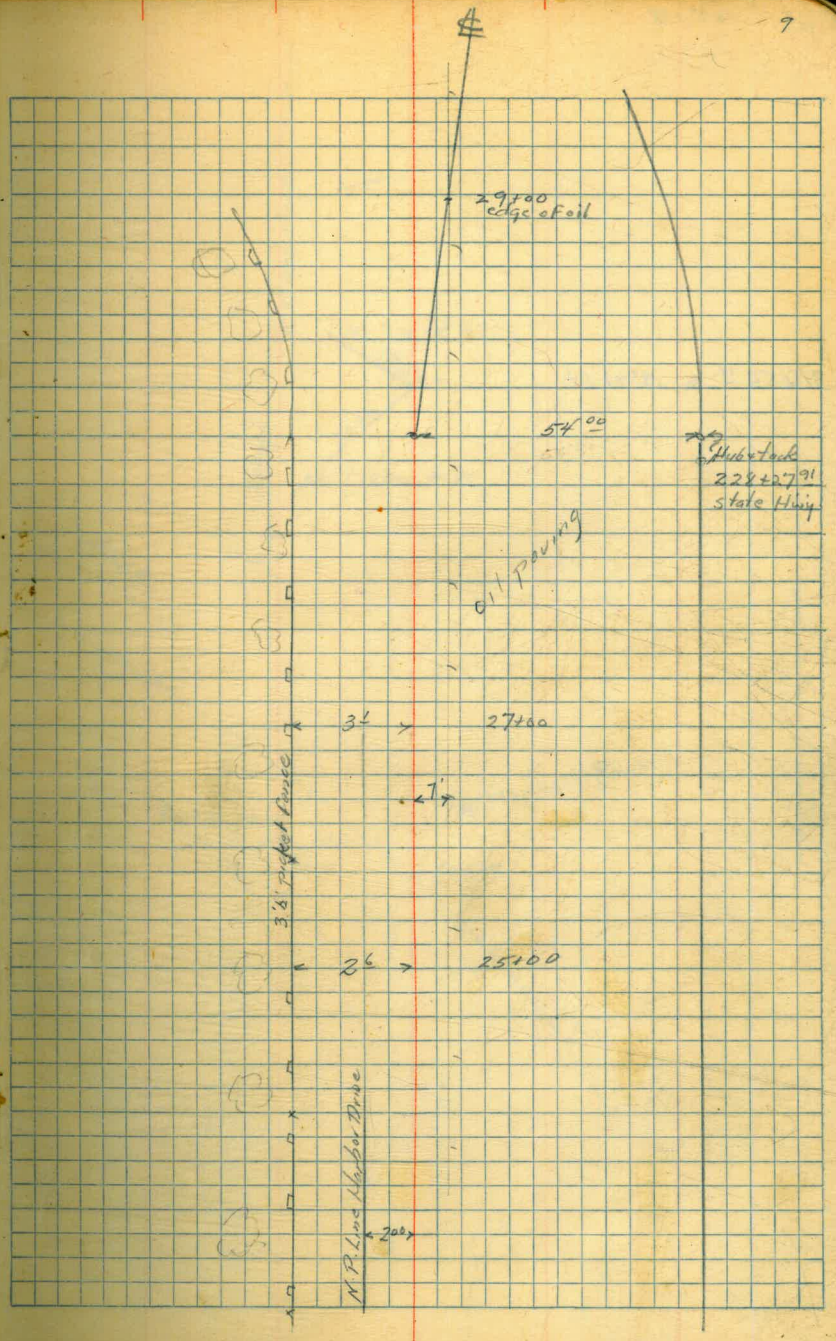


9/11/42
Seper
Klag
Davis

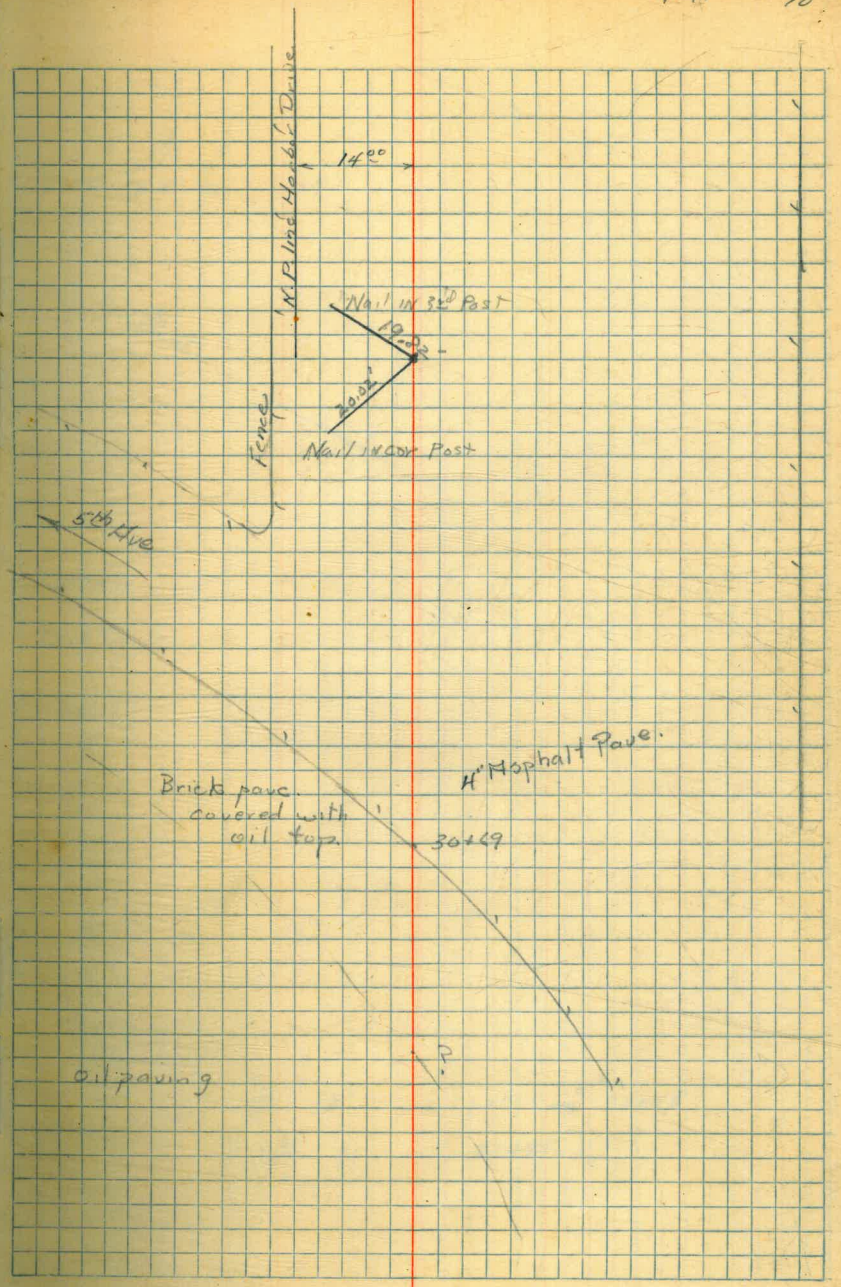


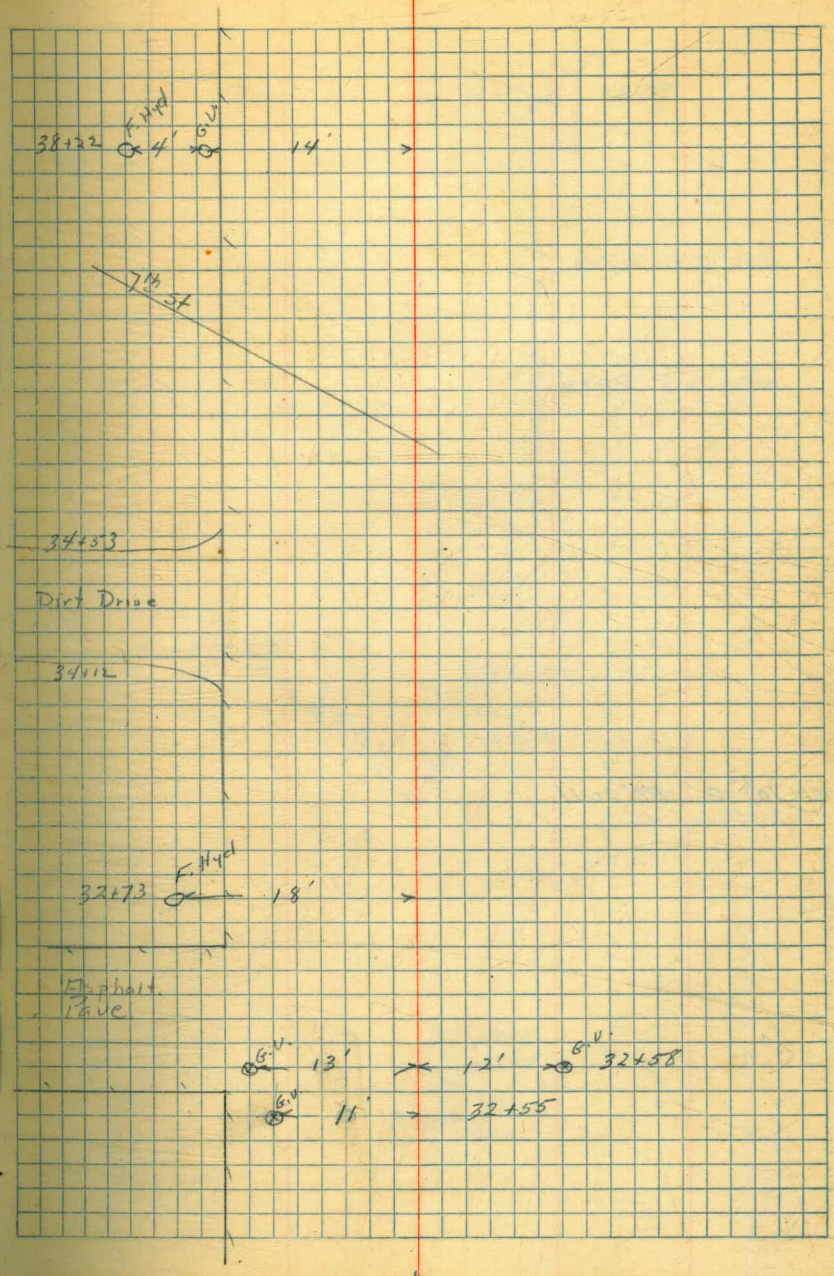

Row of Palm trees are 3 to 4 feet from fence line
4'
21+00
3'
3.6
19+00
3½' picket fence
17+04
4.3
9' Wire fence
54+00
14+65
5'
N. P. Line Harbour Drive
+20
State Hwy. Dr.

$27+96^{62}_{=}$ Δ 3°21' Rt

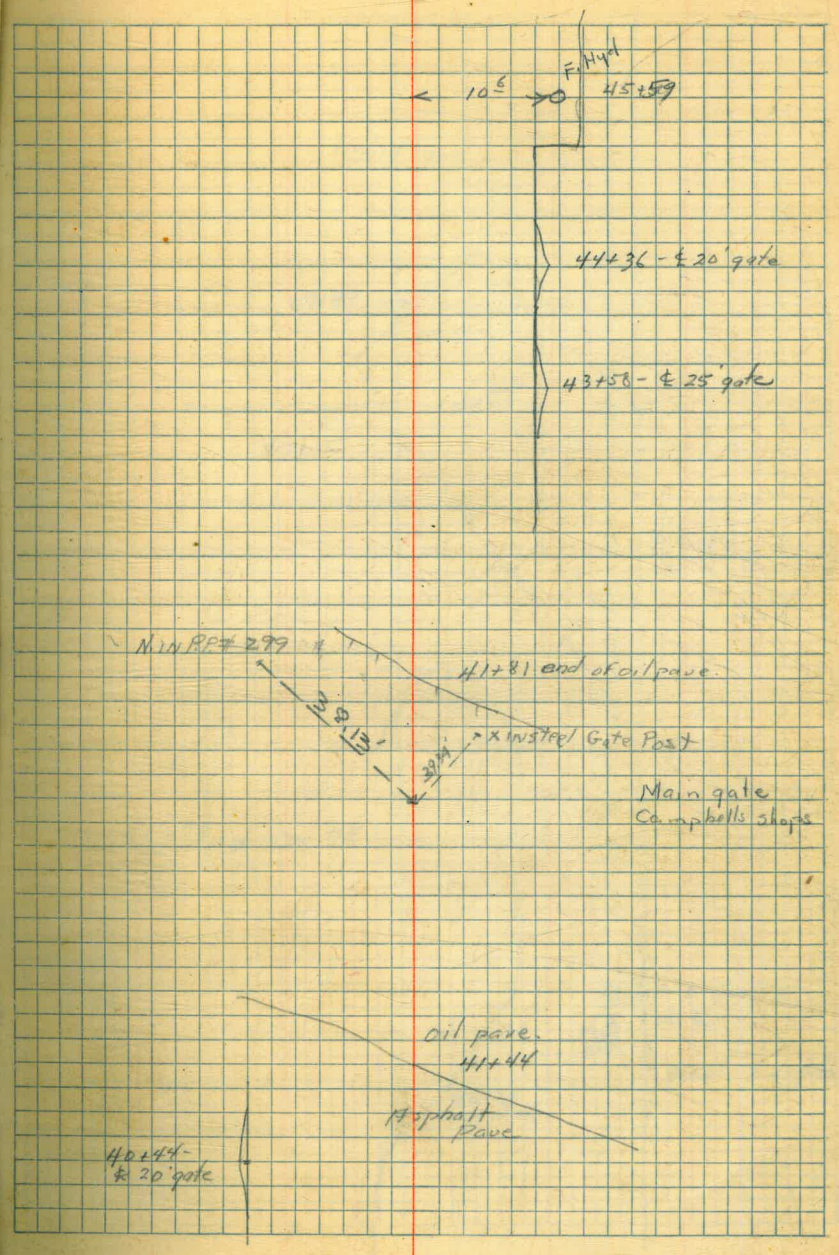


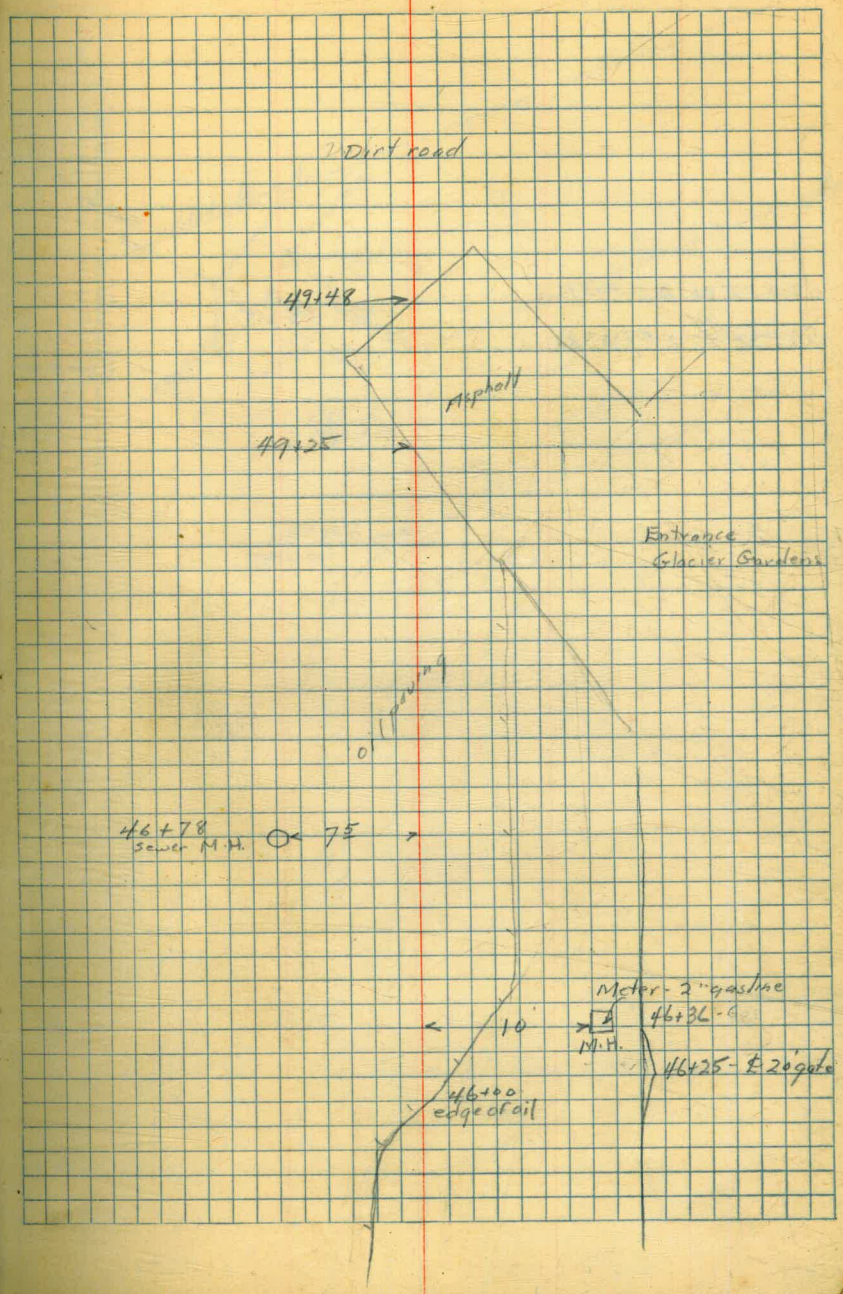
31+56 ± Δ 3°21' Lt


14.00
1" Plank Hedge 6' Drive
Nail in 3x4 Post
19.02
30.02
Nail in Door Post
Fence
5" Mb. Curb
Brick pave. covered with oil top.
4" Asphalt Pave.
30+49
P.I.
Oil paving


38+22
F. Hyd
4'
G.V.
14'
2%
SL
34+33
Dirt Drive
34+12
32+73
F. Hyd
18'
Asphalt
Drive
G.V.
13'
12'
G.V.
32+58
G.V.
11'
32+55

41+70 $\frac{70}{}$ Δ 58°20' Lt

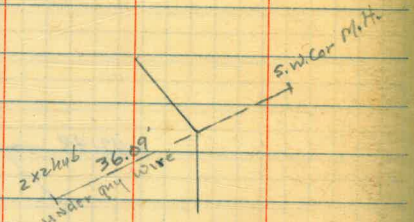


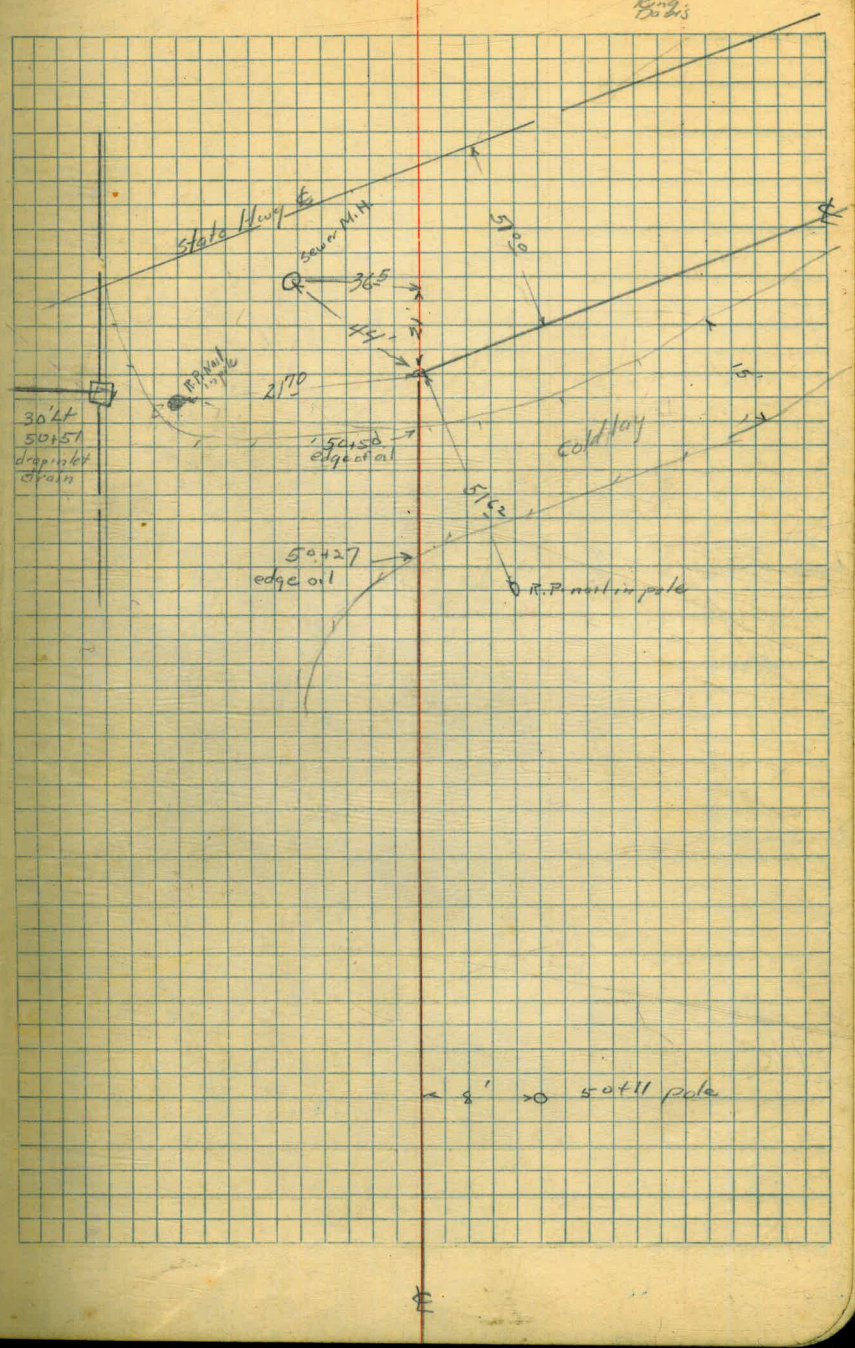

Dirt road
49+48
Asphalt
49+25
Entrance
Glacier Gardens
Drainage
46+78
Sewer M.H.
75
Meter - 2" gasline
46+36
M.H.
10'
46+25 - E 20' gate
46+00
edge of oil

