

OFFICE OF
RAMSEY COUNTY ENGINEER
FINAL CONST. NOTES
UPPER AFTON ROAD

CO. PROJ. 24-56

FILE No. 11

ENGINEERS'
FIELD BOOK
No. 10303

Office of Ramsey Co. Engineer
ST. PAUL, MINN.

Date Filed 8-28-24

File No. 11

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be $30.6 + (20 - 16) \div 2$ or 2 ft. added to 30.6 = 32.6. For slopes of 1 on 1½ see inside of back cover.

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..... Cross Sections

Sta. B. S. H. I. F. S. Grade Gr. R.

B. M. 5.48 298.56 293.08

55+00

54+27⁸ P.T.

53+77⁸

53+25

53+00

52+77[✓]

52+58⁸

52+08⁸

51+58⁸ P.C.

51+08⁸

Inst. H. M. Johnson
 Res. B. M. P. S.
 Chain Pearson-Hockey

Left

CL

Right

293.08 SPIKE 117 T.P. 40' Lt. 52+85

26	32	34	37	40	40	17	25	29	10	12
33	35	45	106	8	00	15	20	22.3	241	33

35	35	45	43	32	26	29	38	37	24	22
33	17	162	104	8	00	18	20	25	263	33

45	42	53	49	35	32	33	40	40	25	20
33	202	19	13	10	00	192	207	25.7	273	33

52	49	60	59	40	35	31	46	46	30	20
33	274	255	204	75	00	194	235	266	277	33

54	52	66	62	44	37	35	52	40		
33	296	273	225	190	00	21	24	33		

✓ 57
33 41 31
00 33

60	56	52	42	39	52	46				
35	307	262	00	183	23.4	33				

73	65	45	43	45	60	62	50	46		
33	212	16	00	15	184	25	26.7	33		

83	76	48	47	48	62	68	56	53		
33	202	15	00	15	178	25.8	283	33		

99	90	51	49	51	65	71	59	58		
33	207	16	00	15	18	25.2	275	33		

Cross Sections

Sta. B. S. H. I. F. S. Grade Gr. R.

298.56

52+00

49+00

TP 434 298.73 457 293.79

48+00

47+00

46+00

45+00

44+00

TP 460 278.59 479 293.90

B.M.

388 274.00

B.M. 544 300.04

43+00

42+00

+40

41+00

Inst. *H. L. ...*
 Rod. *B. L. ...*
 Chain. *P. ...*

Left					G. I.		Right				
					52						
$\frac{76}{33}$	$\frac{81}{34}$	$\frac{49}{16}$	$\frac{53}{00}$	$\frac{52}{15}$	$\frac{66}{175}$	$\frac{71}{253}$	$\frac{61}{277}$	$\frac{58}{33}$			
					53						
$\frac{72}{53}$	$\frac{74}{20}$	$\frac{49}{16}$	$\frac{47}{00}$	$\frac{50}{15}$	$\frac{68}{19}$	$\frac{66}{254}$	$\frac{55}{245}$	$\frac{54}{33}$			
					50						
$\frac{71}{33}$	$\frac{70}{275}$	$\frac{27}{266}$	$\frac{20}{196}$	$\frac{51}{15}$	$\frac{47}{00}$	$\frac{47}{15}$	$\frac{67}{189}$	$\frac{69}{25}$	$\frac{57}{253}$	$\frac{55}{33}$	
					51						
$\frac{60}{33}$	$\frac{59}{271}$	$\frac{70}{254}$	$\frac{65}{195}$	$\frac{50}{158}$	$\frac{46}{00}$	$\frac{51}{15}$	$\frac{66}{19}$	$\frac{69}{23}$	$\frac{52}{252}$	$\frac{50}{33}$	
					52						
$\frac{54}{33}$	$\frac{58}{257}$	$\frac{71}{245}$	$\frac{71}{194}$	$\frac{51}{15}$	$\frac{47}{00}$	$\frac{47}{15}$	$\frac{65}{192}$	$\frac{66}{24}$	$\frac{44}{259}$	$\frac{41}{33}$	
					53						
$\frac{54}{33}$	$\frac{56}{266}$	$\frac{68}{25}$	$\frac{68}{20}$	$\frac{50}{15}$	$\frac{47}{00}$	$\frac{47}{15}$	$\frac{66}{19}$	$\frac{68}{24}$	$\frac{45}{254}$	$\frac{41}{33}$	
					54						
$\frac{65}{33}$	$\frac{68}{253}$	$\frac{76}{25}$	$\frac{77}{202}$	$\frac{50}{15}$	$\frac{46}{00}$	$\frac{48}{15}$	$\frac{69}{176}$	$\frac{72}{23}$	$\frac{56}{25}$	$\frac{50}{33}$	
294.60 ✓ Nail on T.P. 140' RT 43+50											
294.60 Nail on T.P. 140' RT 43+50											
$\frac{94}{33}$	$\frac{95}{254}$	$\frac{74}{197}$	$\frac{70}{15}$	$\frac{64}{00}$	$\frac{66}{15}$	$\frac{90}{177}$	$\frac{98}{223}$	$\frac{52}{235}$	$\frac{77}{33}$		
					7.4						
$\frac{115}{33}$	$\frac{118}{252}$	$\frac{64}{16}$	$\frac{63}{00}$	$\frac{63}{76}$	$\frac{119}{22}$	$\frac{112}{33}$					
					7.4						
$\frac{152}{33}$	$\frac{148}{27}$	$\frac{60}{16}$	$\frac{58}{00}$	$\frac{60}{16}$	$\frac{123}{236}$	$\frac{128}{33}$					
					7.1						
$\frac{153}{33}$	$\frac{146}{29}$	$\frac{55}{16}$	$\frac{55}{00}$	$\frac{55}{16}$	$\frac{124}{26}$	$\frac{134}{33}$					

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R. ✓
------	-------	---------	-------	-------	----------

300.04

40+00

+30

39+00

+50

T.P.	7.62	306.43 ✓	1.73	798.81 ✓	
------	------	----------	------	----------	--

38+00

37+00

+60

+45

+35

36+00

Left

Right

						59 ^u							
	85	84	46	47	42	42	90	90					
	33	22	16	20	16	244	33						
						46 ^u							
5.2	5.9	6.7	4.2	3.8	3.6	3.5	4.0	4.3	5.8	5.0			
33	25.8	25	20.5	16	20	15	19.6	23.8	25	33			
						3.9 ^u							
4.5	5.0	5.8	5.3	3.2	3.0	3.0	4.9	5.3	3.8	3.1			
33	25.7	25	20.3	15	20	15	18	24.6	26.1	33			
						2.1 ^u							
2.3	2.9	4.7	4.7	2.5	2.5	2.5	4.4	2.4	1.2	+0.5			
33	24.3	25	20.4	14	20	15	18.6	23.3	27.3	33			
						7.9 ^u							
6.9	7.7	10.1	10.0	6.1	9.0	7.6	10.0	10.0	5.5	5.0			
33	26.2	24	20	20	20	15	19	22.3	28.8	33			
						5.5							
4.0	5.2	7.9	7.7	5.8	5.8	5.6	7.6	7.8	3.7	3.2			
33	26	24.2	20	16	20	15	19	23.1	27.5	33			
						4.5							
2.7	3.9	6.9	6.8	4.7	4.9	4.0	6.7	6.8	2.9	2.9			
33	25.8	24.2	20.4	16	16	15	18.2	23.6	20.9	33			
						4.3							
2.7	3.4	6.3	4.3	4.3	4.3	4.0	5.6	Nota F.E.					
33	26	24.2	16	17	20	15	33						
						3.9							
Nota F.E.	5.2	3.8			4.1	3.8	5.4	6.0	2.0	2.4			
	33	17			20	15	19.5	23	27.2	33			
						3.1							
1.7	2.3	5.1	4.9	3.2	3.0	3.2	5.0	5.2	0.8	0.5			
33	26.6	24	19.8	15	20	15	18	24	20.2	33			

Sta.	B. S.	Cross Sections			
		H. I. ✓	F. S.	Grade ✓	Gr. R. ✓
		306.43 ✓			
T.P.	10.04	313.98	2.49	303.94 ✓	
13 M			1.78	312.20 ✓	
35+50					
35+00					
34+00					
33+00					
32+00					
+45					
31+00					
T.P.	2.55	312.32 ✓	4.21	309.77 ✓	
+50					
+20					
30+00					

Cross Sections

Sta. B. S. H. I. ✓ F. S. Grade Gr. R.