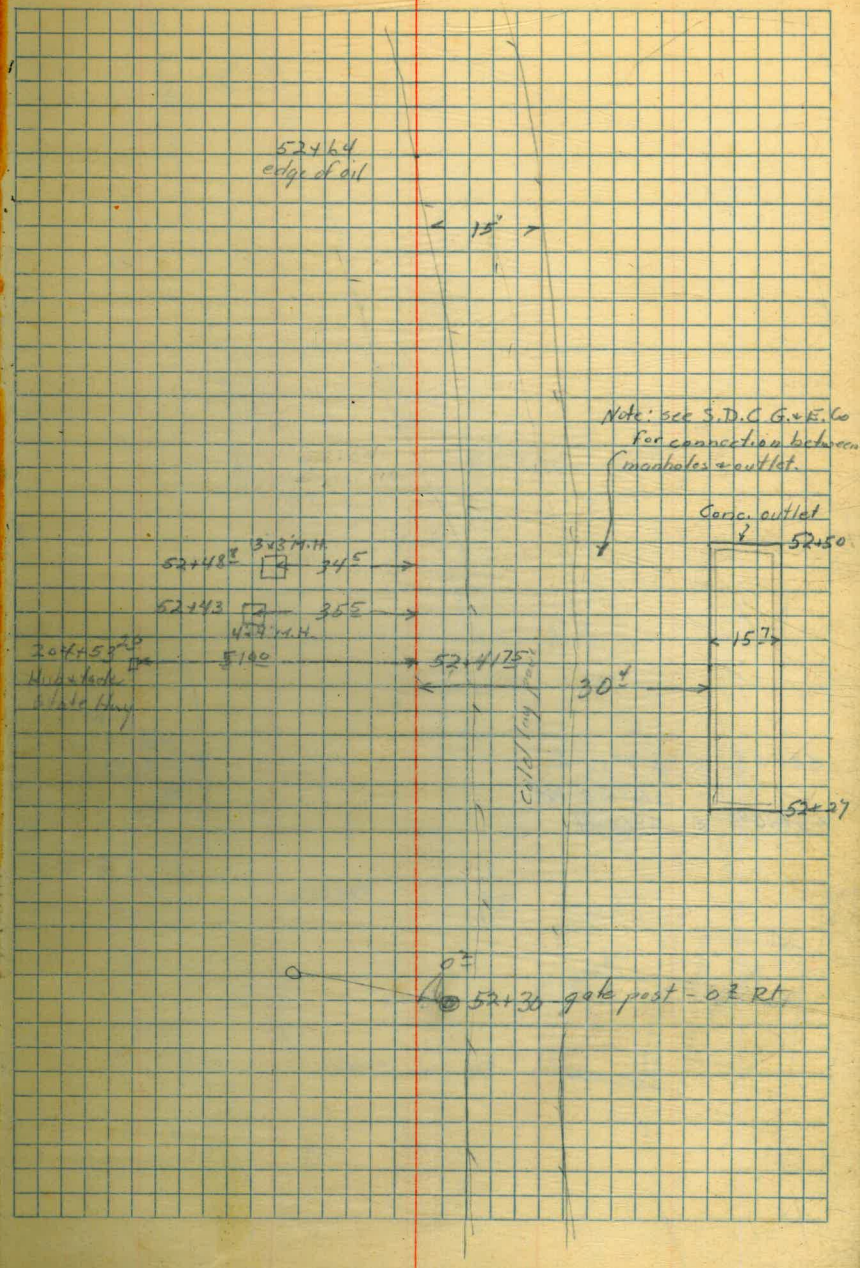
9/15/42
Hill
Soper
King
Davis

50+55.81 Δ 32°01 Rt.

50+62.95 Δ 57°03 Rt.



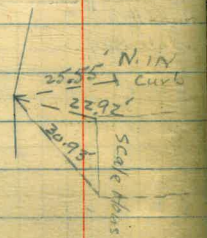


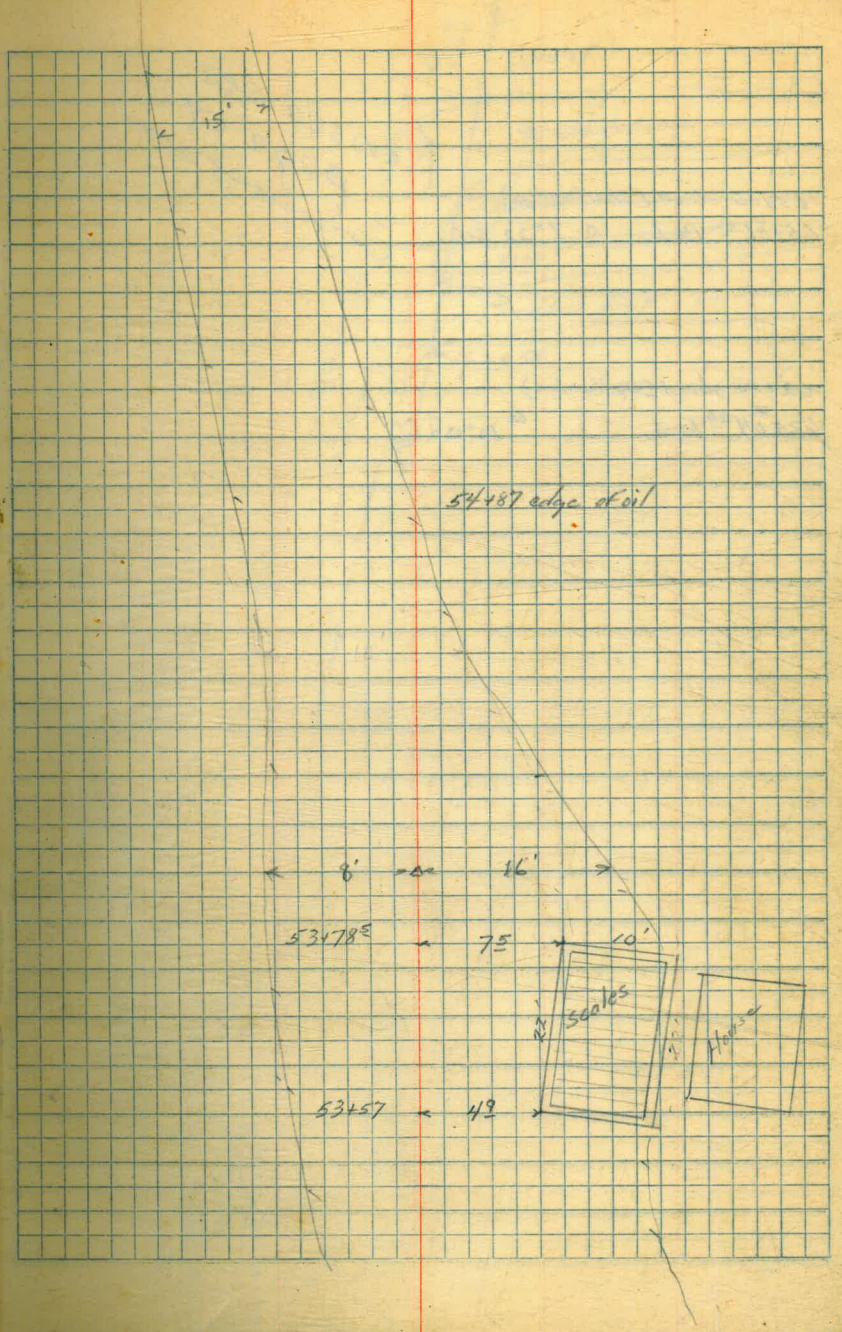

52+64
edge of oil
15'
Note: see S.D.C G.+E. Co
for connection between
manholes + outlet.
Conc. outlet
52+50
52+48 3'x3'x4.11
34.5
52+43
35.5
4'x4' M.H.
204+53.20
Hub+tack
51.00
52+41.75
30'
15'
52+27
Cable line
0'
52+30 gate post - 0.2 Rt.

13+82.83 Δ 7°33' R.

~~6°30' Rt~~

~~53+86.00 = Δ 9°12' Rt~~

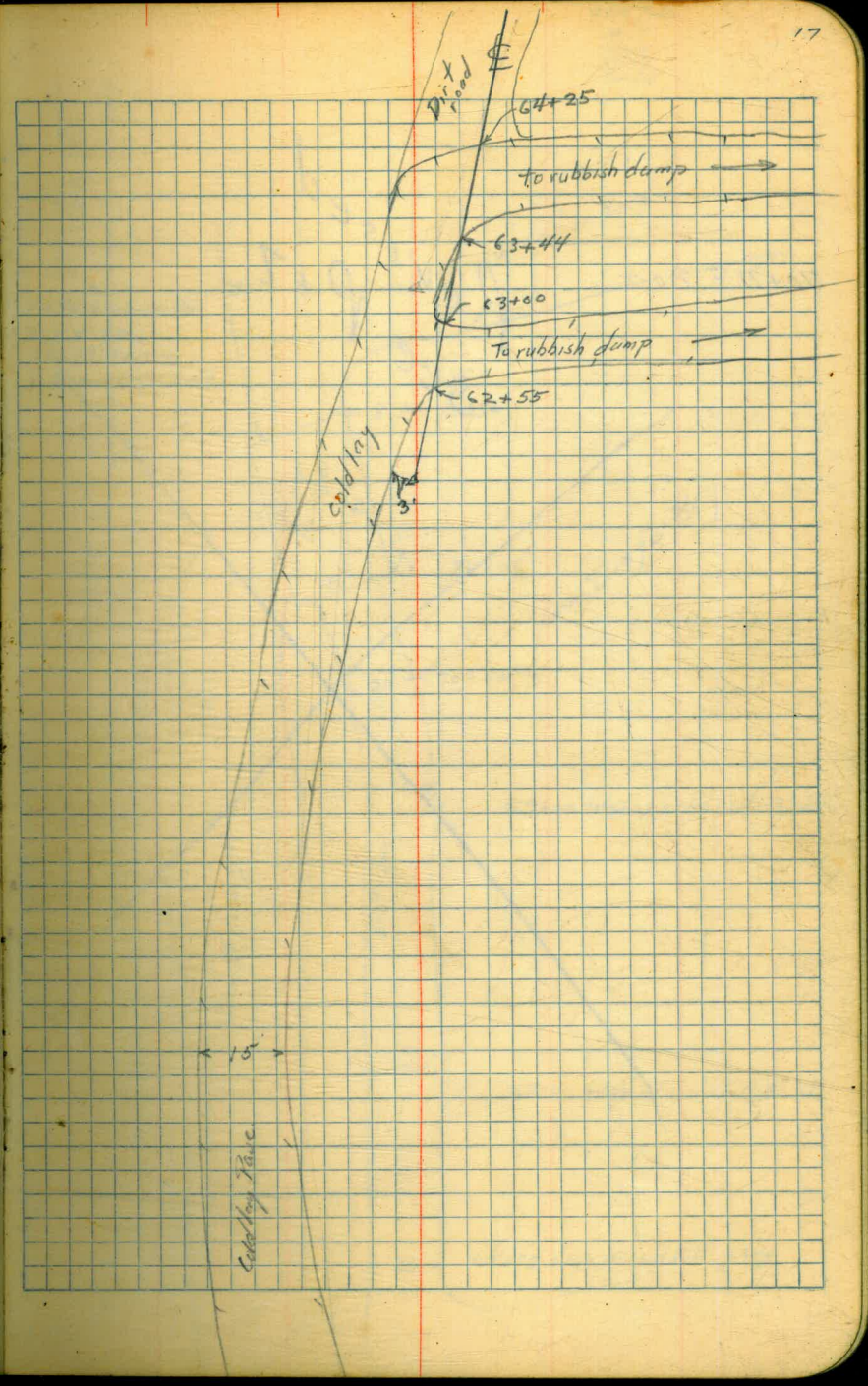




Revised see page 51

~~65+00 ahead (Shelthouse loc.)~~
~~6540 = 83 = Back~~ Δ I° 22' Rt.

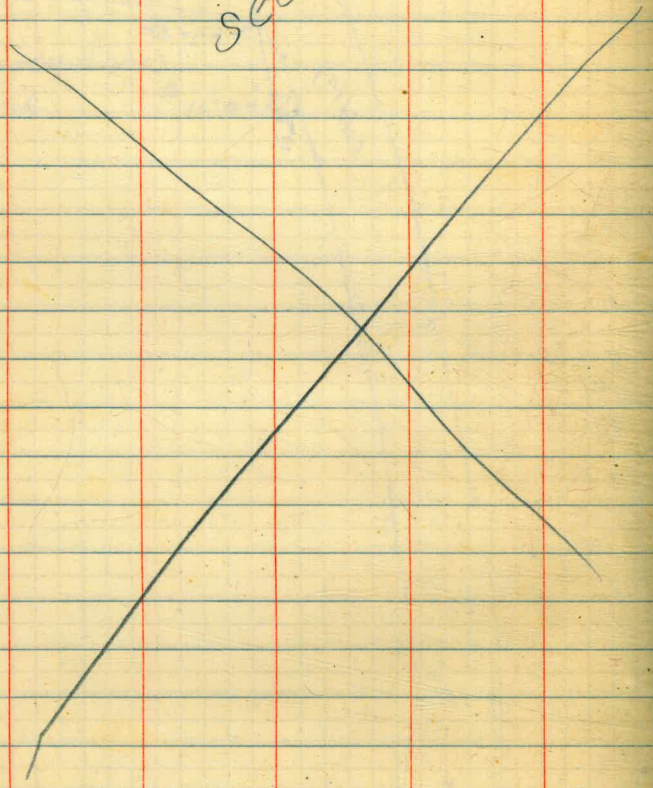
62+00 ahead (Shelthouse)
62+04 = 20 = back Δ 10° 04' Rt

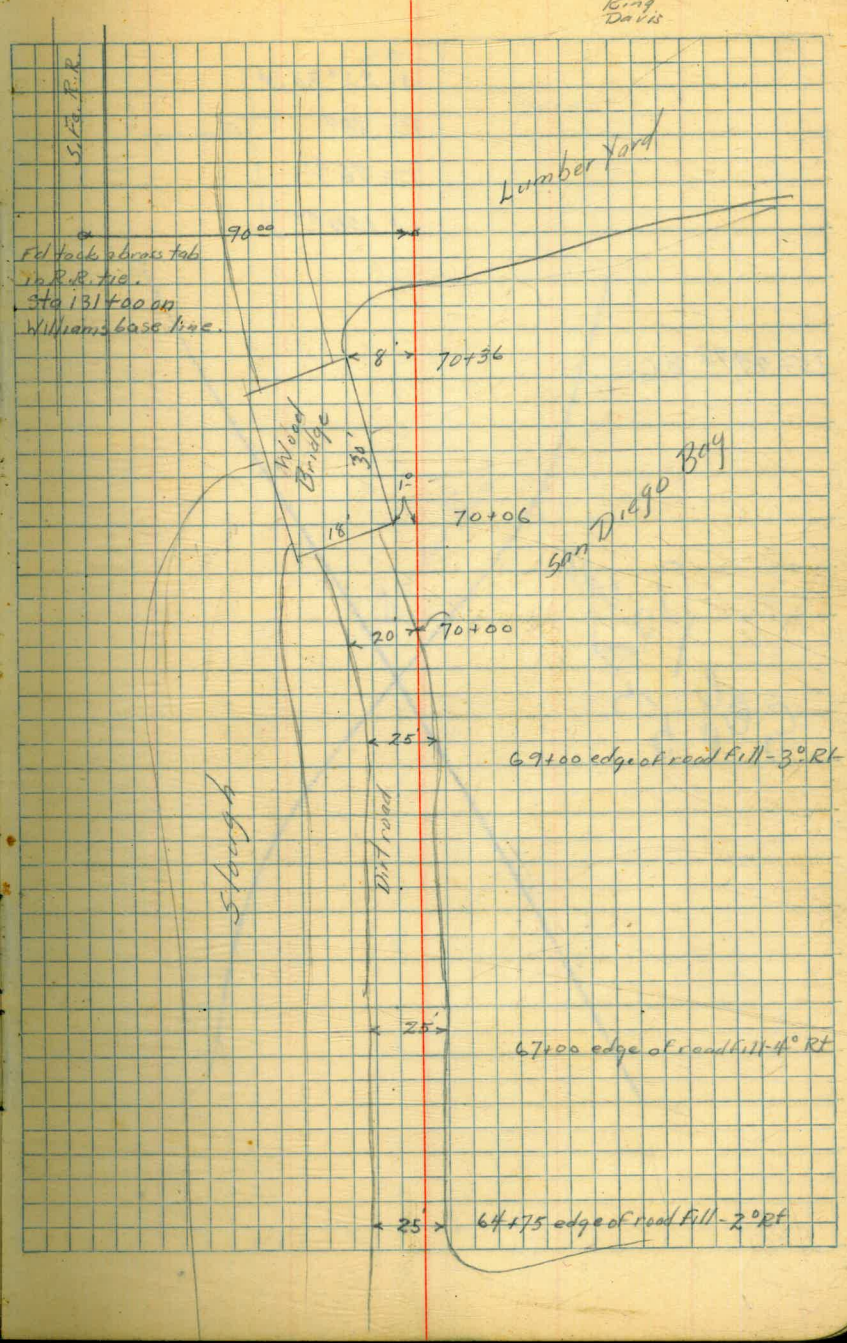


9/16/42
14.11
Super
King
Davis

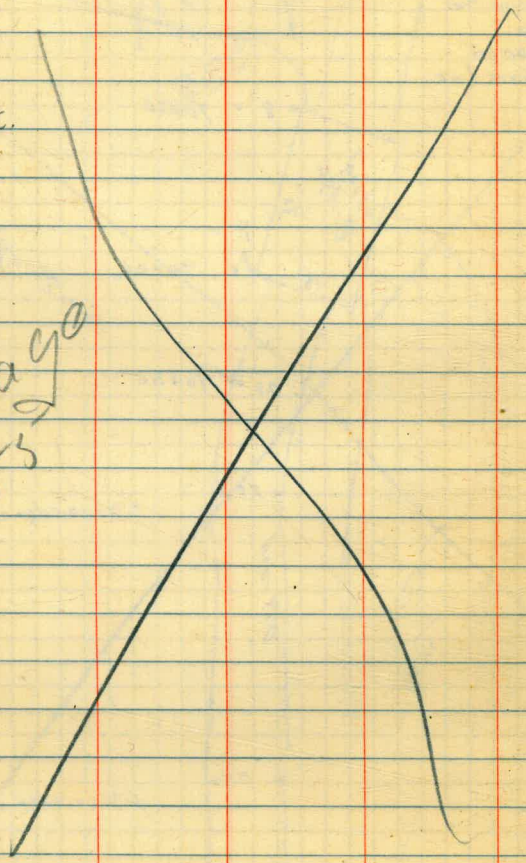
70+71 72 P.O.T.