317.3 ✓

29+75

29+00

+50

28+00

+50

T.P. 197

303.62 ✓

10.67

301.65 ✓

B.M.

753

296.09

27+00

+50

+35

26+00

+50

Inst. *W. H. S. A. 100*
 Rod. *R. 1990*
 Chain. *P. 1990*
W. H. S. A. 100

Left *W. H. S. A. 100* *W. H. S. A. 100* Right

					42	43	14.0	14.0			
33	40	68	67	36	20	17	30	33			
33	289	234	191	75	00	77					
					55	55	11.0	13.1			
42	50	82	80	58	55	55	11.0	13.1			
33	242	216	192	15	00	17	25.3	33			
					68	70	23	11.6			
57	60	80	80	67	46	70	23	11.6			
33	257	233	198	15	00	76	24.3	33			
					83	83	10.1	10.4	9.0	1.8	
45	75	102	101	81	83	83	10.1	10.4	9.0	1.8	
33	287	232	21	15	00	76	19	20.6	26	33	
					96	100	11.7	11.7	11.0	12.1	
71	78	117	114	78	97	100	11.7	11.7	11.0	12.1	
33	285	23	186	15	00	76	19.2	23.2	24	33	
					2.7	3.2	35	19.7	26	25.0	
296.08	30	40	20	17	2.6	2.6	25	28	30	5.2	
410	62	47	45	25	2.6	2.6	25	28	30	5.2	
33	275	243	183	15	00	75	19.6	23	25	33	
					4.5	4.3	5.8	4.6	7.3		
X	28	25	45	46	4.5	4.3	5.8	4.6	7.3		
	232	183	15	00	75	15	2.27	24.4	33		
					4.9	5.3	7.2	7.1	2.5	5.8	
	24	24	50	50	4.9	5.3	7.2	7.1	2.5	5.8	
	213	17	15	00	75	17.3	22	24.3	33		
					6.5	6.8	5.0	9.0	4.6	7.2	
	7.8	2.8	6.8	4.6	6.5	6.8	5.0	9.0	4.6	7.2	
	24	17.3	15	00	75	17	21.4	26	33		
					8.5	8.8	11.2	11.2	6.4	7.3	
	11.3	11.0	7.6	8.7	8.5	8.8	11.2	11.2	6.4	7.3	
	221	17	15	00	75	17	10.5	16	33		

..... Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade ✓	Gr. R. ✓
T.P.	5.40	303.42 ✓	8.50	294.82 ✓	
25+00					
+50					
T.P.	6.52	295.68 ✓	11.06	289.16 ✓	
24+00					
+50					
T.P.	6.46	291.61 ✓	11.53	285.15 ✓	
23+00					
T.P.	3.99	285.53 ✓	10.07	281.54 ✓	
+50					
22+00					
+50					
T.P.	6.40 ✓	280.19 ✓	11.54	273.99 ✓	
21+00					
+50					
T.B.M.	2.65	273.33 ✓	9.51	270.68 ✓	
			6.22	267.11 ✓	

Cross Sections

Left Gr. R. Right Gr. R.

				7.2					
	101	102	76	77	79	104	104	28	35
	215	178	15	00	15	177	21	30	33
				9.6					
	123	124	100	101	101	124	126	49	55
	215	17	15	00	15	172	224	305	33
				7.5					
	104	103	79	77	78	105	106	21	21
	21	174	15	00	15	188	23	3/3	33
				10.0					
	126	126	100	102	103	127	127	44	55
	214	173	15	00	15	194	242	305	35
				8.3					
	111	110	85	86	86	113	113	43	46
	223	17	15	00	15	178	23	34	37
				10.0					
	73	73	40	47	48	73	73	+27	+42
	21	176	15	00	15	182	215	32	36
				7.1					
	74	84	70	77	69	76	76	12	13
	23	171	15	00	15	17	215	31	34
				9.5					
	46	114	74	81	76	116	116	46	50
	224	15	15	00	15	184	23	30.6	33
				6.7					
	93	91	66	64	65	90	91	52	70
	212	167	15	00	15	176	20	26	30
				9.4					
	53	58	42	44	46	56	49	135	
	93	237	234	15	15	10	18	26.7	33

767.11 1107 07 12 09K 30' RT 70+70

Sta.		Cross Sections		Gr. R.
	B. S.	H. I. ✓	I. S.	✓	
B.M	12.01	308.09		296.08	
76+50					
+35		✓		✓	
T.P.	3.90	309.51	2.48	305.61	
76+00					
+50					
75+00					
+50					
74+00					
+50		✓		✓	
T.P.	0.57	304.93	5.15	304.36	
73+00					
+50					
72+00					

Inst. M. W. Schuster
Rod. 81995
Chain Pecked
Hockey
Lat

Right

796.08 spike on 12" oak 5' AA 26+50

$$\begin{array}{r} 33 \\ - 33 \\ \hline \end{array} \quad \begin{array}{r} 41 \\ - 31 \\ \hline \end{array} \quad 9.0 \checkmark$$

$$\begin{array}{r} 27 \\ - 33 \\ \hline \end{array} \quad \begin{array}{r} 27 \\ - 370 \\ \hline \end{array} \quad 9.4 \checkmark$$

$$\begin{array}{r} 39 \\ - 20 \\ \hline \end{array} \quad \begin{array}{r} 55 \\ - 321 \\ \hline \end{array} \quad 12.4 \checkmark$$

$$\begin{array}{r} 40 \\ - 40 \\ \hline \end{array} \quad \begin{array}{r} 67 \\ - 33 \\ \hline \end{array} \quad 14.4 \checkmark$$

$$\begin{array}{r} 43 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 41 \\ - 21 \\ \hline \end{array} \quad \begin{array}{r} 57 \\ - 37 \\ \hline \end{array} \quad \begin{array}{r} 25 \\ - 35 \\ \hline \end{array} \quad 10.5 \checkmark$$

$$\begin{array}{r} 41 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 38 \\ - 20 \\ \hline \end{array} \quad 18.9 \checkmark$$

$$\begin{array}{r} 45 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 45 \\ - 214 \\ \hline \end{array} \quad 21.3 \checkmark$$

$$\begin{array}{r} 54 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 54 \\ - 23 \\ \hline \end{array} \quad 23.8 \checkmark$$

$$\begin{array}{r} 106 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 108 \\ - 36 \\ \hline \end{array} \quad 21.6 \checkmark$$

$$\begin{array}{r} 43 \\ - 29 \\ \hline \end{array} \quad \begin{array}{r} 45 \\ - 44.7 \\ \hline \end{array} \quad 24.0 \checkmark$$

$$\begin{array}{r} 71 \\ - 27 \\ \hline \end{array} \quad \begin{array}{r} 83 \\ - 43.6 \\ \hline \end{array} \quad 26.5 \checkmark$$

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. E
		304.93			
21+50		✓			
	1.27	294.62	11.58	293.35 ✓	
21+00		✓			
T.P.	0.34	283.68	11.28	283.34 ✓	
T.P.	2.66	274.21	12.13	271.55 ✓	
T.B.M.		✓	7.06	267.15 ✓	
T.B.M.	4.79	271.90			
21+00					
+67					
+50					
+30					
19+00		✓			
T.P.	1.04	263.14	9.80	262.10 ✓	
+50					
18+00					

Inst. W. Schuyler
Rod. Reuter
Chain. Platman
HOCKNEY

.....