Revised
see p 67



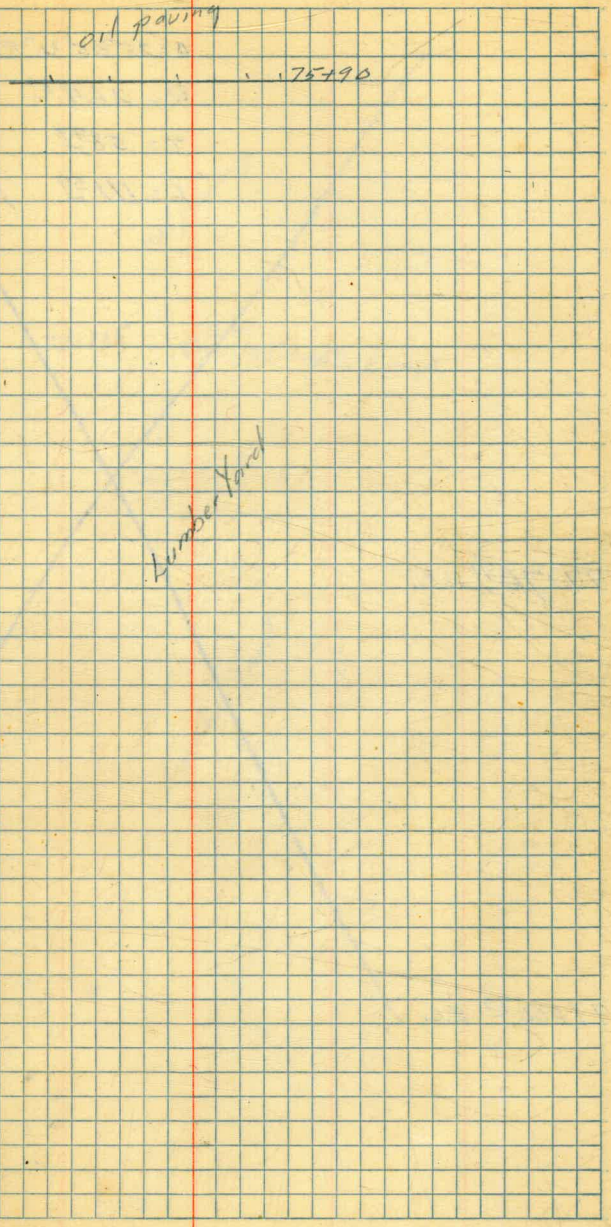


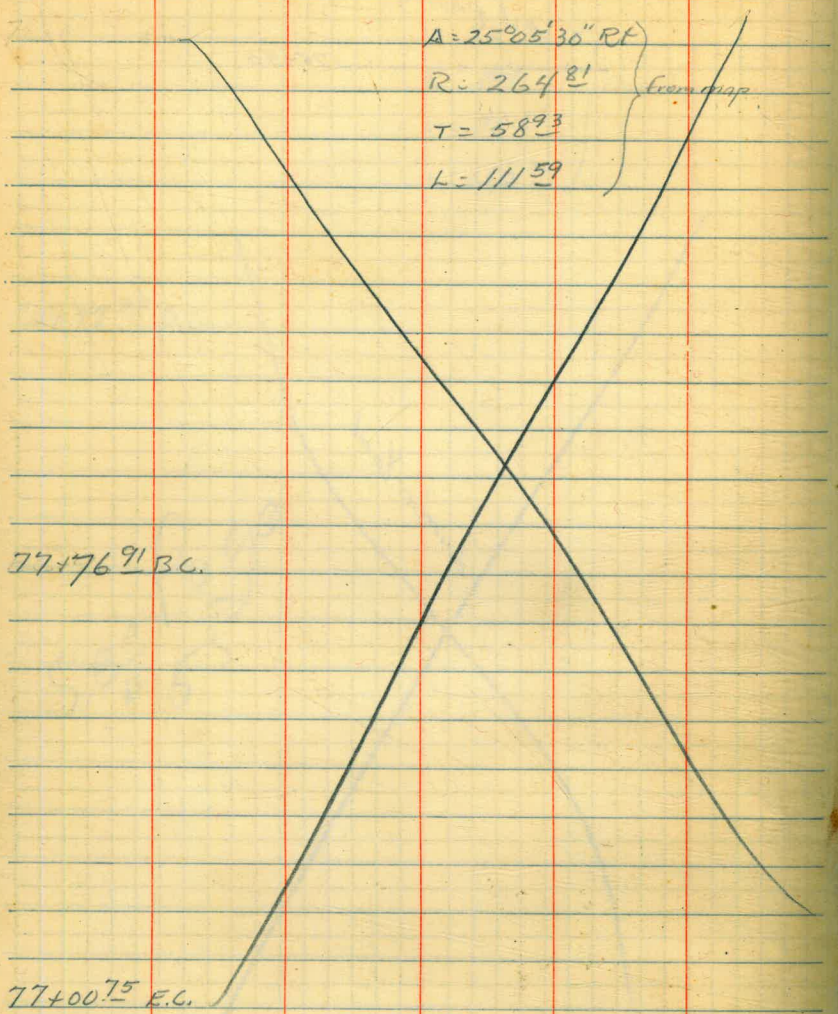
Δ = 22° 30' (+)
R 384'
T = 76 37
L = 150 80
} From map

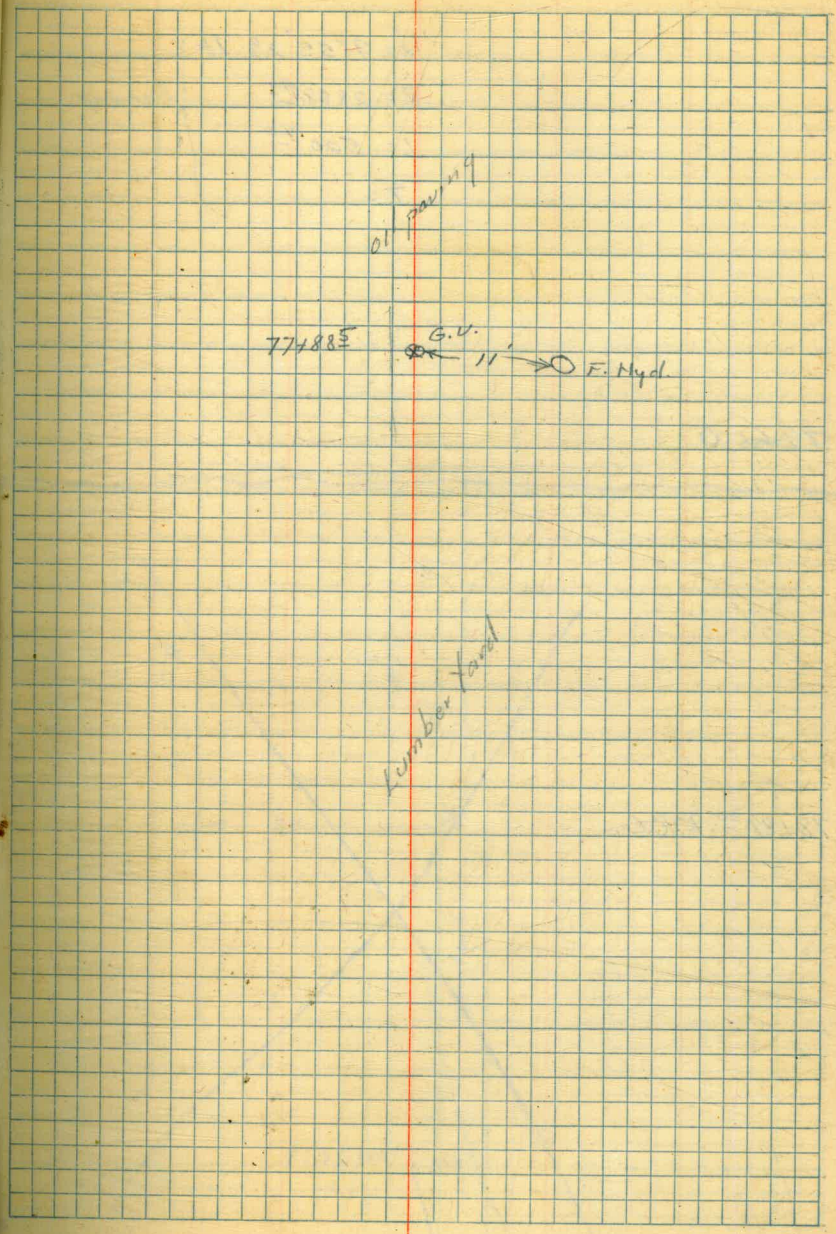


7.5+49 95 B.C.

See Page #5



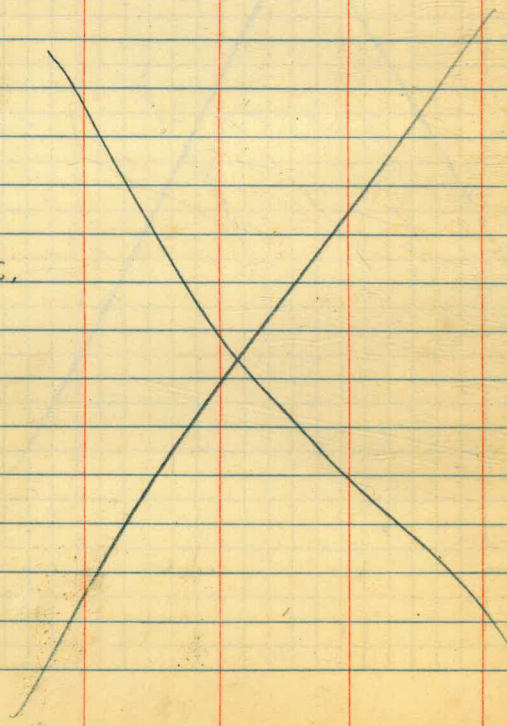

Δ = 25°05'30" Rt
R = 264.81
T = 58.93
L = 111.59
from map.
77+76.91 B.C.
77+00.75 E.C.

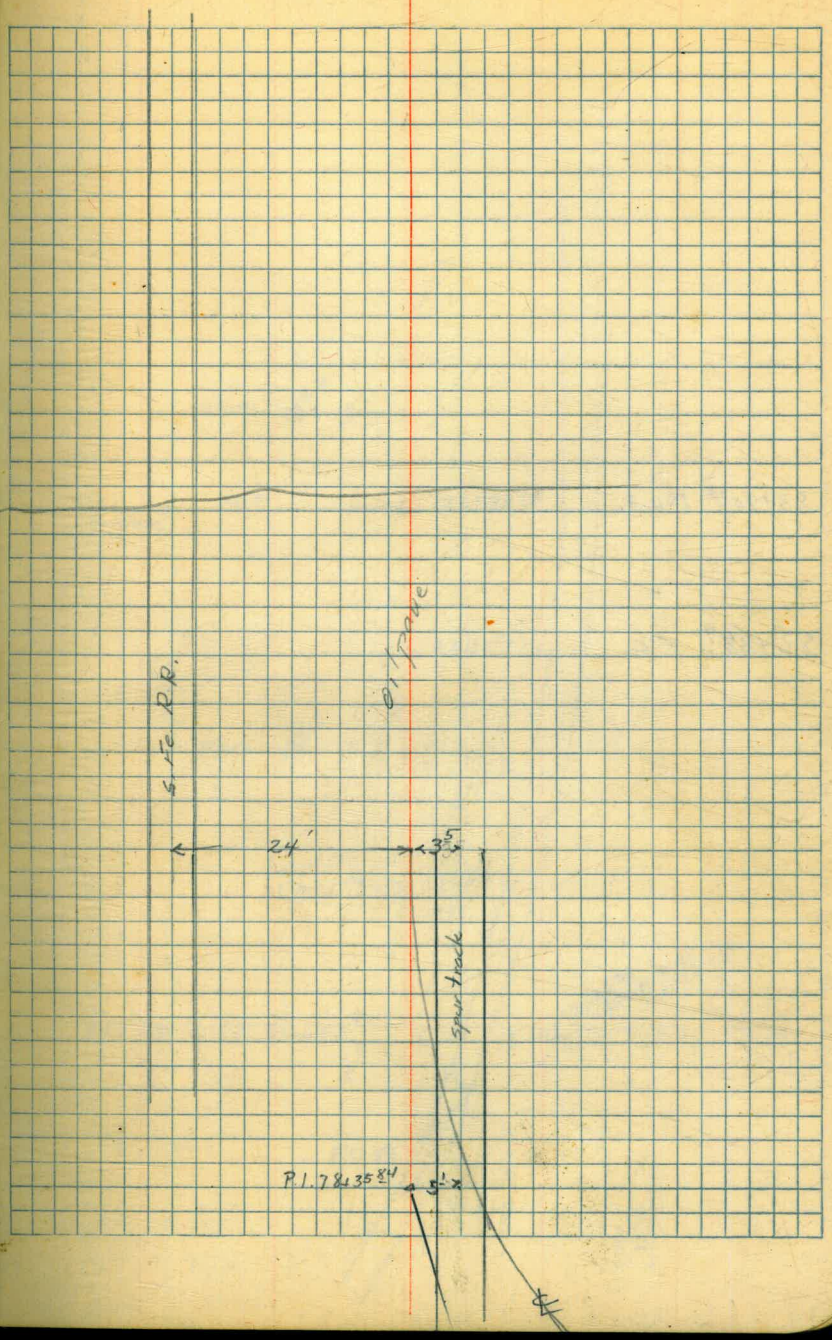

oil pan
774885
G.U.
11'
F. Hyd.
Lumber yard

$\Delta = 9^\circ 55' 28''$ Lt
$R = 2888.93$
$L = 500.40$
$T =$
} From map

79+50

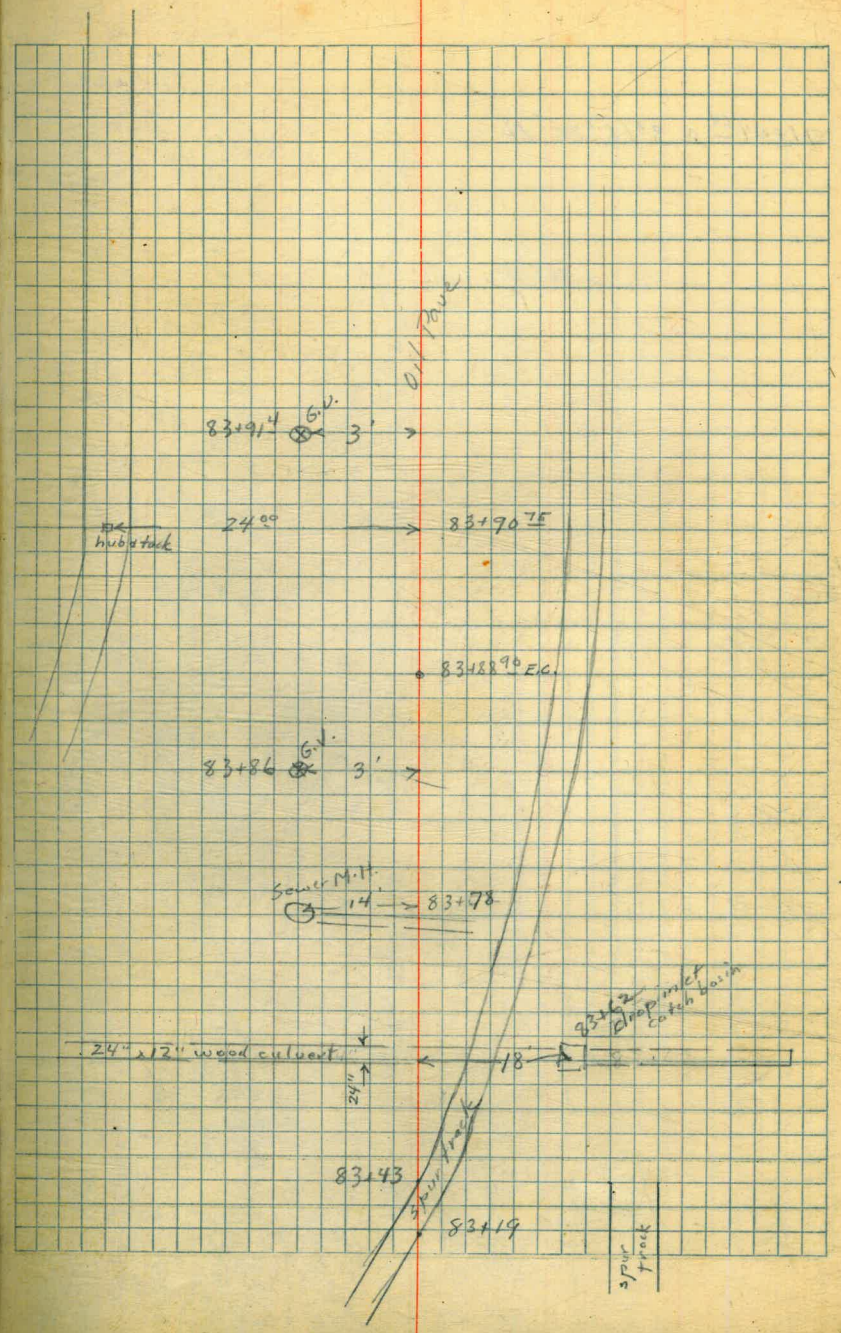
78+88.50 P.R.C.



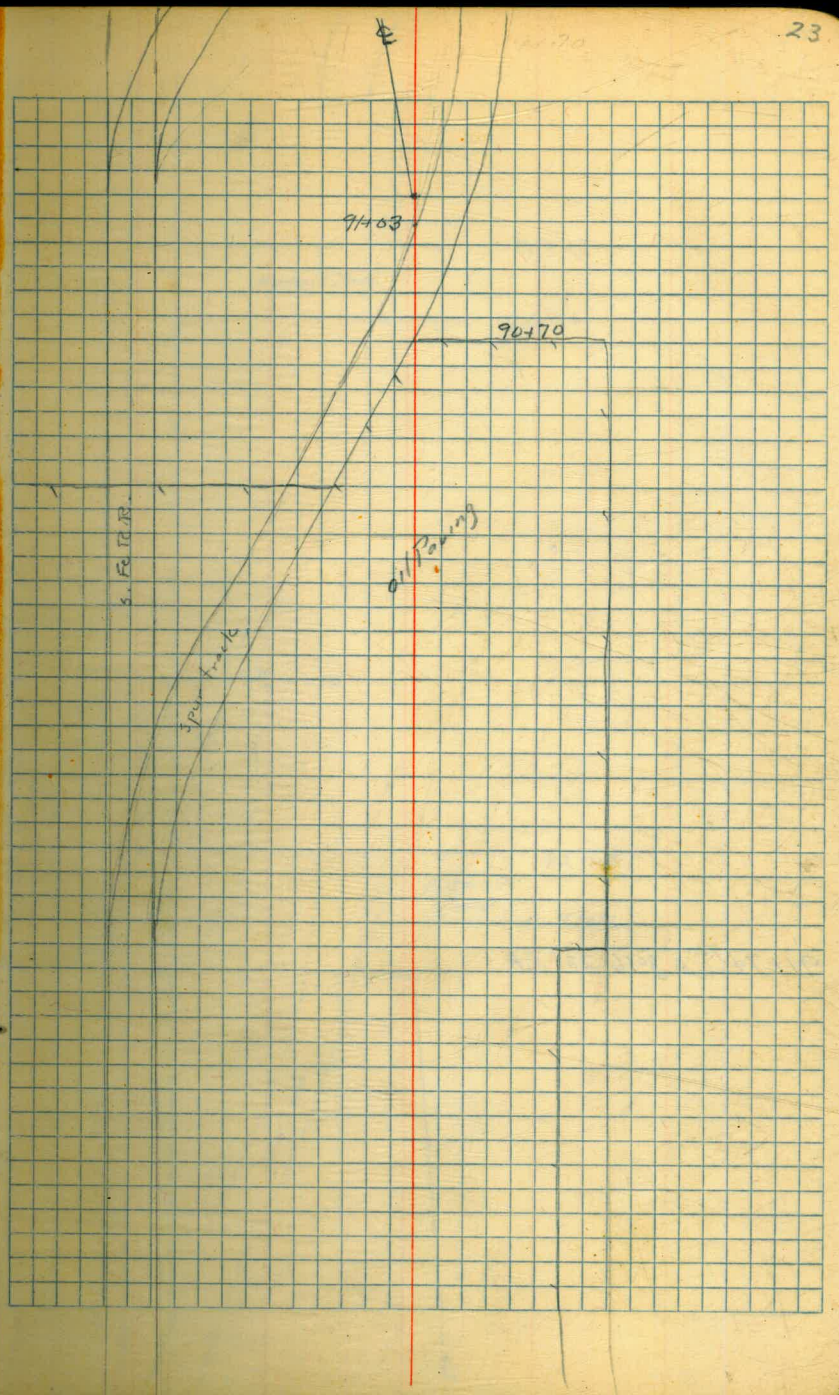


$83+90\frac{75}{}$ P.O.T.

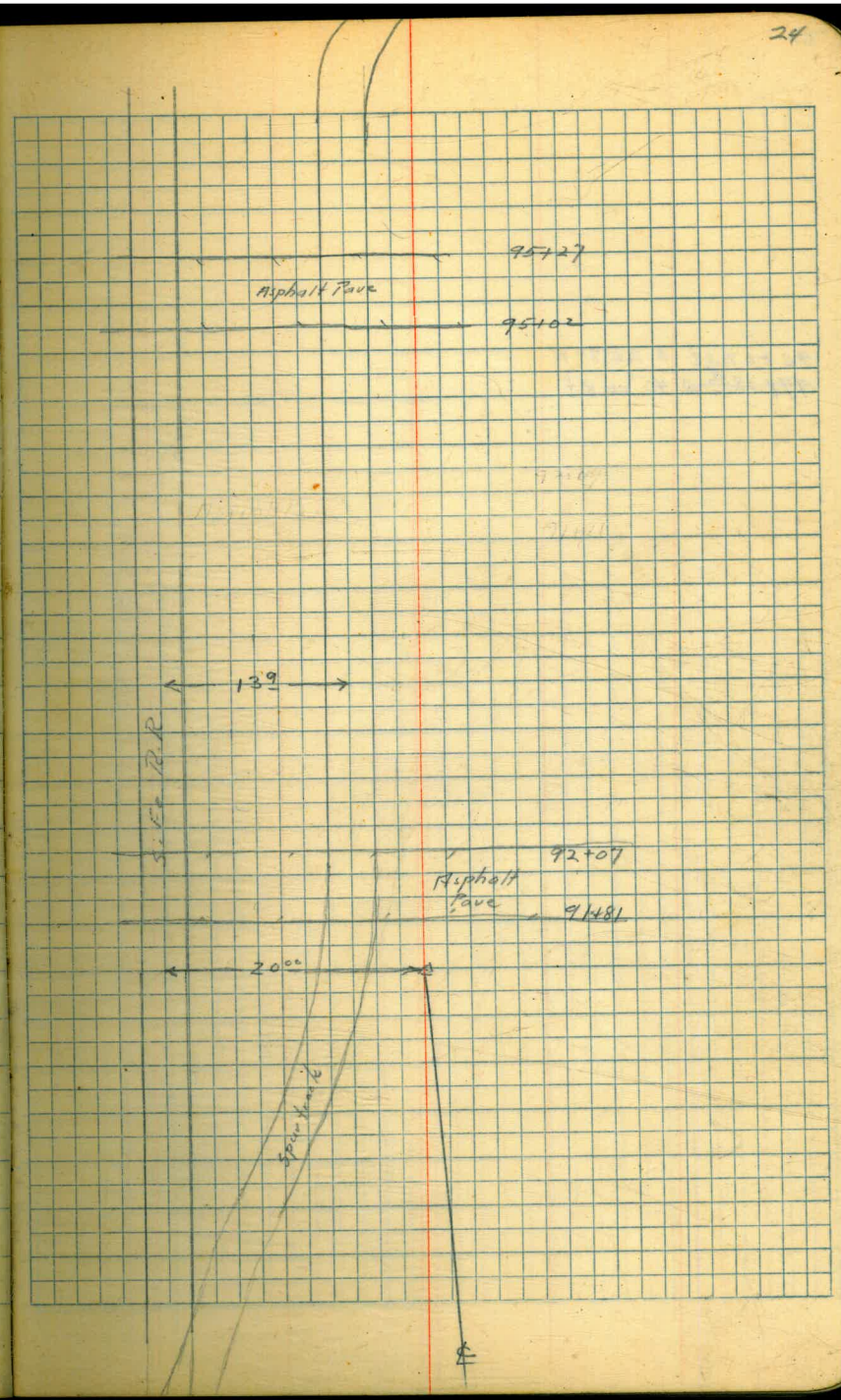
$83+88\frac{90}{}$ E.C.