Left

C L

Right

185	18.9	28.9 ✓
45	374	
92	19.2	21.1 ✓
52	330	

26711 Nail on 12" oak 35" Pt. 20+20

3.7	2.8	5.8	5.8	3.0	2.6	2.8	4.0	7.8	8.8
33	25	23	12.1	15	20	15	19.4	26	33

6.1	4.2	4.9	7.6	7.4	4.7	4.4	4.5	7.7	9.7
33	28	26	23	20	16	20	16	21.4	33

6.4	5.7	6.5	8.1	5.2	4.5	5.5	7.8	8.7	7.4	7.2
33	24	24	19	15	20	15	19	25	26	32

7.7	6.4	7.5	7.1	6.2	6.7	6.1	7.1	7.3	5.9	5.7
33	26.3	24	19	15	20	15	20	24	27	32

7.4	7.6	7.5	11.0	11.2	7.5	7.2	7.0	7.7	10.1	7.6	10.0
33	30.5	28.2	23	19.4	15	20	16	19.4	23	24.6	33

6.8	4.4	5.3	4.0	4.4	4.4	4.4	7.8	10.6
33	28	22	16	20	17	28.3	33	

10.5	<u>-10.0</u>	3.4	3.4	4.0	10.0	14.3
35	33	19	20	18	39.2	35

Cross Sections

Sta. B. S. H. I. ✓ F. S. Grade Gr. R.

263.14 ✓

17+00 ✓

T.P. 116 254.27 10.03 253.11 ✓

16+00

+73

+27 ✓

T.P. 105 247.88 3.44 246.83 ✓

B.M.

76.4 240.36 ✓

15+00

14+00

+57

+35 ✓

T.P. 0.60 239.47 9.01 238.87 ✓

13+00

12+40

12+25

Sta.	B. S.	Cross Sections		Gr. R.
		H. I.	F. S.	
		✓ 39.47		
12+00				✓
T.B.M		✓	413	✓ 235.34
B.M	9.52	✓ 249.51		✓ 240.29
13+00				
+40				
+25				✓
T.P.	2.71	✓ 240.44	14.08	✓ 237.73
F.B.M.			505	✓ 235.39
B.M.	2.27	✓ 242.56		✓ 240.29
11+85				✓
T.P.	0.93	✓ 234.49	9.00	✓ 233.56
11+00				
10+00				
9+00				
+50				

Inst. ~~W. H. ...~~

Rod. 17.11.1998

Chain ~~...~~

Hackney

Left

Right

6.3	5.8	6.9	6.7	4.8	4.8	9.8	7.3	7.3	0.2	10.3
33	28	25	21.6	15	10	15	10	23	30.2	34

4.5 ✓

235.34 Nail on F Post. 33' Pt. 11+90

240.29 Spike on 16" Oak 50' Lt. 13+50

4.1	1.0	8.7	10.5
38	36.5	34.5	39

11.6 ✓

6.6	6.9
34.6	38

5.7	5.7
34.8	36

Note -
Borrow Pit.
Note for Claying

235.34 Nail on F Post. 33' Pt. 11+90

240.29 Spike on 16" Oak 50' Lt. 13+50

4.0	1.1	8.2	8.2	10.6	10.6	6.5	6.1	
33	28.7	17	00	16	19	23	28	33

2.0 ✓

6.1	5.2	3.0	2.5	2.8	4.5	4.4	4.4
33	31	16	30	16	20.6	24	33

2.2 ✓

2.4	2.0	2.7	5.1	5.2	5.0	7.3	7.5	6.6	6.2
33	23.6	19.6	7.6	30	17	21.1	24.4	26	33

4.4 ✓

8.5	8.2	7.0	6.7	4.7	8.2	7.2
33	20	17	00	16	17.1	33

6.2 ✓

7.9	8.1	9.5	9.1	8.0	7.8	5.7	9.0	8.8	8.8	
33	5.3	5.5	30.6	17	20	15	17.1	21.9	22.4	33

6.8 ✓

Cross Section

Sta. B. S. H. I. ✓ F. S. Grade Gr. R.

234.49

8+00

+50

7+00

T.P. 2.82 ✓ 228.67 ✓ 8.64 225.85

+50

6+00

5+00

4+00

3+00

T.P. 3.58 ✓ 225.49 ✓ 6.76 221.91

2+00

1+00

0+00

B.M. 7.85 217.64

Inst. WilbursonRod. AKAASChain. Redusa

11

Left

G.L

Right

61	66	70	73	80	72	82	96	102	83	82
33	263	231	194	17	20	15	17.7	271	236	33

7.9

68	78	101	101	89	86	90	103	106	90	90
33	312	268	235	195	20	15	17.7	22	246	33

8.4

65	60	111	110	91	91	90	110	112	78	82
33	278	232	196	15	20	15	18.1	215	258	33

8.1

65	65	78	47	35	35	38	56	89	89	97
33	273	23	19	15	20	15	18.5	221	273	33

8.6

64	66	61	53	42	40	43	60	67	62	62
33	273	22	18.7	15	20	15	19	22	27.8	33

8.6

46	43	70	69	50	51	83	72	73	55	51	43	41
33	241	231	188	15	20	15	19	23	24	266	28	33

8.6

77	73	80	77	63	60	61	96	88	78	76	89
33	24	231	115	15	20	15	18.6	22.3	24.8	28	33

6.6

76	86	71	71	70	71	70	90	97	90	81
33	183	16	00	16	21.0	27.5	29	33		

4.4

74	65	45	44	44	44	71	74	68	65
33	205	16	20	16	19.5	27	29	33	

5.4

112	95	86	45	50	45	91	101	100
33	238	16	20	16	24.6	29	33	

5.8

79	73	46	43	40	40	90
33	17.7	16	30	16	33	

217.61 SPIKE on 34" maple NW. of Mont.

Cross Sections

Sta.	B.S.	H.I. ✓	F.S.	Grade ✓	Gr. R.
B.M.	11.07	728.68		217.61	
0+50					
+50					
1+00					
+50					
2+00					
+50					
T.P.	10.03	738.06 ✓	0.65	728.03 ✓	
3+00					
+50					
4+00					
+50					
T.P.	8.13	745.60 ✓	1.59	737.47 ✓	
T.B.M.			9.54	736.06 ✓	
5+00					
+50					

Inst. *W. Shusen*

Rod. *Quares*

Chain. *P. 1000*

6/9/24

Left

G L

Right

217.61 *Spring 00* 81 36" *maple NW of root*
 70 78 87 94 75 65 29 12 99 115
 33 245 234 194 145 76 50 76 20 33

7.1

2.0 24 78 73 60 57 6.3 8.2 7.2
 33 241 23 166 75 00 16 19.3 32
 44 51 64 00 46 44 50 59 6.0
 33 240 23 182 75 80 76 17.4 33

3.0

2.4 34 50 45 25 25 3.2 4.1 4.6
 33 242 23 19 75 25 16 19.6 33

0.7

2.5 26 31 26 25 25 10 4.1 5.3
 33 243 23 187 75 00 17 22 33

7.7

2.8 73 101 101 79 77 8.1 13.5 12.0
 33 244 23 19 75 80 17 27.3 33

5.4

3.4 47 79 65 52 53 5.9 11.0 12.3
 33 241 23.4 171 75 00 77 25.6 33

3.1

X 55 52 29 29 3.3 7.6 7.6
 23 179 75 80 17 23.4 33

0.7

Y 53 31 26 27 1.1 2.8 2.3 0.7 2.8
 23 185 75 80 15 17.7 23 25.4 33

236.06 *North on T.P. 58* 28 47 34.75

88 85 68 79 6.1 8.3 8.7 X
 23 176 75 80 15 18.1 33

3.8

6.7 6.5 43 41 4.4 6.5 6.7
 21 176 75 80 15 19 24

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		245.60			
6+00					
+50					
7+00					
T.P.	463	248.83 ✓	1.40	244.20 ✓	
+50					
8+00					
T.B.M.			3.84	244.99 ✓	
T.B.M.	11.33	247.39 ✓			
4+00					
+50					
T.P.	8.03	253.52 ✓	1.90	245.49 ✓	
5+00					
+50					
6+00					
+50					