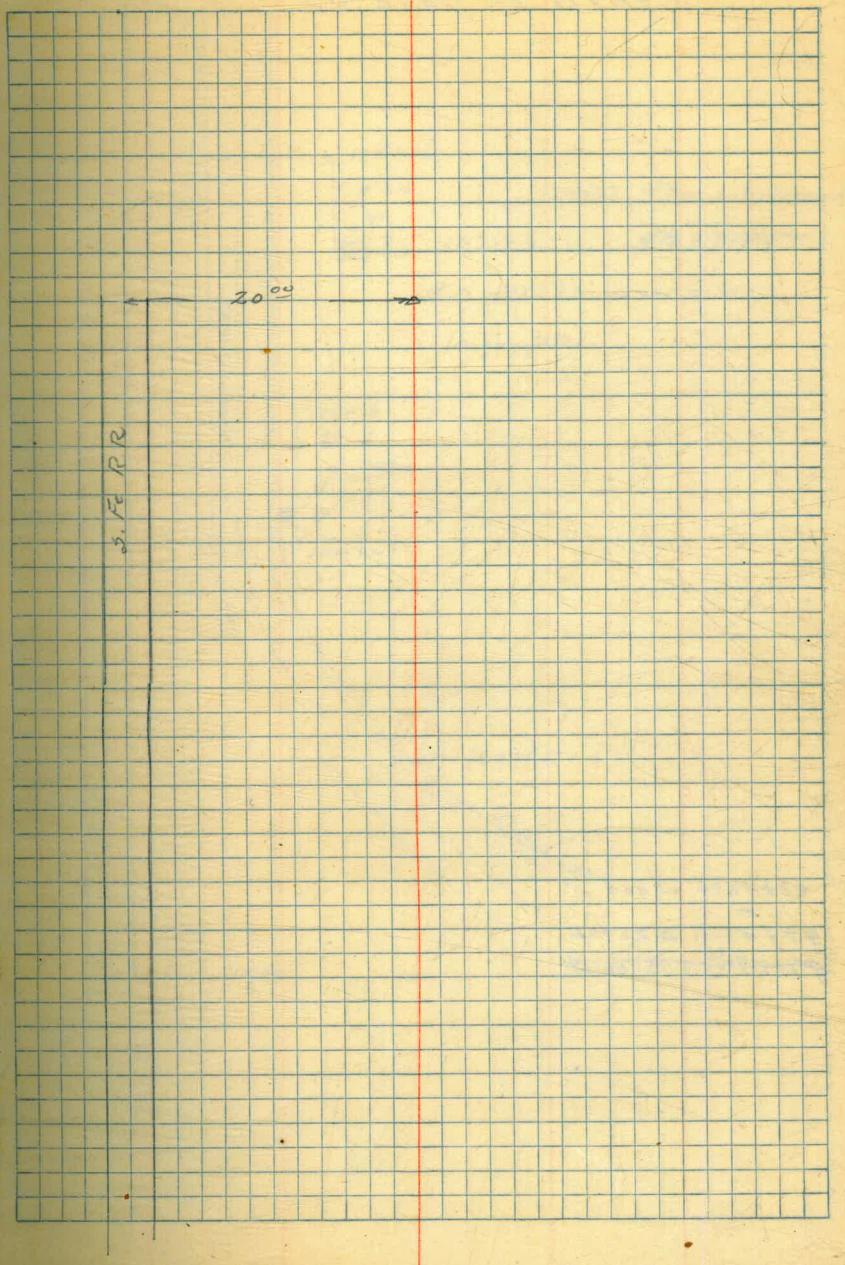
91+04.64 ∆ 3°16'25" Lt



91+74.76 Δ 30°16'25" Rt

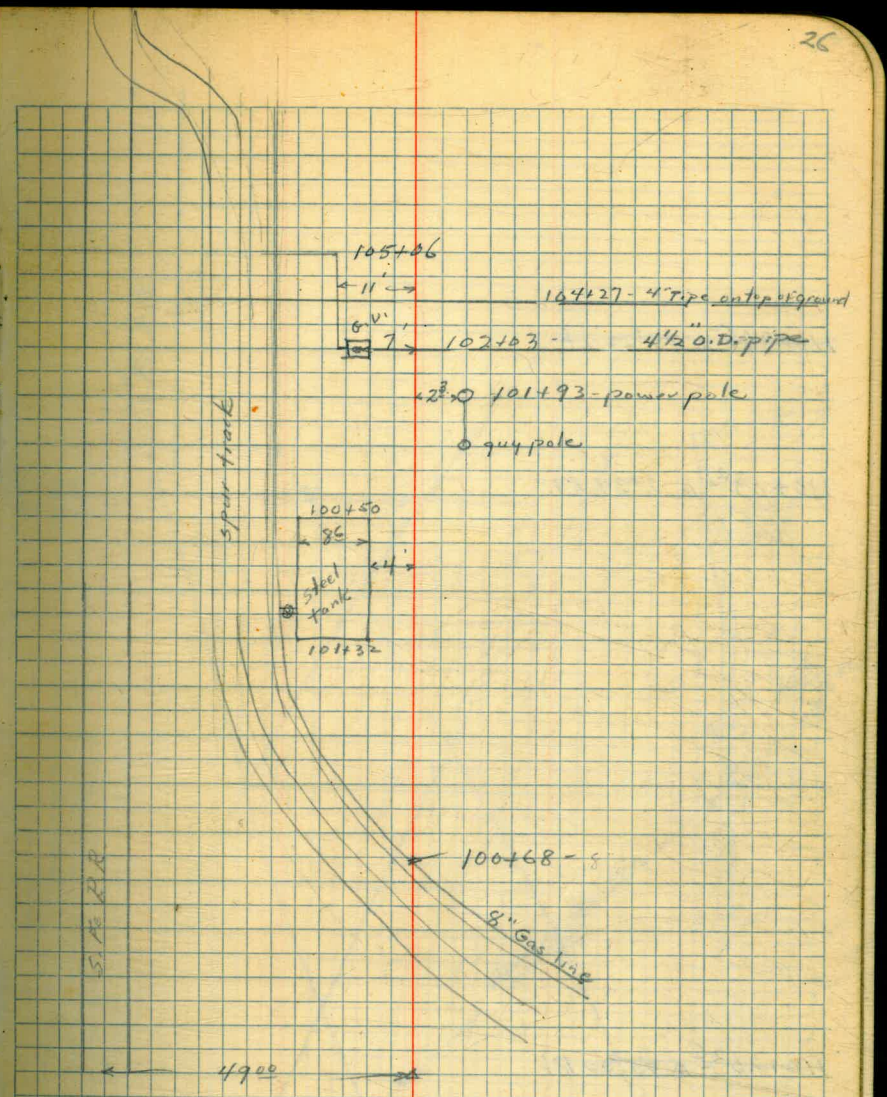


96+67.36 Δ 22°30' R
~~97+08.36~~ Δ 45°00' Rt



Cont'd on page 33

97+49.36 ahead
=
97+43.11 Δ 22°30' Lt
~~97+49.36~~ Δ 45°00' Lt

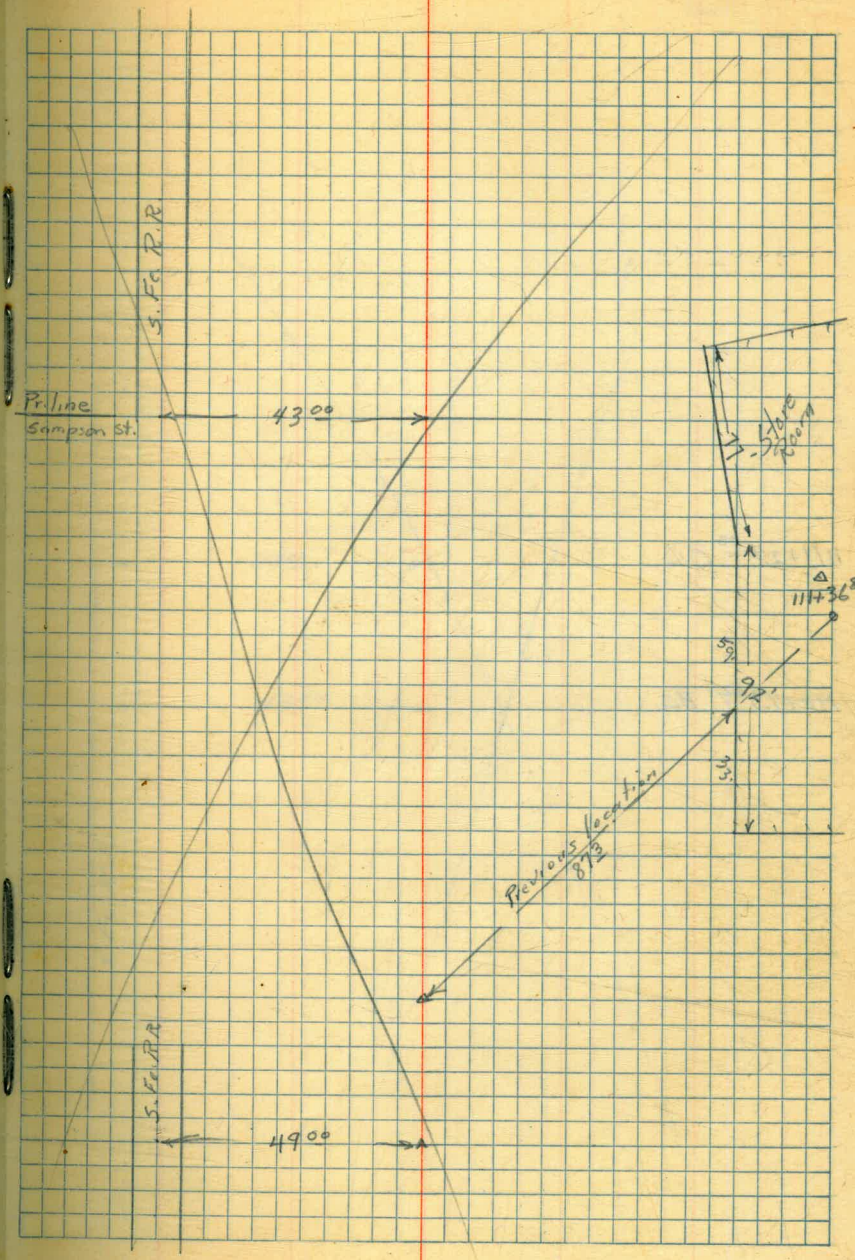


~~111+36.82 Δ 47°23' Lt~~

110+03.21 Δ 2°34' Rt

~~110+20.26 Δ 45°00' Rt~~

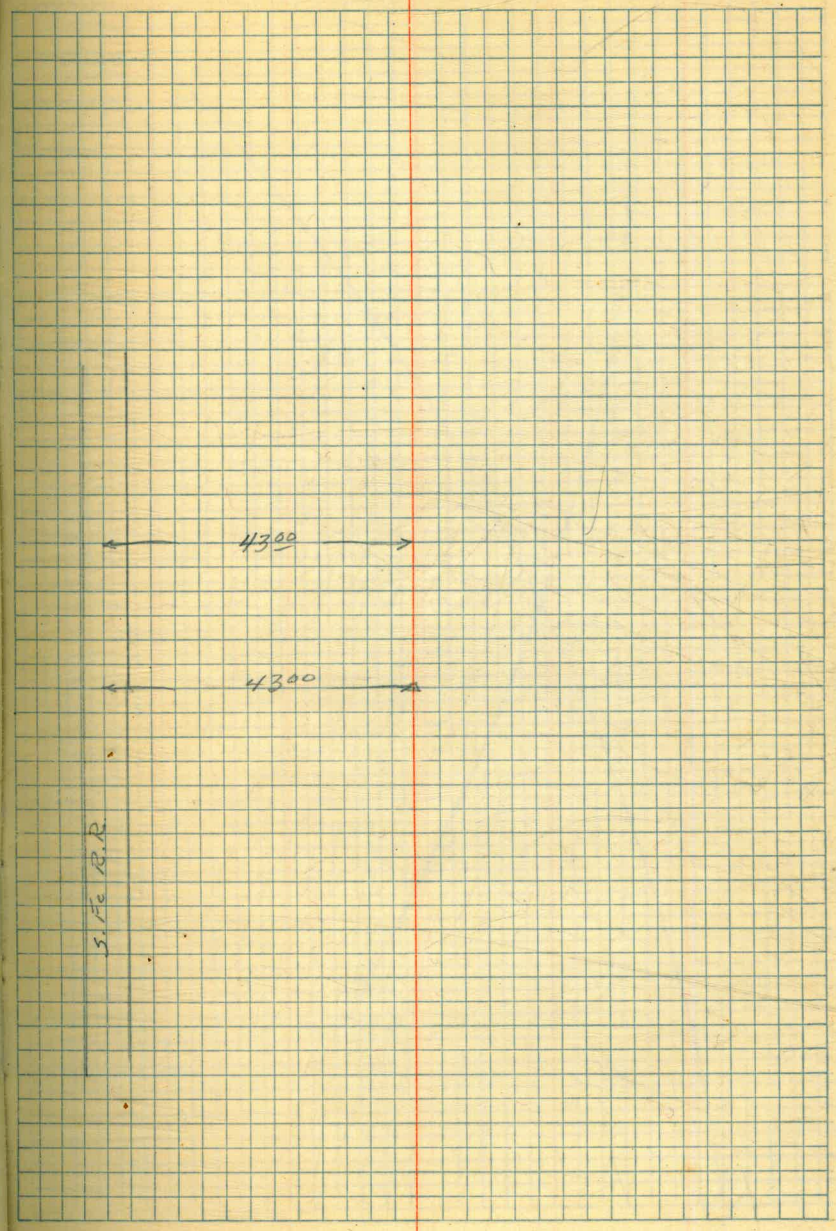
108+70.00 Δ 2°34' Lt

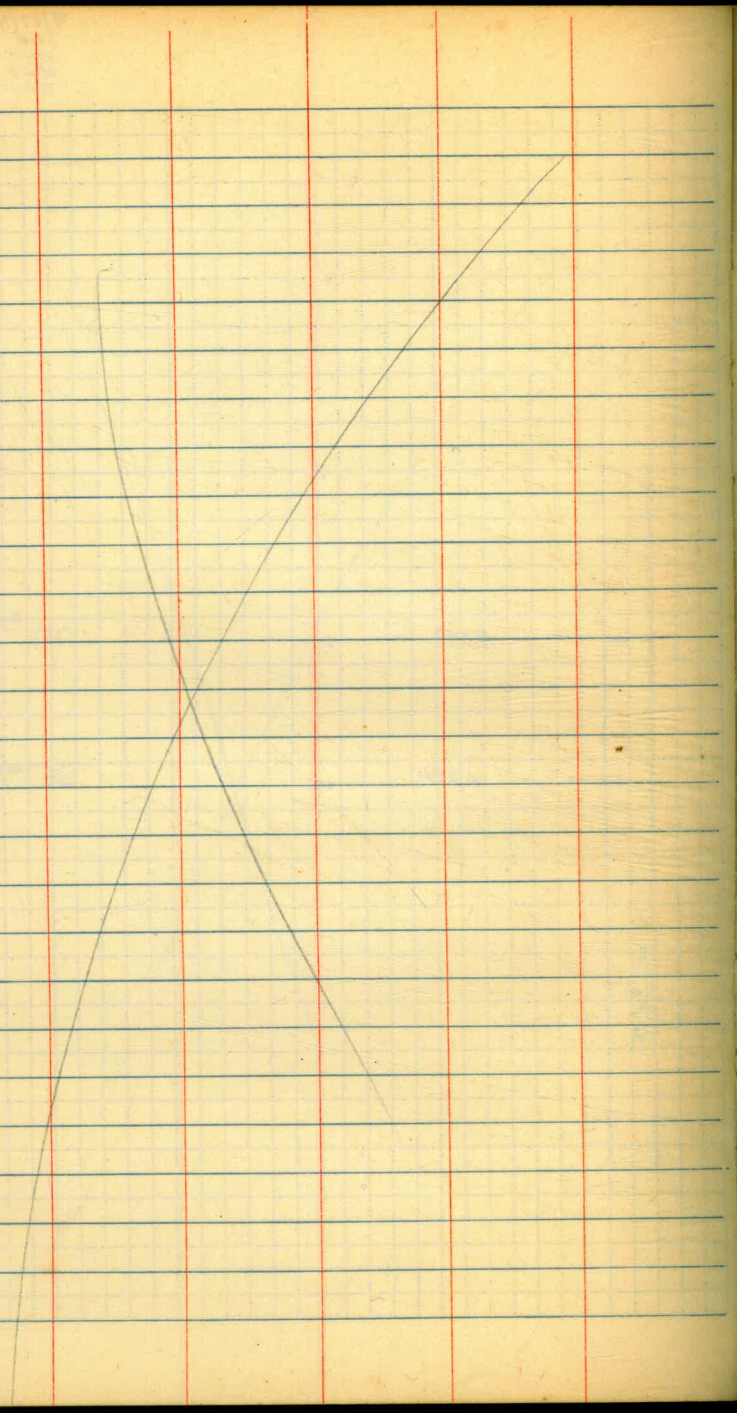


9/17/42
Hill
Soper
King
Davis

111+24.42 BC

110+73.82 BC.