Rod. Richards
 Chain. Hackney
Pearson

2011. Cool 6/9/20 ✓ 13

Left

C L

Right

2.4 ✓

$$\begin{array}{r} 49 \\ 21 \\ \hline 173 \end{array}$$

$$\begin{array}{r} 26 \\ 15 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 2.7 \\ 15 \\ \hline 17.6 \end{array}$$

$$\begin{array}{r} 46 \\ 17.6 \\ \hline 52 \\ 24 \end{array}$$

1.6 ✓

$$\begin{array}{r} 42 \\ 22 \\ \hline 78 \end{array}$$

$$\begin{array}{r} 2.0 \\ 15 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 2.0 \\ 15 \\ \hline 15 \end{array}$$

$$\begin{array}{r} 4.0 \\ 18.5 \\ \hline 23.5 \end{array}$$

1.5 ✓

$$\begin{array}{r} 3.5 \\ 22 \\ \hline 183 \end{array}$$

$$\begin{array}{r} 3.5 \\ 15 \\ \hline 50 \end{array}$$

$$\begin{array}{r} 16 \\ 10 \\ \hline 70 \end{array}$$

$$\begin{array}{r} 4.2 \\ 17.9 \\ \hline 23 \end{array}$$

4.9 ✓

$$\begin{array}{r} 27 \\ 33 \\ \hline 297 \end{array}$$

$$\begin{array}{r} 6.9 \\ 22 \\ \hline 180 \end{array}$$

$$\begin{array}{r} 2.0 \\ 15 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 4.7 \\ 15 \\ \hline 72 \end{array}$$

$$\begin{array}{r} 6.9 \\ 22 \\ \hline 29 \end{array}$$

$$\begin{array}{r} 1.3 \\ 29 \\ \hline 33 \end{array}$$

5.1 ✓

$$\begin{array}{r} 22 \\ 33 \\ \hline 276 \end{array}$$

$$\begin{array}{r} 2.0 \\ 22 \\ \hline 184 \end{array}$$

$$\begin{array}{r} 6.8 \\ 15 \\ \hline 100 \end{array}$$

$$\begin{array}{r} 4.7 \\ 15 \\ \hline 75 \end{array}$$

$$\begin{array}{r} 6.8 \\ 18 \\ \hline 22 \end{array}$$

$$\begin{array}{r} 6.9 \\ 22 \\ \hline 25.3 \end{array}$$

$$\begin{array}{r} 4.4 \\ 25.3 \\ \hline 33 \end{array}$$

244.99 Nail on TP 28' 24" 9+00

236.06 ✓ Nail on TP 28' 24" 3+75

2.9

$$\begin{array}{r} 29 \\ 33 \\ \hline 284 \end{array}$$
 12.4 ✓

2.3

$$\begin{array}{r} 29 \\ 35 \\ \hline 32.4 \end{array}$$
 10.0 ✓

2.9

$$\begin{array}{r} 30 \\ 33 \\ \hline 35.8 \end{array}$$
 13.7 ✓

$$\begin{array}{r} 6.3 \\ 33 \\ \hline 38 \end{array}$$

1.4

$$\begin{array}{r} 38 \\ 35 \\ \hline 35.0 \end{array}$$
 11.7 ✓

$$\begin{array}{r} 3.3 \\ 33 \\ \hline 36 \end{array}$$
 3.6

0.6

$$\begin{array}{r} 36 \\ 34 \\ \hline 34.4 \end{array}$$
 10.3 ✓

$$\begin{array}{r} 2.7 \\ 32.6 \\ \hline 35 \end{array}$$
 2.9

1.4

$$\begin{array}{r} 36 \\ 32 \\ \hline 32.6 \end{array}$$
 9.5 ✓

$$\begin{array}{r} 3.2 \\ 31.3 \\ \hline 34 \end{array}$$
 3.2

Note these are high readings

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. B.
		253.52			
7+00					
T. B. M.		✓	257	244.95 ✓	
T. B. M.	2.79	247.78		244.99	
8+50					
9+00					
+50					
10+00					
+50					
11+00					
+50					
12+00					
T. P.	6.61	✓ 248.83	556	242.27 ✓	
+50					