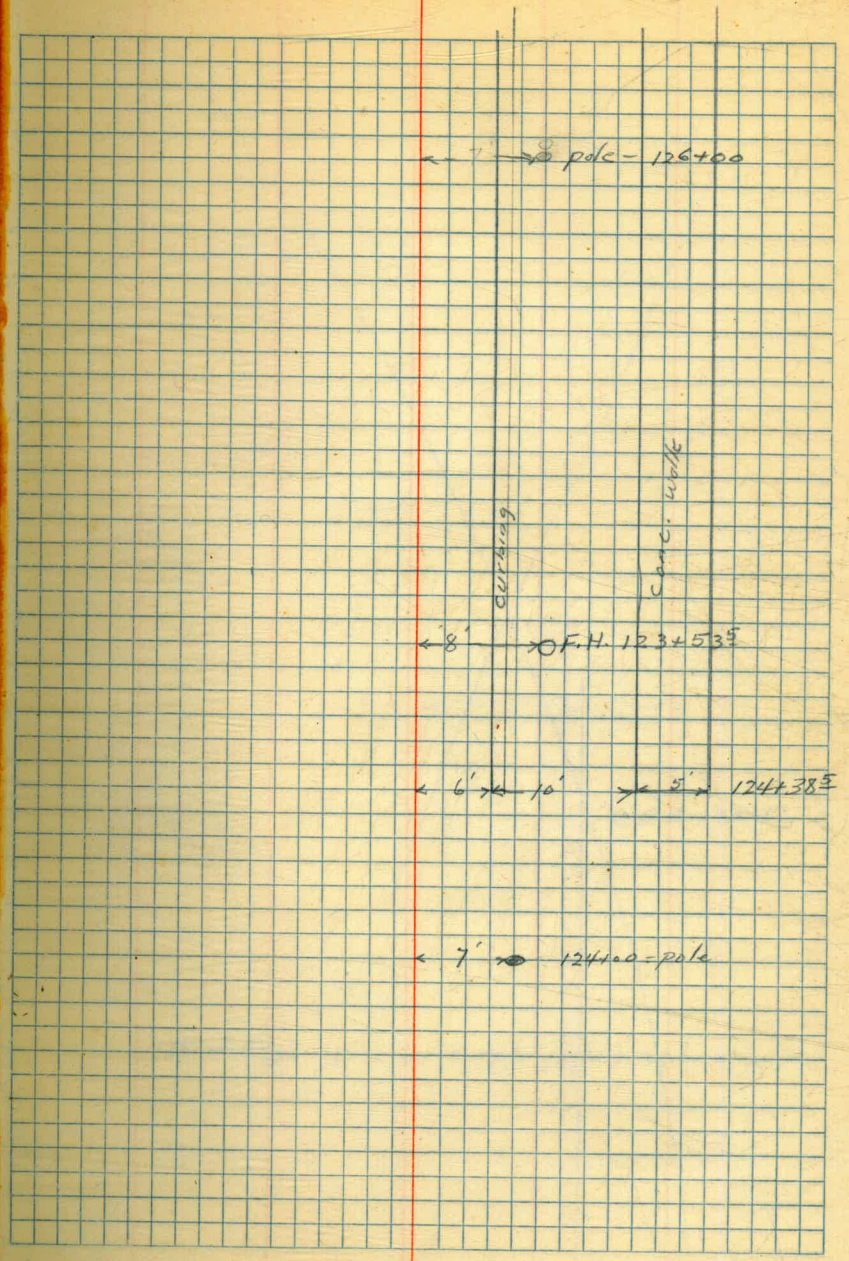


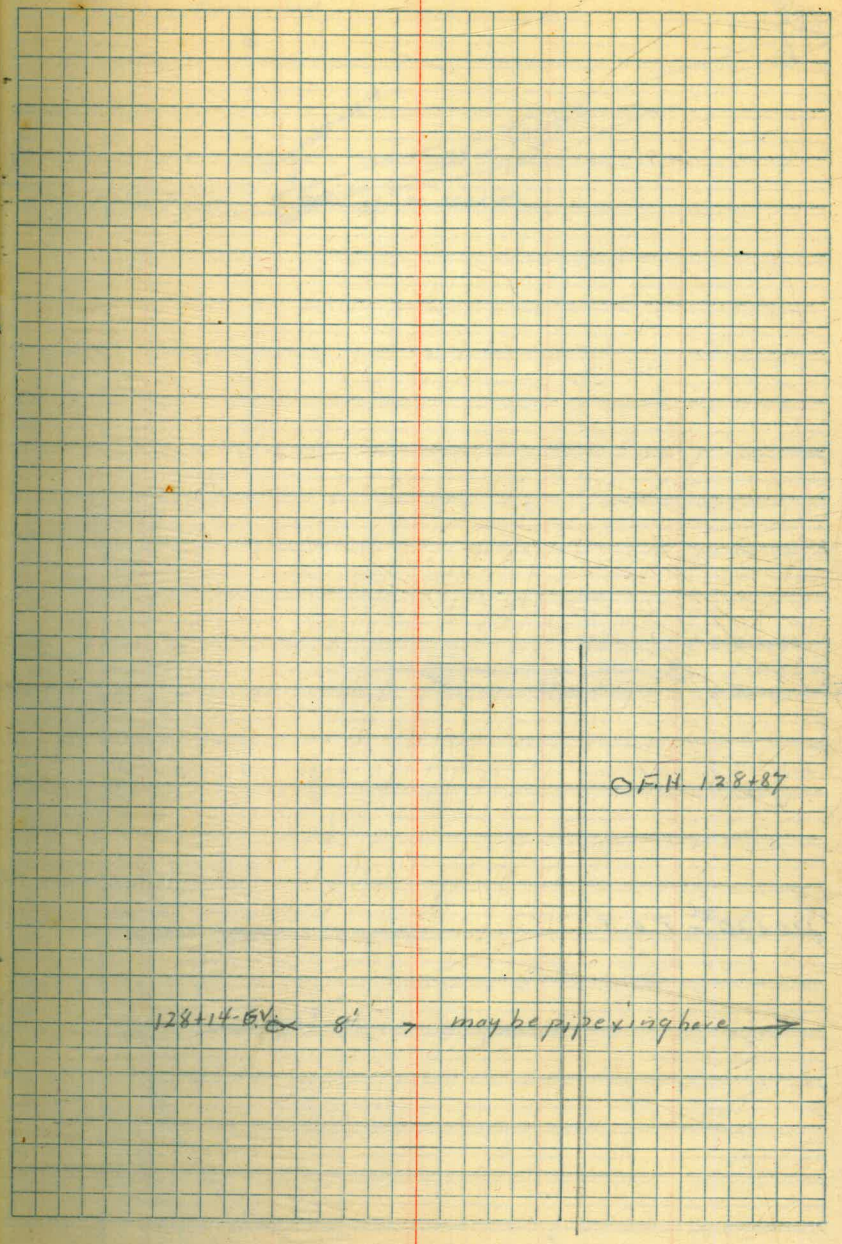


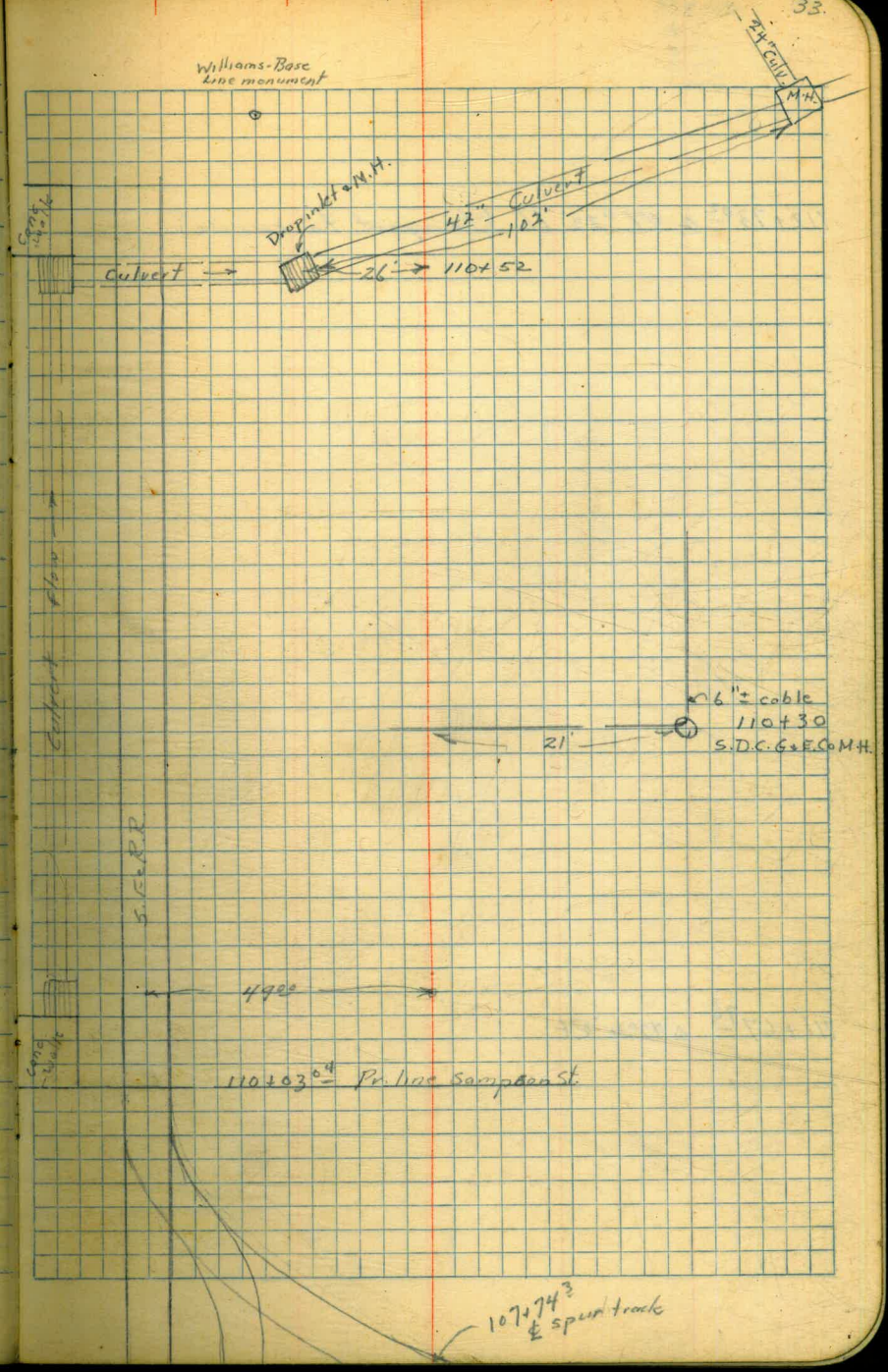
122+82.91 Δ 45°00' Lt.

121+72.63 Δ 45°00' Rt. (To tangent ahead.)

121+72.63 E.C.


7'
pdc - 126+00
curbing
conc. walk
8'
F.H. 123+53
6'
10'
5'
124+38
7'
124+00 = pdc


O.F.H. 128+87
128+14-G.V. 8' → may be pipe xing here →


Williams-Base
line monument
24" Culvert
M.H.
Drop inlet & M.H.
42"
Culvert
103'
Culvert
26'
110+52
Culvert
6" ± cable
110+30
S.D.C.G.&E.Co M.H.
21'
S.D.C.R.R.
44°°
110+03.4 ± Pr. line Sampson St.
107+74.3
± spur track

110+20.26 ± P.O.T.

112+73$^{02}_{--}$ Δ 46°22' Lt (tangent to curve)

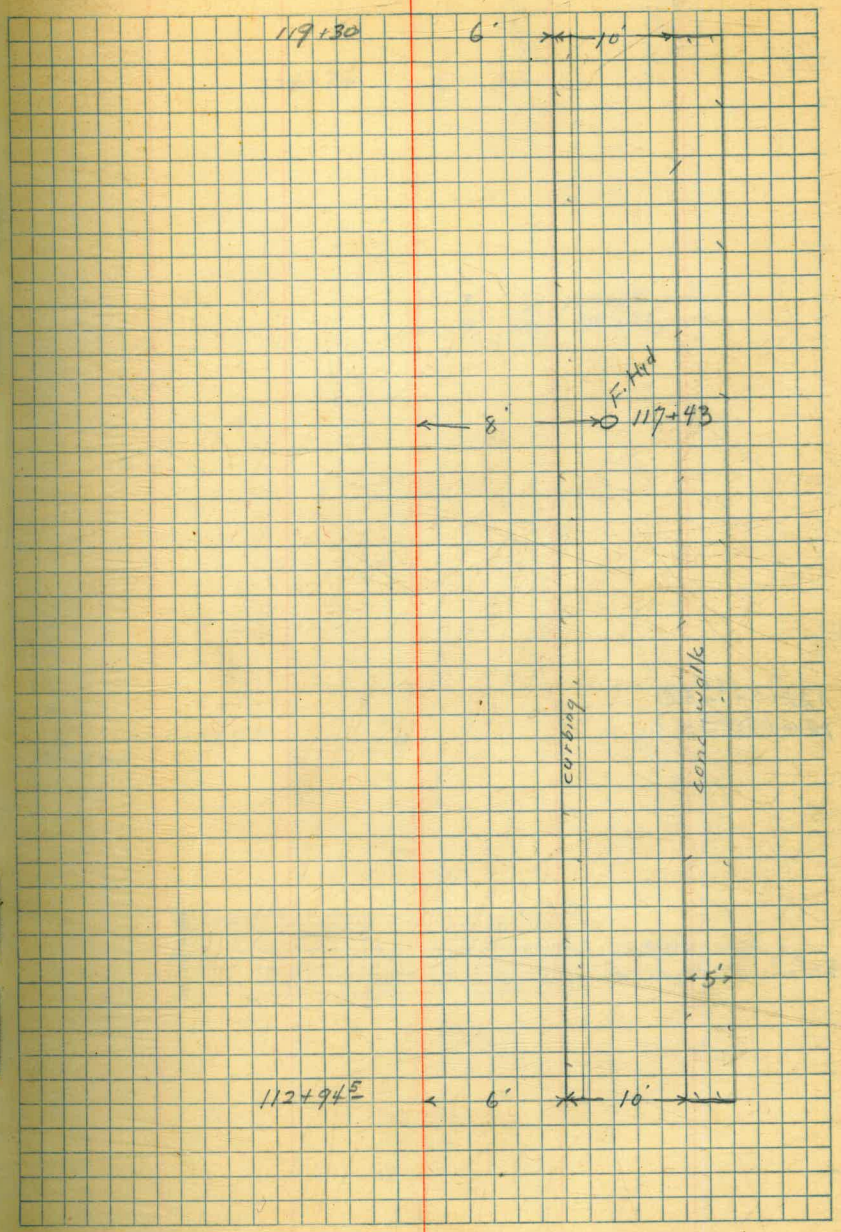
111+67$^{76}_{--}$ Δ 42°30' Rt

Δ = 2(°52'Lt

R = 2067.70

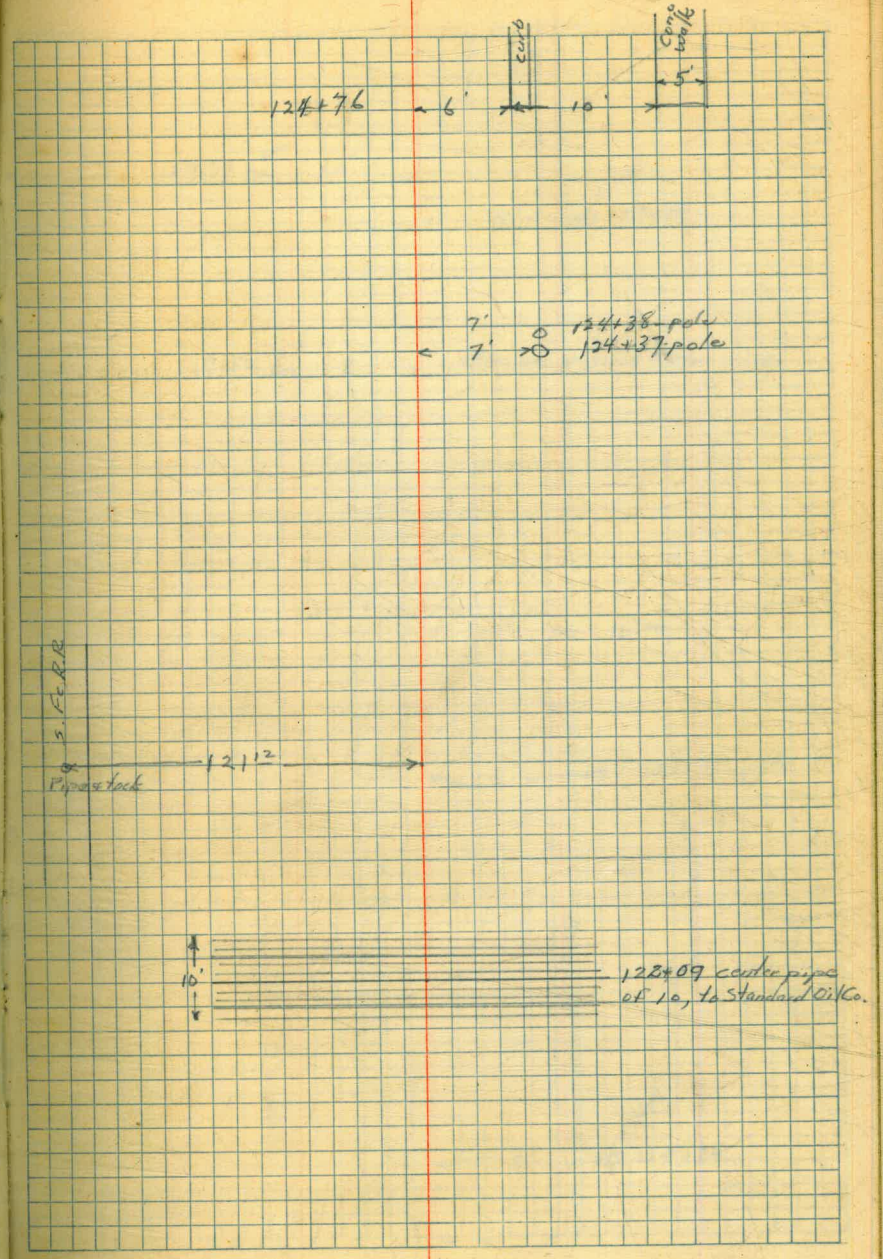
L = 969.64

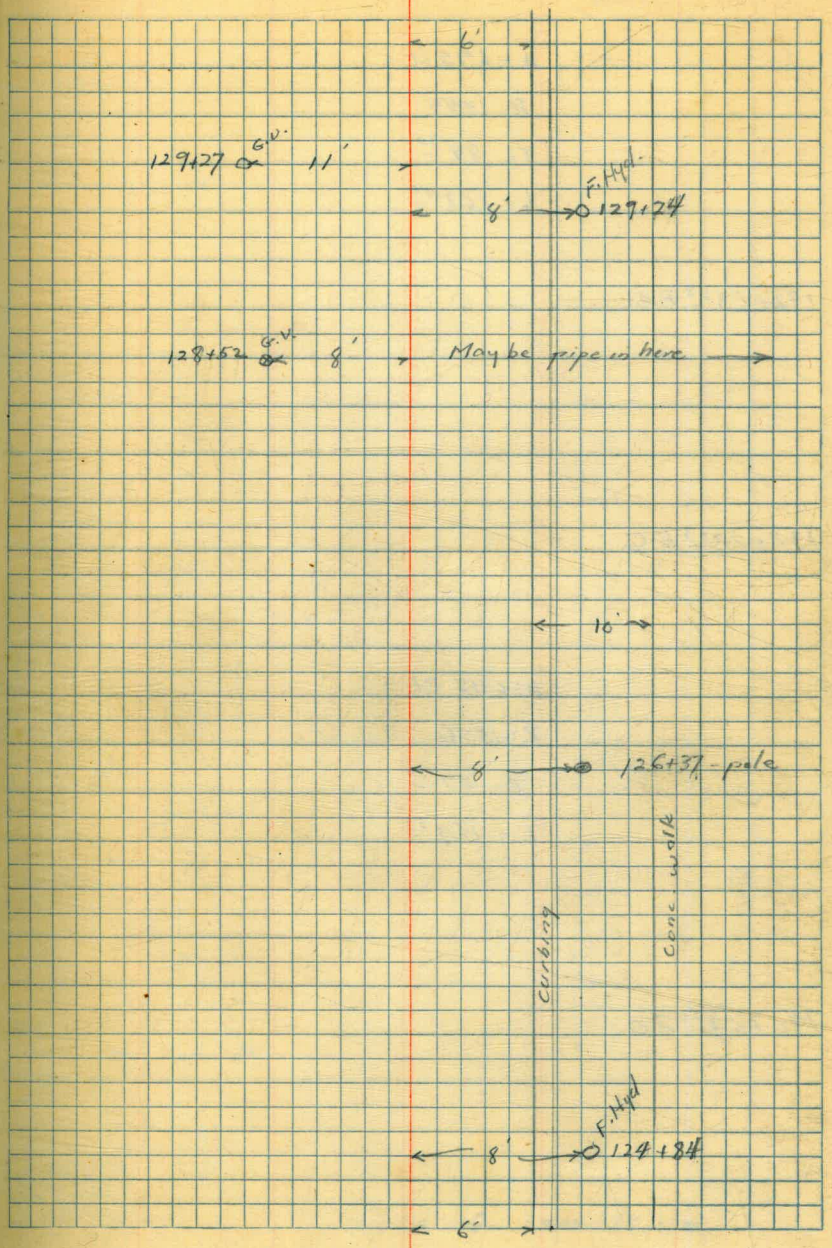
112+73.02 = B.C.



122+42 66 E.C.

~~120+92 66~~ E.C.




6'
129+27 G.V.
11'
F.Hyd.
8'
129+74
128+52 G.V.
8'
Maybe pipe in here
10'
8'
126+37 - pole
curbing
conc. walk
F.Hyd
8'
124+84
6'

9/21/42
Soper
King
Davis

Δ = 6°15' Lt

R = 1544'

T = 84 30/100

L = 168 42/100

132+63 88/100 B.C.

132+22 13/100 E.C.

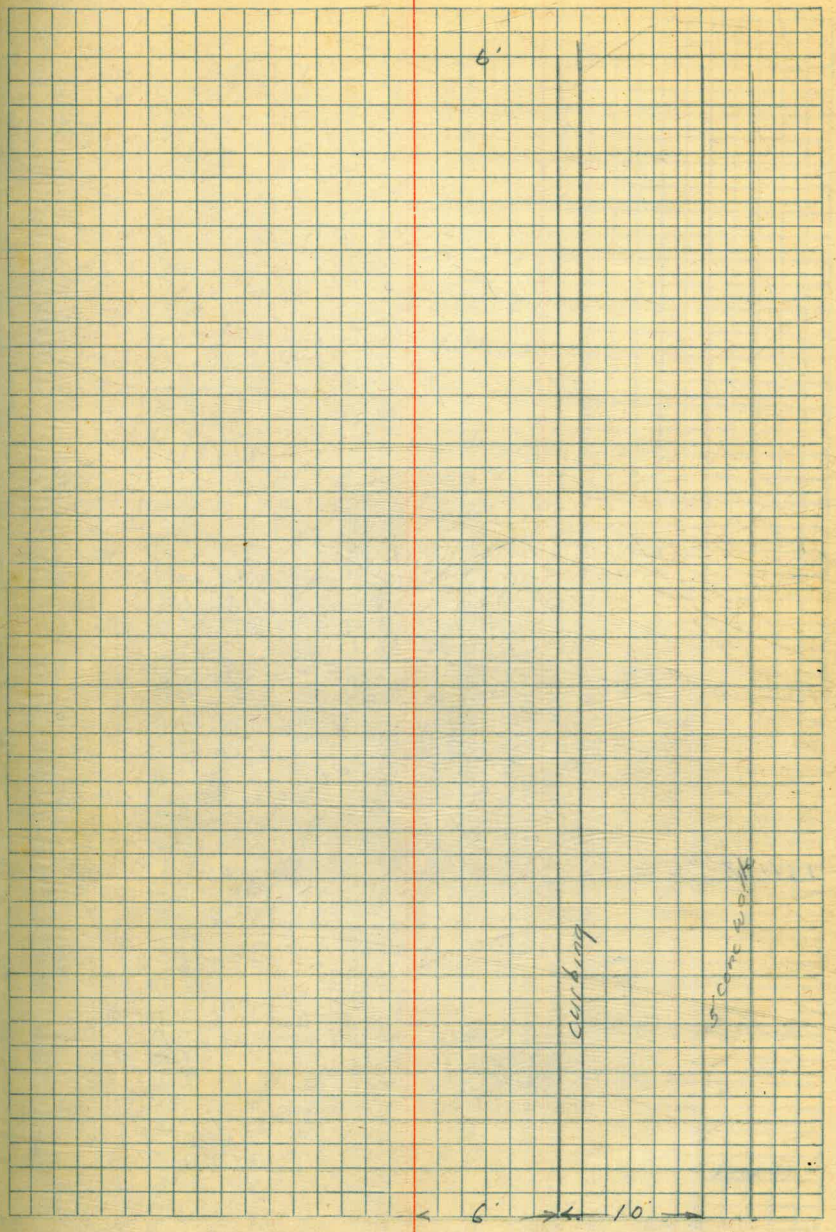
Δ = 6°15' Rt

R = 1556'

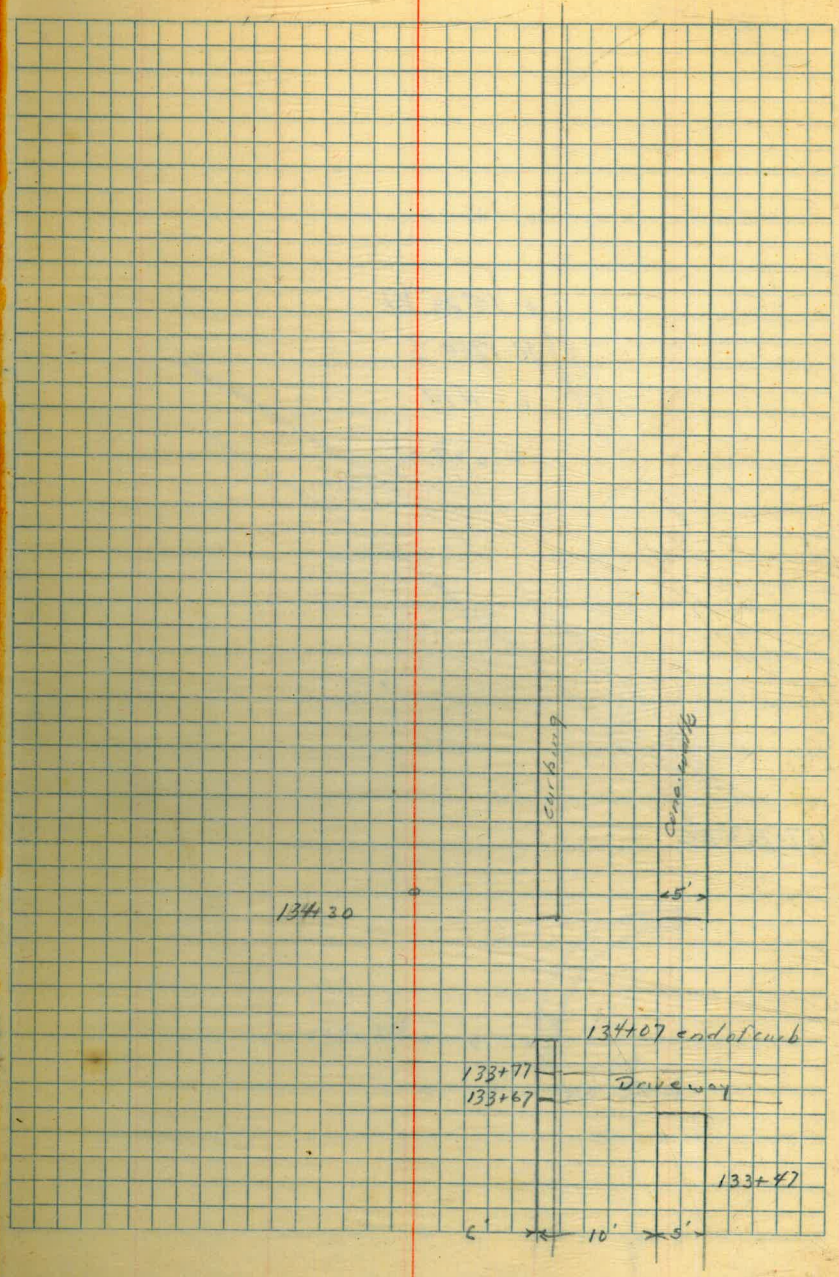
T = 84 96/100

L = 169 73/100

130+52 40/100 B.C.



134+32.30 E.C.


134+30
Curb ramp
Curb ramp
45'
134+07 end of curb
133+77
133+67
Driveway
133+47
6'
10'
5'

9/22/42
Hill
Sipper
King
Davis

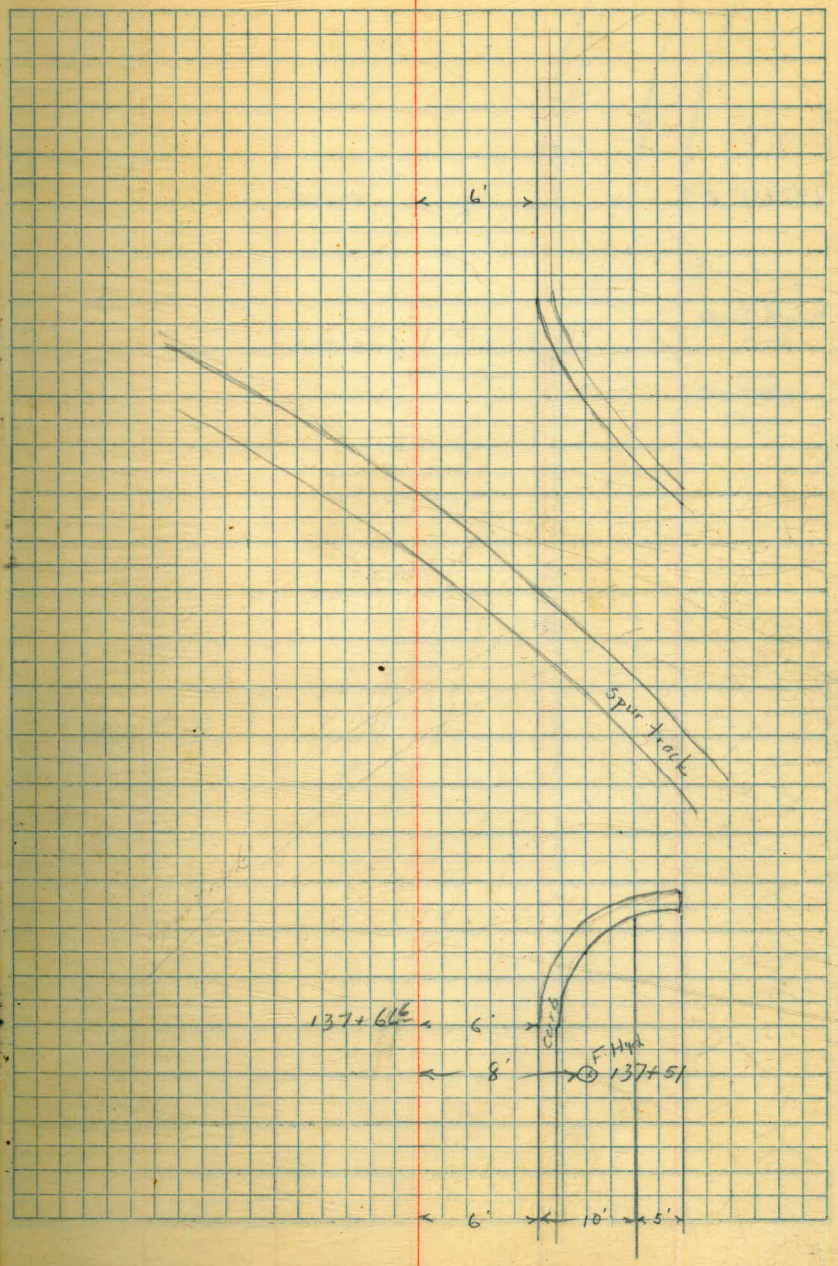
Δ = 15°28' Rt

R = 1755.3

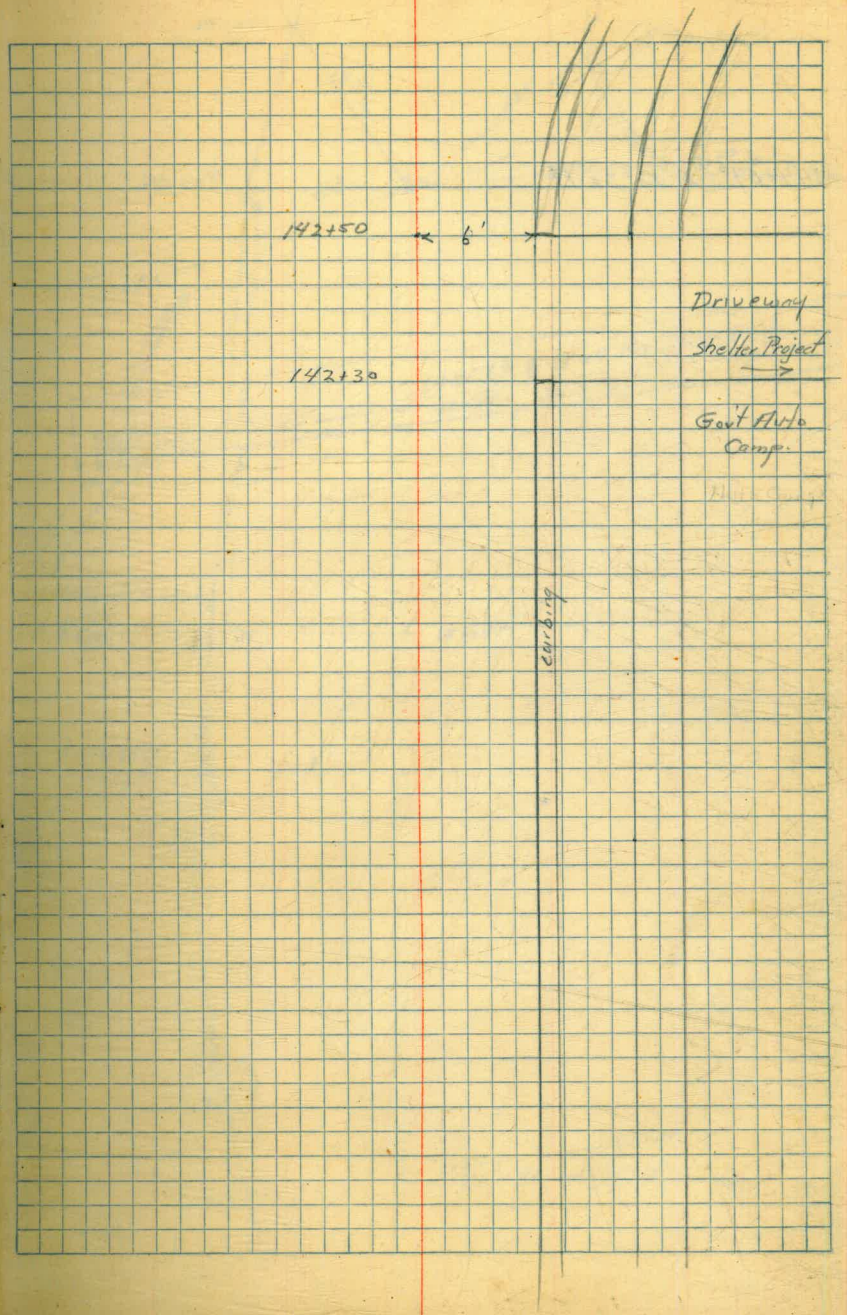
L = 474'

T. 238.07

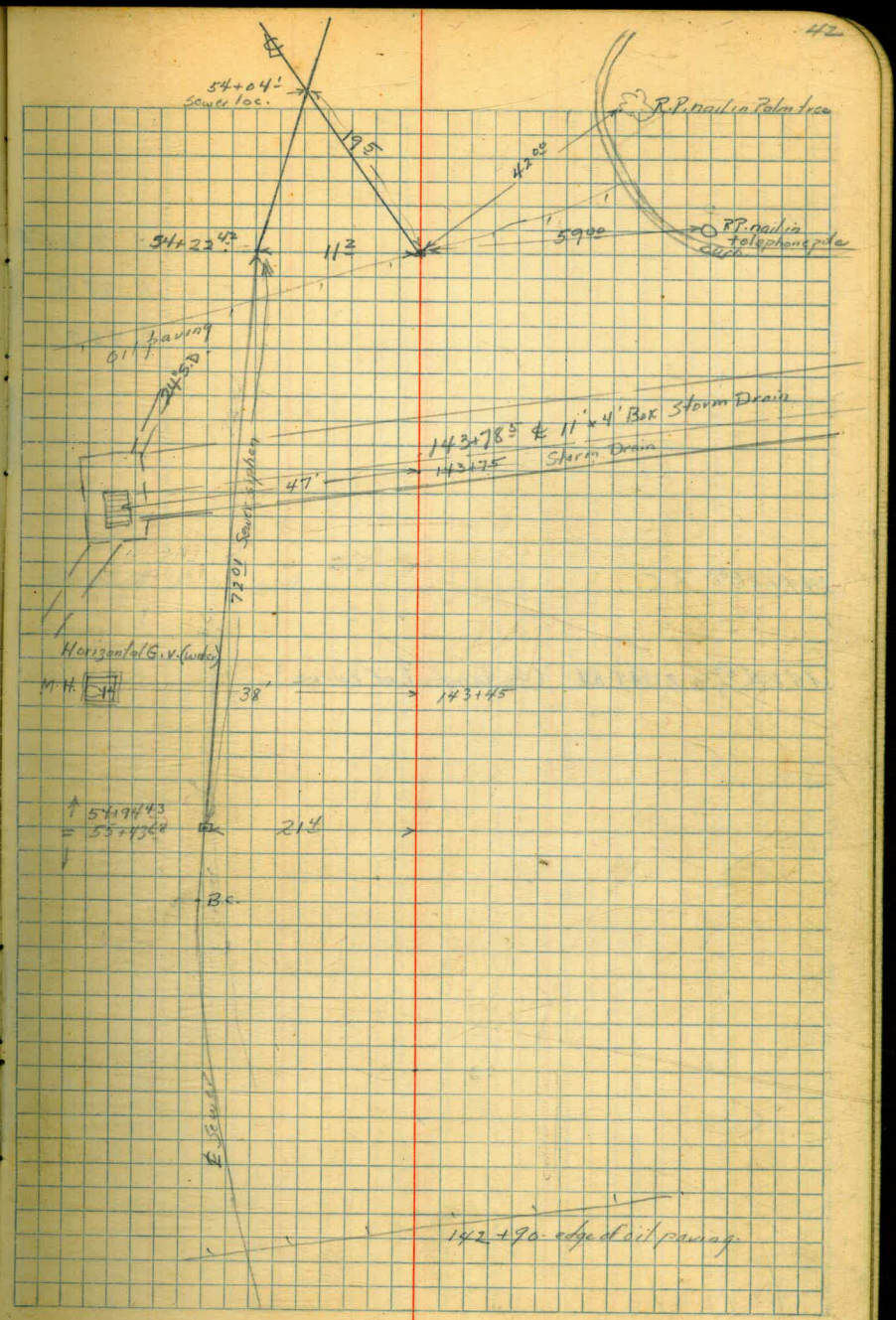
137+76.00 B.C.



142+50 E.C.


142+50
6'
Driveway
Shelter Project
142+30
Gov't Auto
Camp.
curbing

144+07.0 & 22°30' Lt



Δ 16°06'R

R 2715.

L 763.01

144+86.02 B.C.

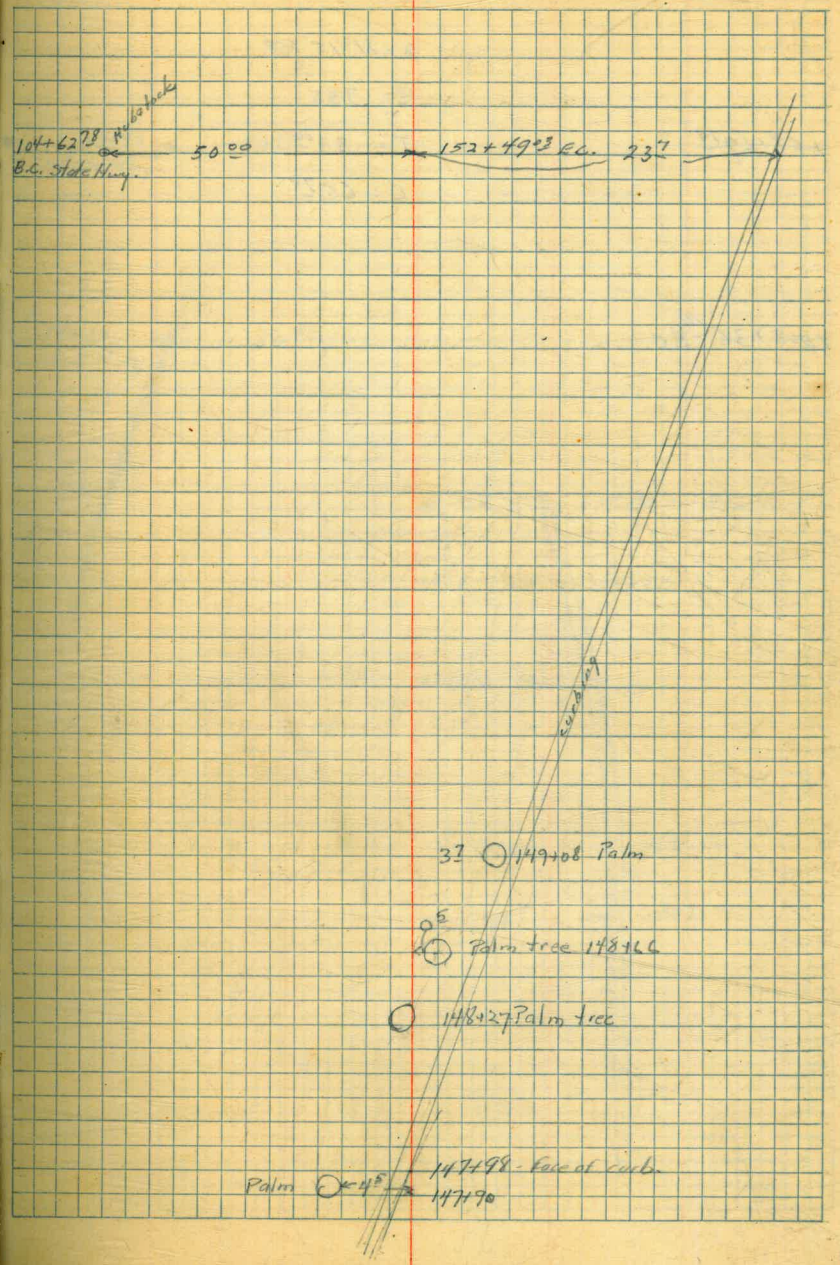
144+86.02 Δ 21°44' Rt (to tangent of curve)

State Hwy. ℄ ↙ 50.00 →

152+49.03 E.C.

9/23/42
14,11
Soper
King
Davis

44



Δ = 11°15' Rt.

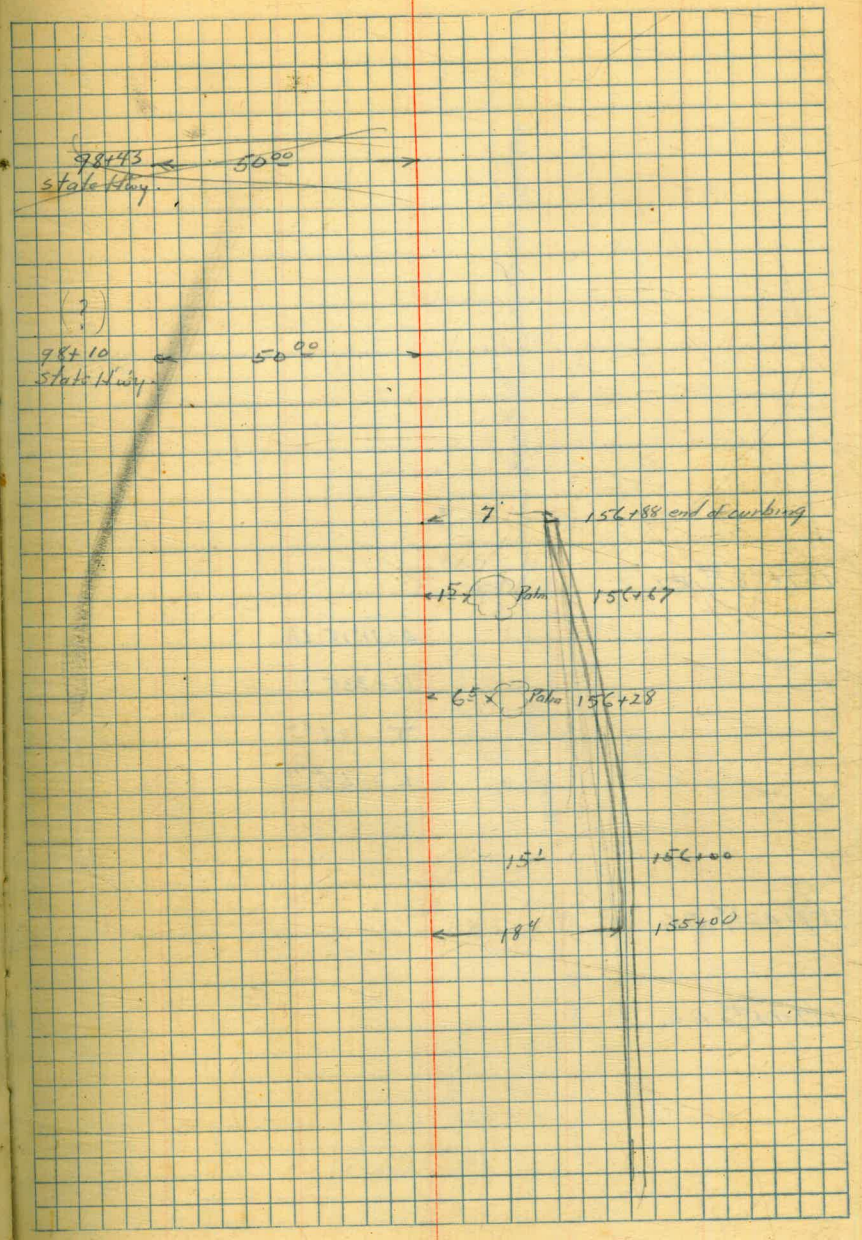
R = 335'

T = 33.00

L = 65.78

158+69.14

158+36.14 BC



159+68.34 E.C.

Δ = 11°15' Lt

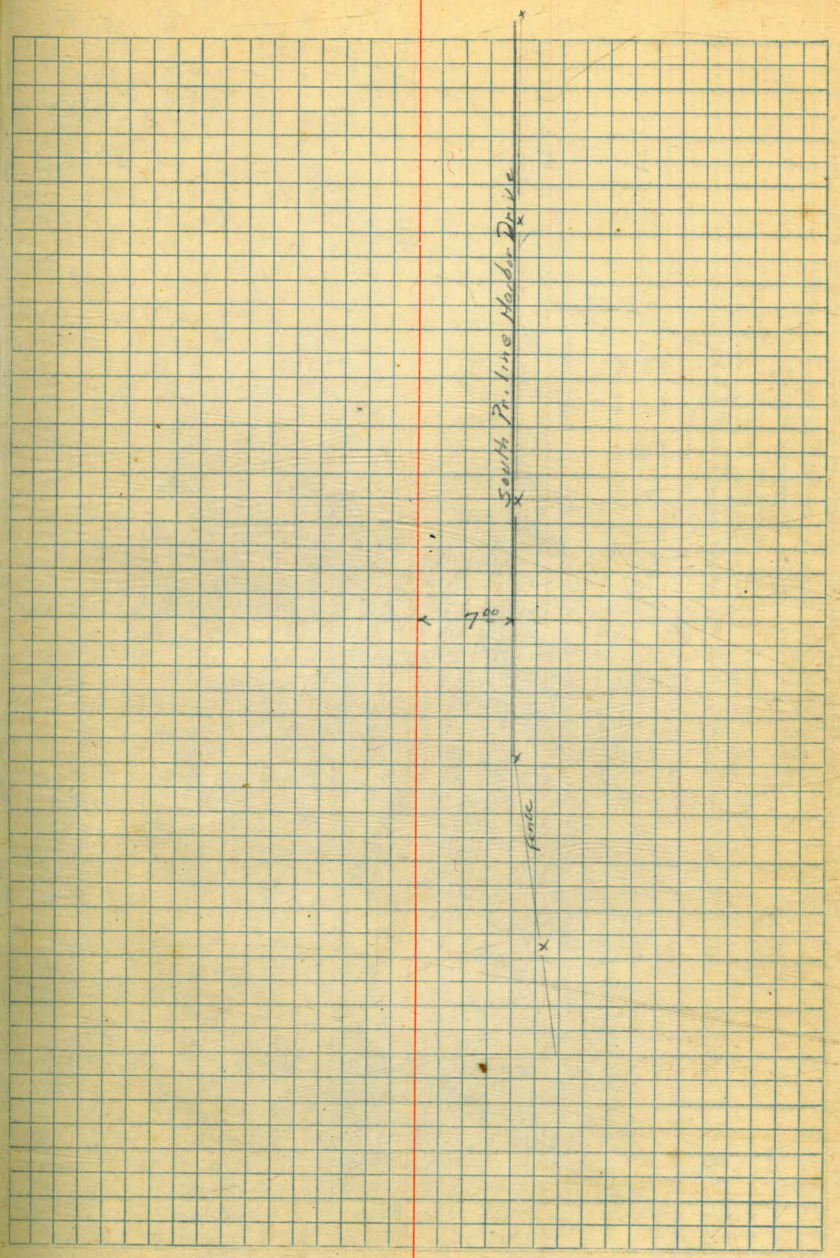
R = 335'

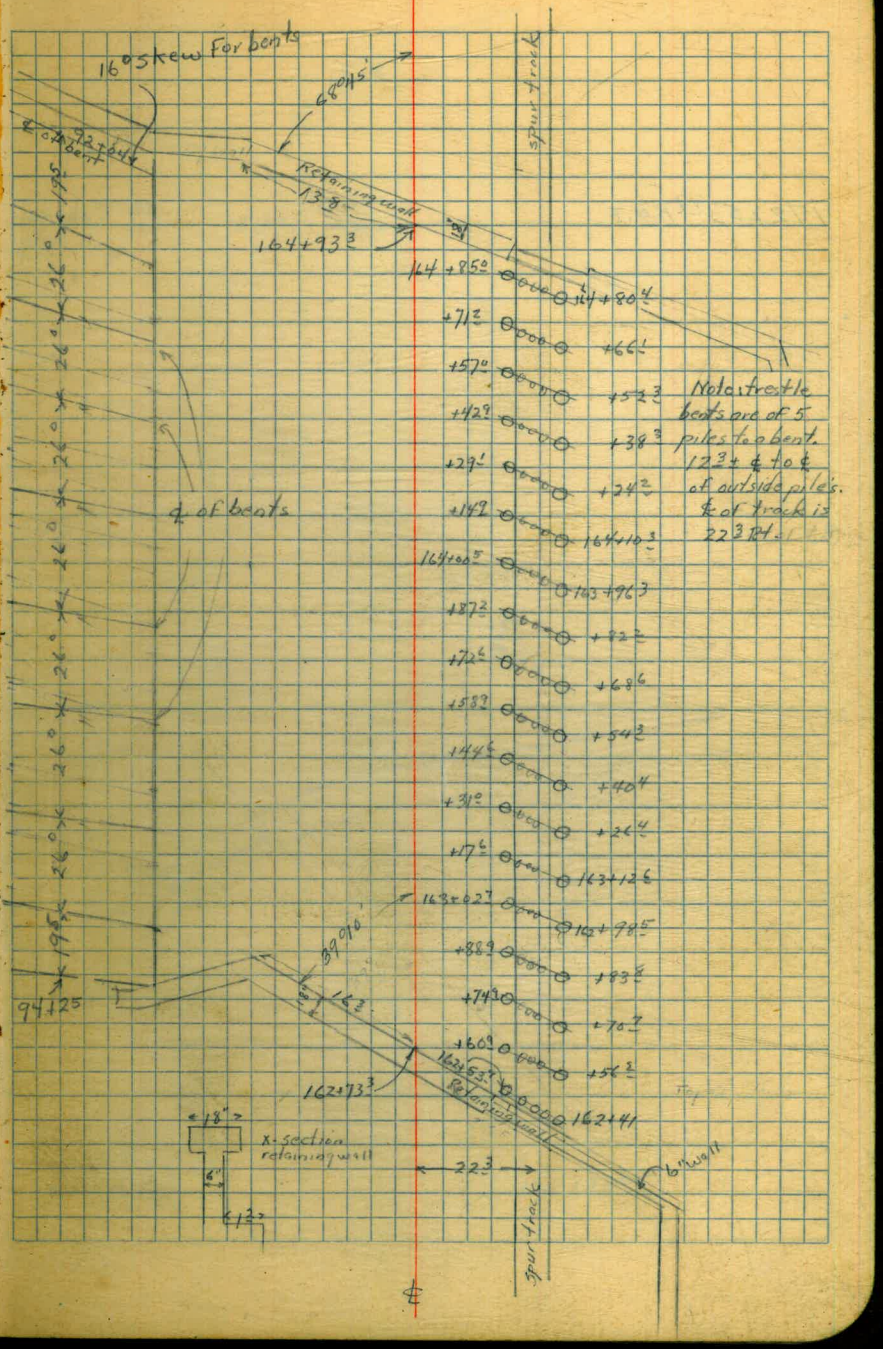
T = 33.69

L = 65.78

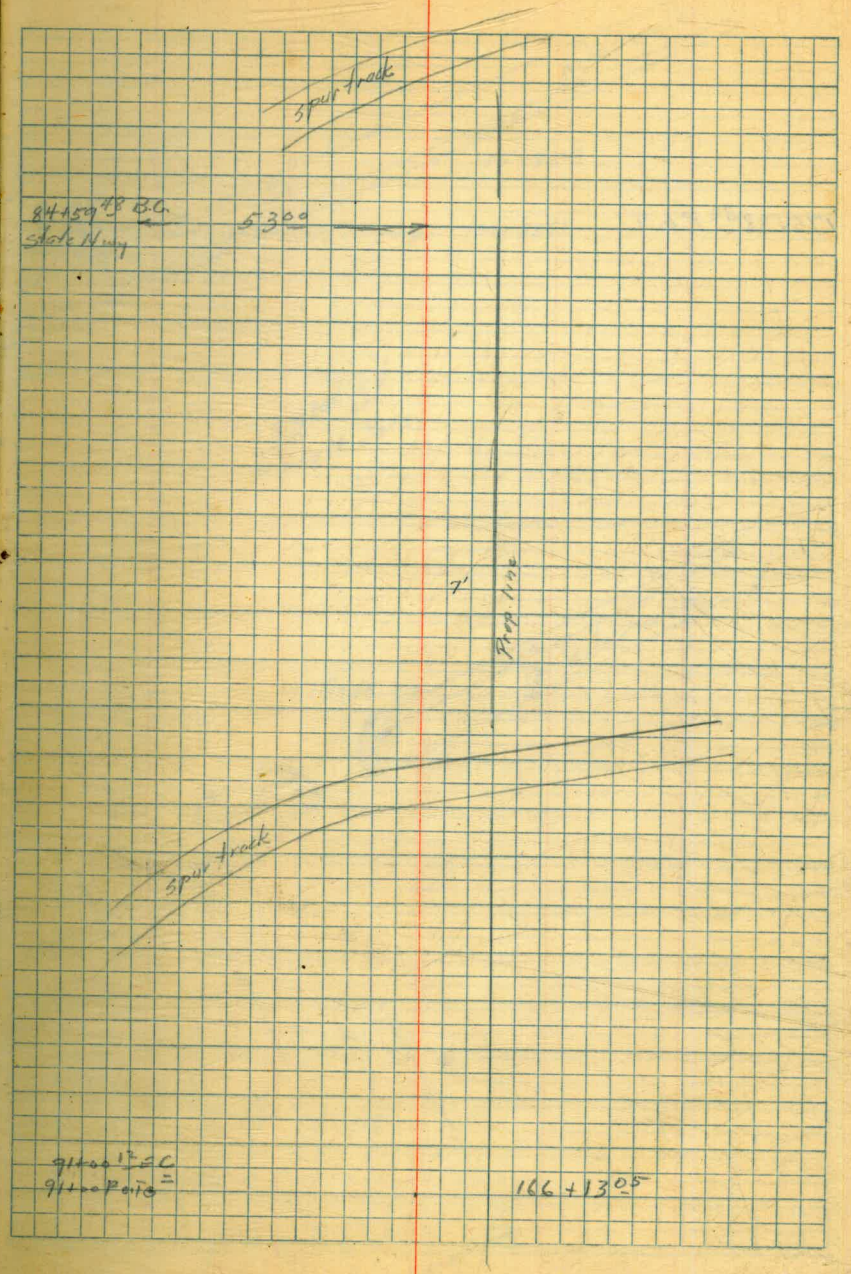
159+02.56 B.C.

159+01.93 E.C.

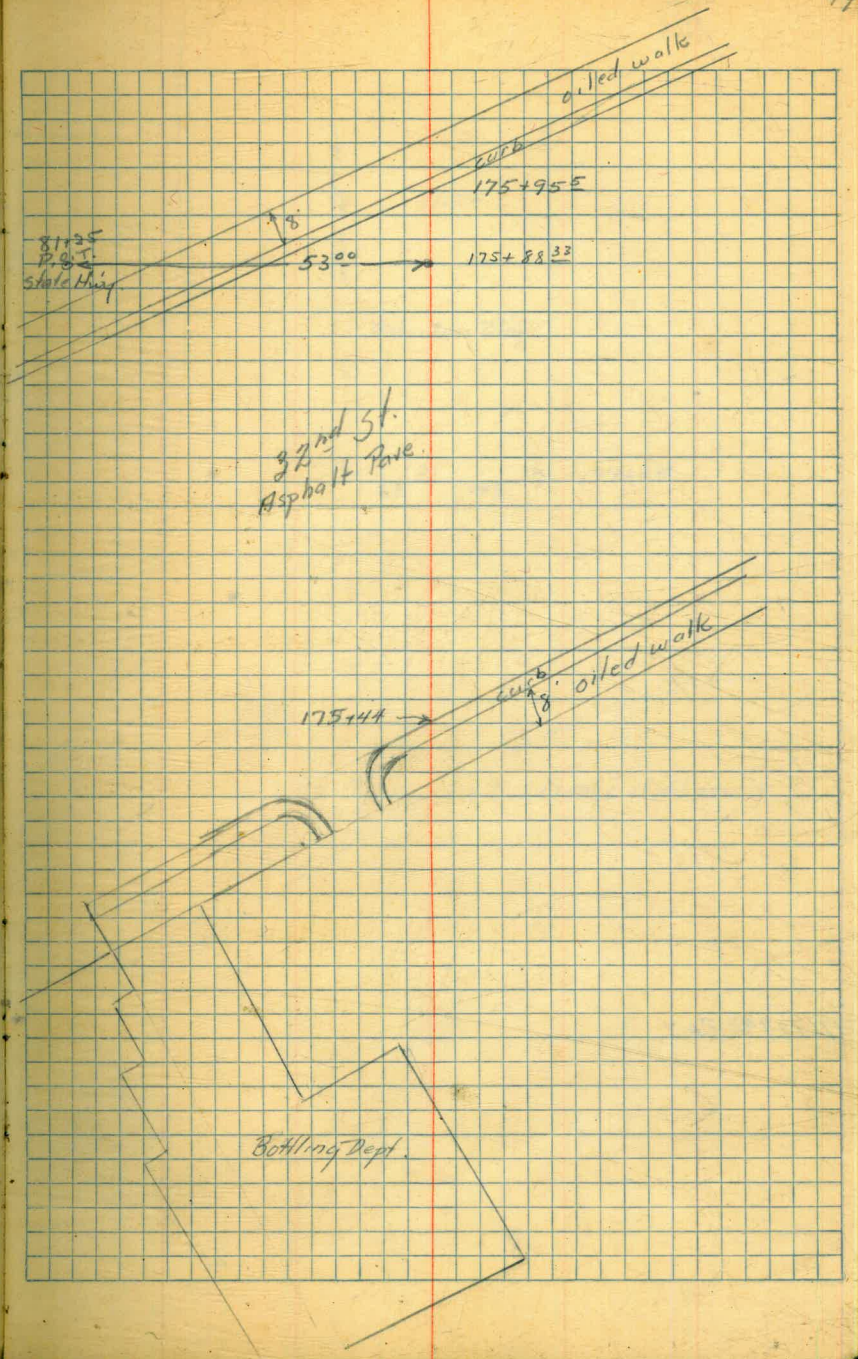



160 skew For bents
68°11'
Retaining wall
13.9
164+93.3
spur track
164+85.0
+71.2
+57.0
+42.9
+27.1
+14.2
164+06.5
+87.2
+72.6
+58.9
+44.6
+31.0
+17.6
163+02.7
+88.9
+74.0
+60.9
162+73.3
89°01'0"
162+41
Retaining wall
22.3
6" wall
spur track
164+80.4
+66.1
+52.3
+38.3
+24.2
164+10.3
163+96.3
+82.2
+68.6
+54.3
+40.4
+26.4
163+12.6
162+98.5
+84.5
+70.7
+56.3
Note: trestle bents are of 5 piles to a bent. 1234 & 10 & of outside piles. & of track is 22.3 FT.
& of bents
97.125
x-section retaining wall
18"
6"
6"
12"

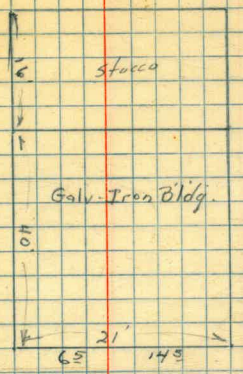
172+53.79 P.O.T.


Spur track
84+59.48 B.C.
State Hwy
53°00'
7'
Proj. line
Spur track
91+00.12 E.C.
91+00 Point
166+13.05

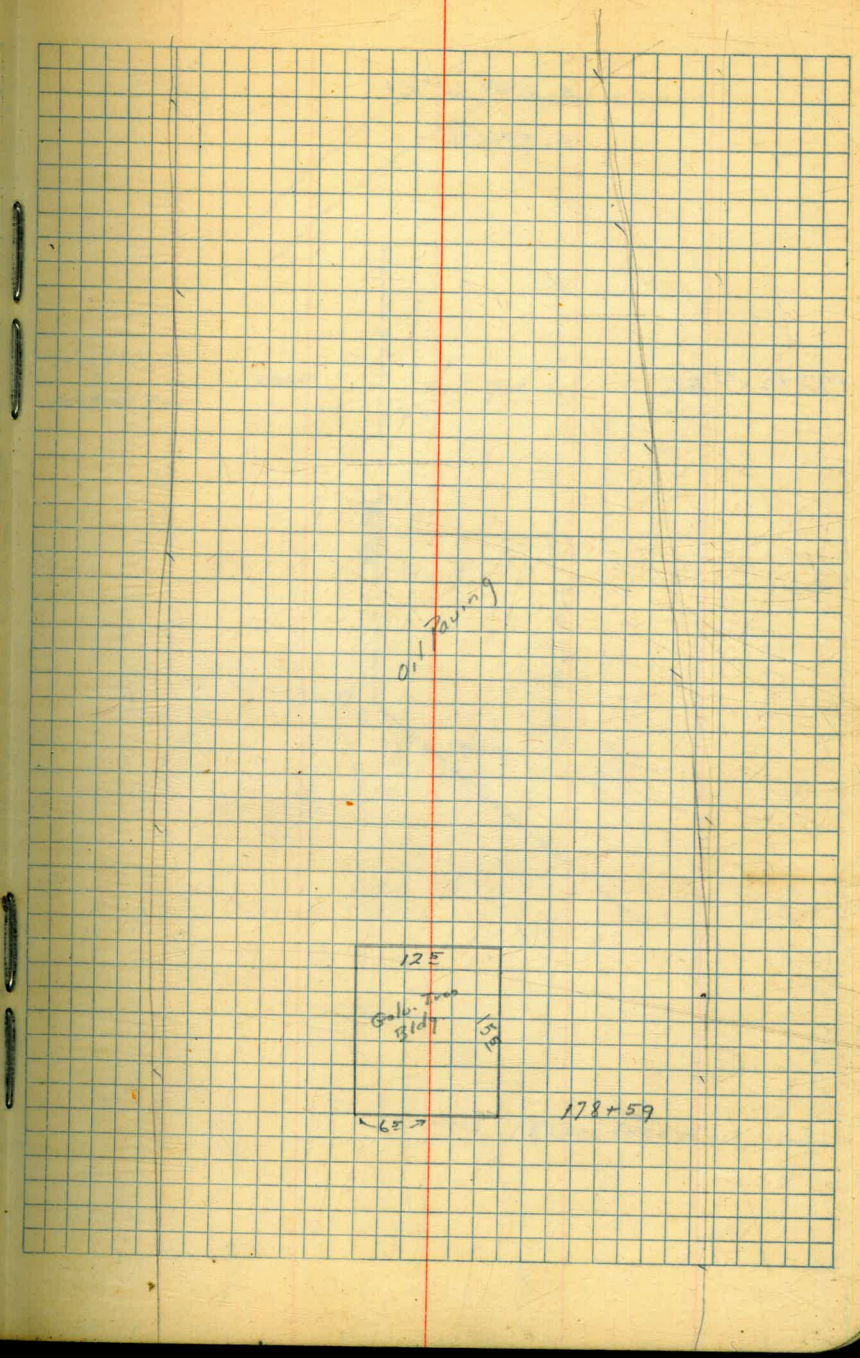
175+88.33 P.O.T.


oiled walk
curb
175+95 E
81.25
P.O.T.
State Hwy
8
53.00
175+88.33
32nd St.
Asphalt Pave.
175+44
curb
oiled walk
Bottling Dept.

176+27.5 P.O.T.



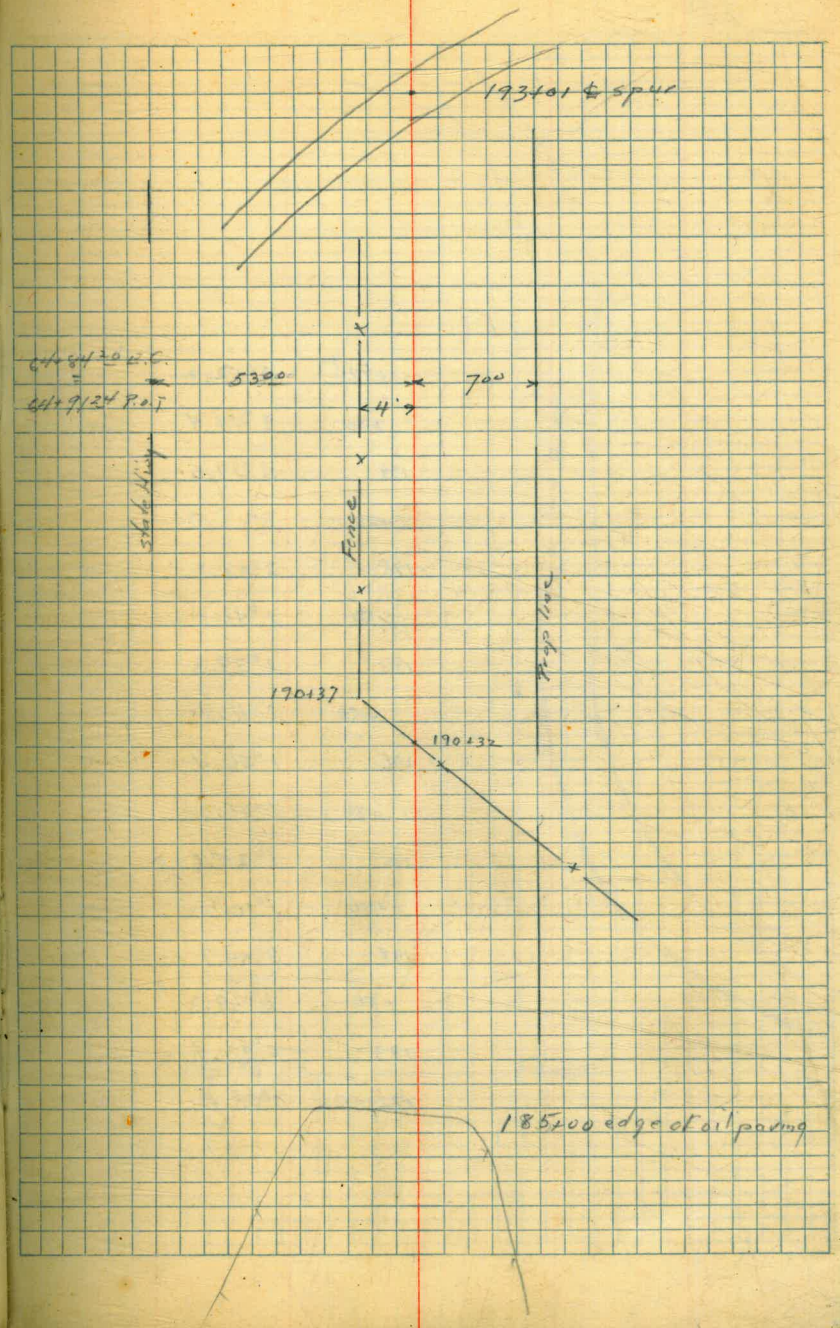
176+= Edge of oil paving


01' Paving
125
Gale. Bldg
178+59
63'

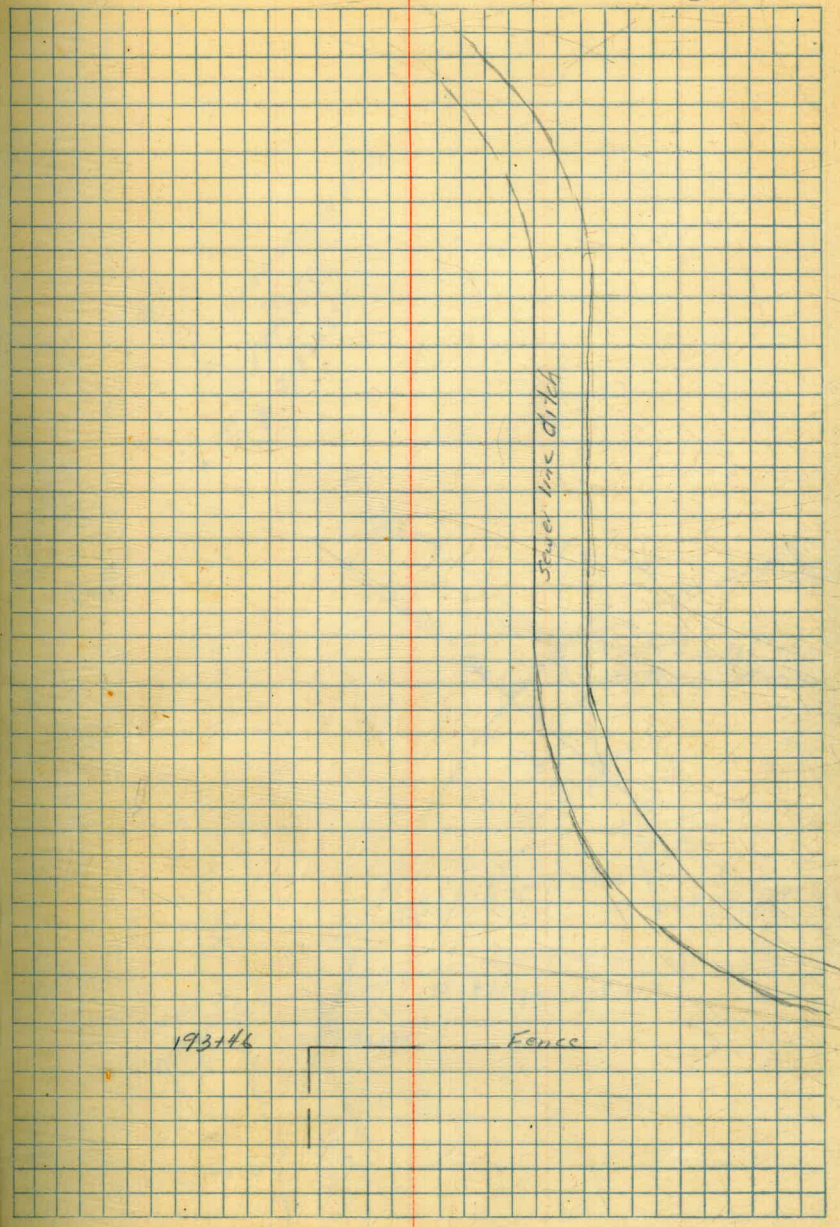
Δ = 7°44' 15" Rt

R = 556.65

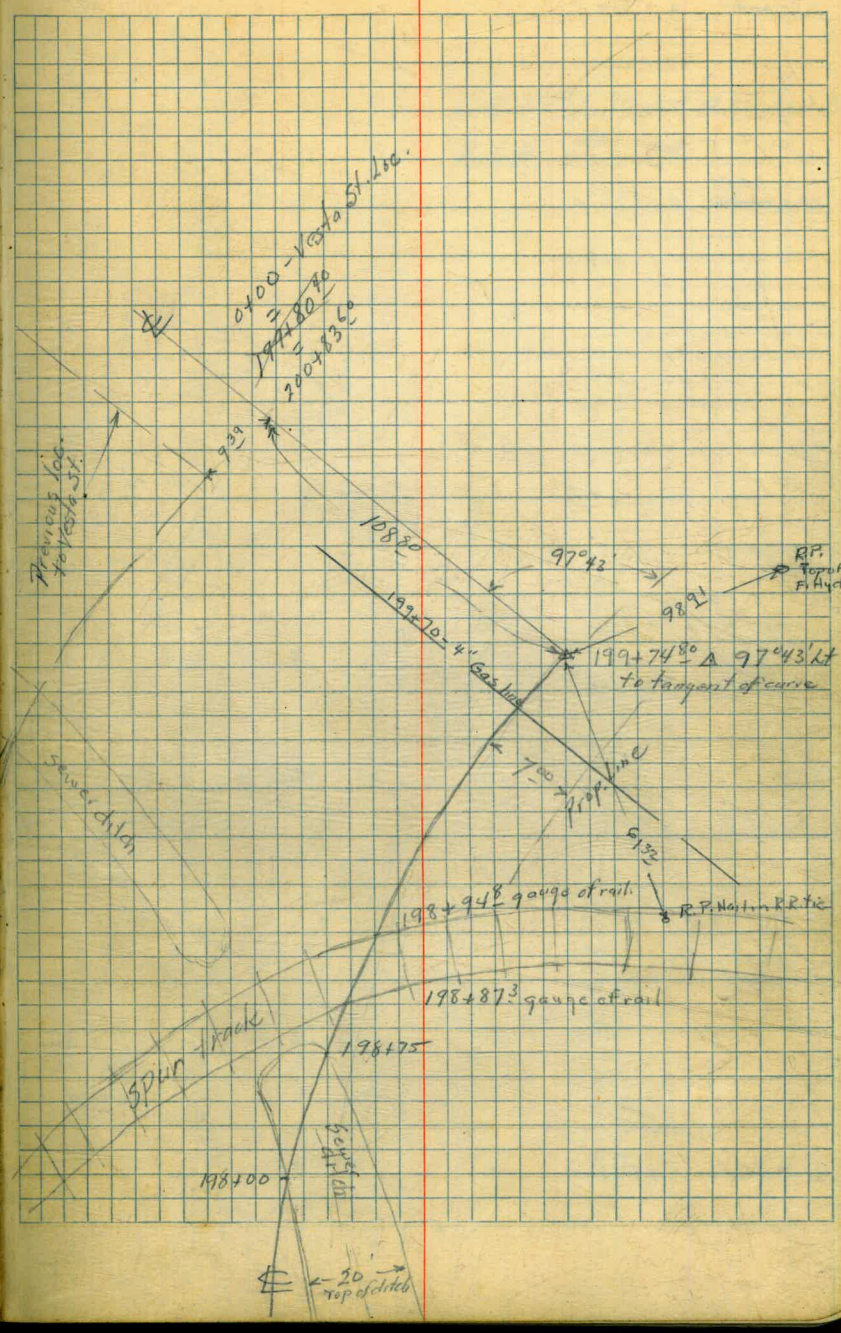
192+22.73 B.C.



+74 80	3°52.2
+50	3°44.4
199	3°29.0
+50	3°13.5
198	2°58.1
+50	2°42.7
197	2°27.3
+50	2°11.8
196	1°56.4
+50	1°41.0
195	1°25.6
+50	1°10.1
194	0°54.7
+50	0°39.3
193	0°23.8
192+50	0°08.4



4.7.84.
164


0400 - Vesta St. Loc.
199+80 ±
200+83 ±
7.39
Previous job to Vesta St.
108 ±
97°43'
R.P. Top of F. Hyd.
98.91
199+74 ± A 97°43' Lt to tangent of curve
199+10 - 4" Gas line
Sewer ditch
7.00
5.32
198+94 ± gauge of rail
R.P. Nat'l. R.R. tie
198+87 ± gauge of rail
Spur track
198+75
198+00
Sewer Manhole
℄
20'
Top of stake

Relocation at Benson Lumber Co.

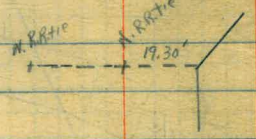
79+~~11.21~~ 10.40 Δ 21°~~02~~ 29' R

78+~~02.32~~ 82.51 Δ 24°10' L

79+~~20.17~~ 37.66 0°29' L

71+~~92.0~~ 91.19 0°56' R

70+~~61.33~~ 61.33 Δ ~~45°~~ 14°06' R



69+65.43 Δ 44°10' L

1 (12) 2/13 Hill King Hyman

55

21°29'

79+~~11.21~~ 10.40

Level notes book 668 P. 34

82.51

78+~~02.32~~

78+06 65.0 10.5 0 E.H

3-0 77+38

0 77+35 gate valve on Sicard St

N. RR tie

71+~~92.0~~ 91.19

21.2

70+~~61.33~~ 61.33

25.3

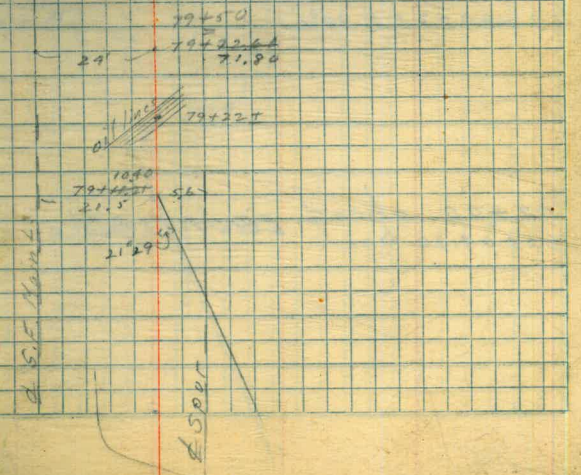
44°06'

70+64

69+65.43

79+50 ahead
~~79+72.64~~ back EQUATION
71.80

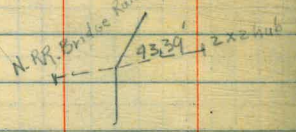
~~79+11.11~~ Δ 21°29'R
10.10



Revision west of Benson Lumber Co.

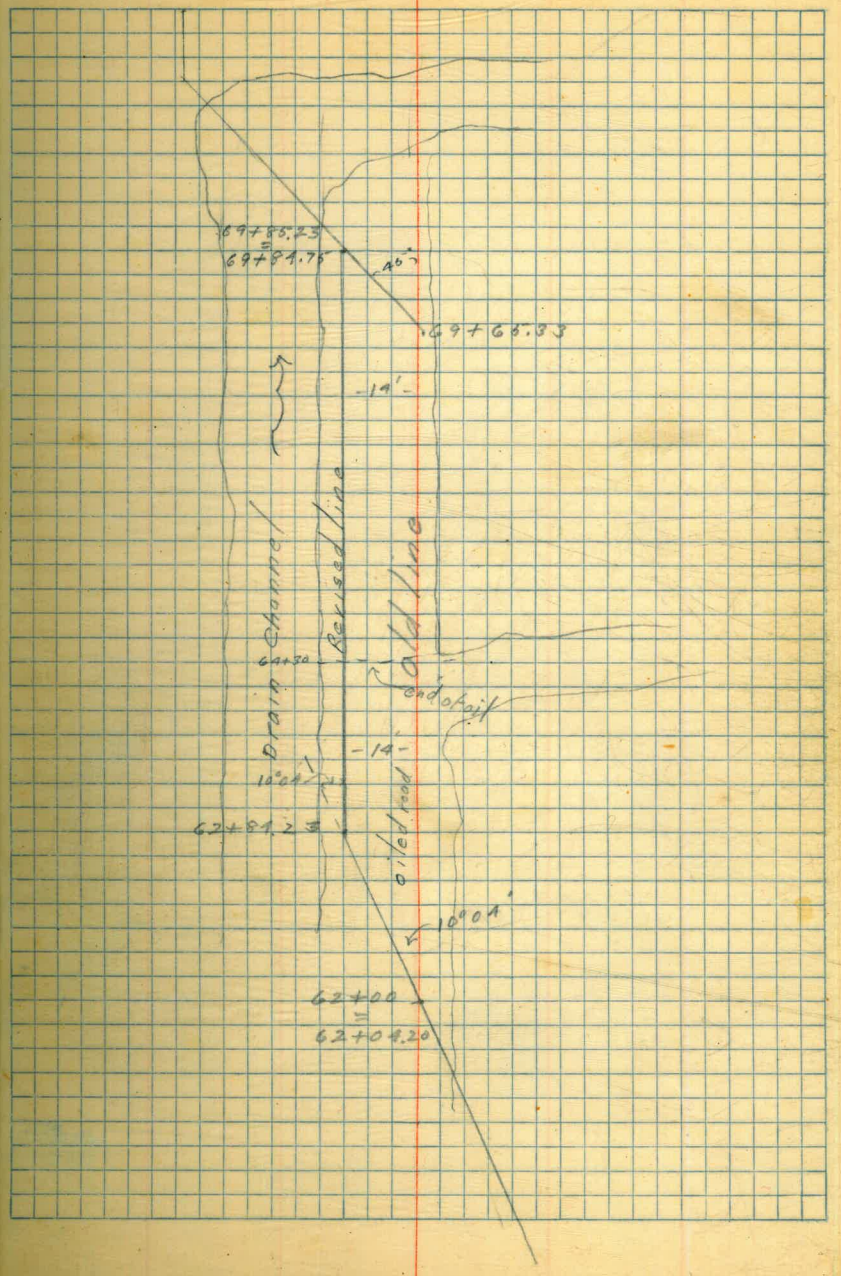
Level notes Book 668 P. 43

69+85.23 ahed EQUATION
69+81.75 back Δ L 95° (99°00')



62+89.23 Δ R 10°01'

62+00 ahead EQUATION
62+04.20 back



change at Crosby east of Oil. 1/8/43

90+50 ℄ Mt. tk. to ℄ P.L. 24'

91+04 " " " " " 22.7'

" " " " 4" oil line 24'

91+22 " " " " 8" " " 22.85'

" " " " " Pt. 21.5'

91+41 " " " " Pt. 20.3

" " " " " 8" oil line 22.9

91+76 " " " " Pt. 19.9'

Concr. beams south of Crosby St. 1/8/43.

Sta.	Dimension	Depth below surface
89+45	3.6 deep - 2.5 wide	1.3
+58	3.6 " 2.5 "	1.3
+72	4.0 " 4.5 "	1.3
+77	3.5 " 2.5 "	1.3
+82	3.5 " 2.5 "	1.3
+95	4.0 " 2.5 "	1.3

90+15 2-4" Shell oil lines

CURVE TABLES.

Published by KEUFFEL & ESSER CO.

HOW TO USE CURVE TABLES.

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

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

To find Deg. of Curve, having the Central Angle and 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.

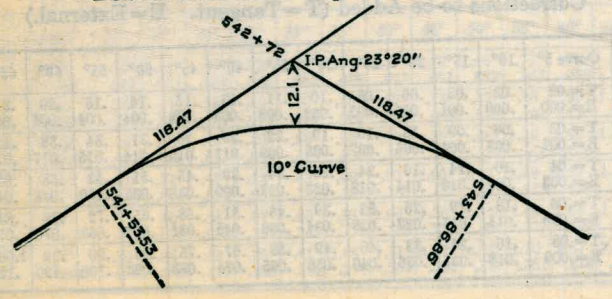
Correction for A. 23° 20′ for a 10° Cur. = 0.16
118.31 + 0.16 = 118.47 = corrected Tangent.

(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+86.86	E. C. = Sta.	543+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.



Natural Trigonometrical Functions

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

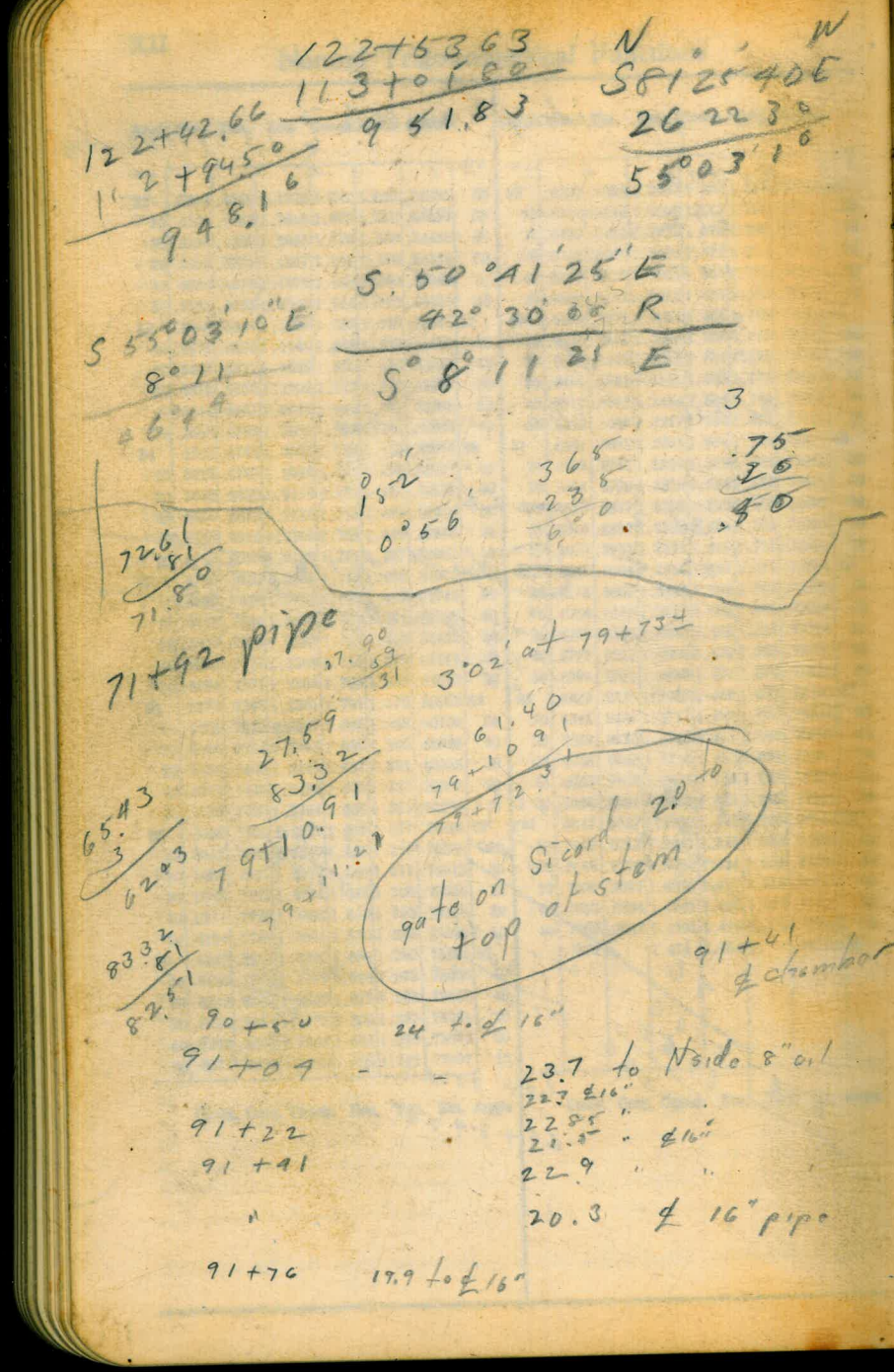
Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

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

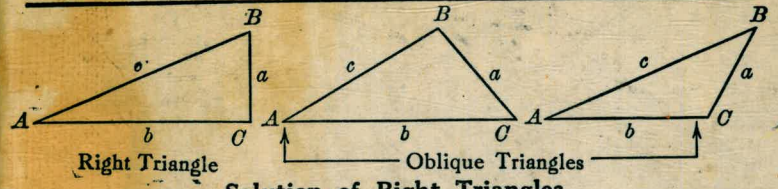
Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

89 + 45 3.6 deep 2.5 wide } 1.3 below surface
89 + 58 " " "
+72 4 " 45 " " "
+77 3.5 " 25 " " "
+82 " " " " " "
+95 4' " " " " 4"
90 + 15 2" shell oil lines

21.2 71+92
22.5 4.6 41 .70712
at 70'
4.3
16
2.8
23.3
19.90
38.47
.91
37.56
11.21
81
10.40
1.6
9000
6488
5320
921
69+65-43
96
43
70+61.
70+61.33
69+85.23
=
69+84.75
9900
1990
76.10
+65-33
99
700
63639
7361



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

REDUCTION TO HORIZONTAL

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

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