Inst. H.W.
 Rod. H.C.B.
 Chain. Hockey Pearson

2011. Cool

14

6/9/24

Left

C L

Right

3.0 3.2 9.4 4.3 4.3
 35 31.4 30.7 33

✓ V44.99 Nail on T.P. 28' LF. 9+00

✓ V44.99 Nail on T.P. 28' LF. 9+00
 13 13 57 40 39 42 62 63 52 51
 33 28 23 167 15 00 15 19.3 24 26.3 33

4.5
 37 40 61 60 44 41 45 70 76
 33 25 22 17 15 00 16 21.1 33

4.7
 54 62 40 41 43 117 152
 33 199 16 00 19 28.3 36

4.9
 64 77 44 44 46 172 185
 33 211 16 00 19 38.8 44

5.1
 71 83 46 44 45 190 202
 33 215 17 00 19 39.8 43

5.3
 95 84 50 48 48 204 210
 33 217 17 00 18 40.4 44

5.5
 96 83 50 49 50 124 130
 33 208 17 00 18 30 40

5.7
 Note F.F. 61 55 53 53 71 73 35 33
 32 15 00 15 18.1 24 27.2 33

6.9
 85 93 90 89 86 64 48 92 57 22 22
 33 292 23 194 15 00 15 23 25.7 33 35

Gross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		248.83			
13+00					
B.M.			6.74	242.09 ✓	
B.M.	8.31	250.34 ✓			
+50					
14+00					
+50					
T.P.	405	244.93 ✓	9.46	240.98 ✓	
15+00					
+50					
16+00					
+50					
17+00					
B.M.			4.56	240.37 ✓	

Inst. H.L.W.
 Rod. H.C.13
 Chain. R.P. N.H.

6/9/24

15

Left

C L

Right

48	35	87	87	67	47	20	86	70	1.2	1.4
33	28.3	24	18.7	15	20	75	171	22.2	31	33

24203 Top of Mont. 13409.7 $\frac{1}{2}$

24	8.8	107	103	89	86	58	109	111	2.6	2.9
33	24.2	22	18	15	20	15	18	23	31	30

115	18.4	112	110	89	88	93	11.5	114	3.3	2.8
33	23.7	23	18.5	15	20	15	18	23	30.9	33

103	11.7	125	117	95	92	76	11.4	115	6.7	5.6
33	23.7	24.3	19	15	20	15	17.8	23	28	33

93	5.4	40	38	42	6.5	6.5	5.3	4.7
33	22.7	16	20	15	17.1	23	23.6	33

110	9.6	45	39	40	6.0	7.3
33	23.7	16	20	16	19.1	33

120	11.2	43	41	45	6.2	6.8	7.7	8.1
33	17.3	16	20	16	19.2	23	25	33

105	9.7	47	43	51	6.2	7.4	8.0
33	25.2	17	20	16	20	23.9	33

85	7.1	5.1	46	50	6.8	7.5	6.9
33	19.8	16	20	15	21	25.6	33

24035 Nail on 12" oak 40' RT. 19250

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
+50		✓4493			
18+00					
+50					
B.M.	6.93	✓47.28 ✓			
19+00					
+50					
20+00					
+50					
21+00					
T.P.	7.83	✓44.97 ✓	10.14	✓37.14 ✓	
+50					
T.P.	9.22	✓43.24 ✓	10.95	✓34.02 ✓	
22+00					
T.P.	10.58	✓41.68 ✓	12.14	✓31.10 ✓	
+50					

Inst. Wilkinson
 Rod. Briggs
 Chain. Hackney
 Pavers

Left

G L

Right

6.0 ✓

65	58	74	71	51	51	52	68	72	60	56
33	244	200	172	13	00	16	70	25	258	33

5.2 ✓

43	41	73	73	51	49	52	70	70	45	43
33	261	220	172	15	00	16	20	25	261	34

5.4 ✓

68	17	70	68	50	49	50	69	69	32	33
33	29	24	17	15	00	17.1	20	24	278	33

740.35 nail on 12' 00" 60' 40' 7' 17+50

5.0 ✓

26	26	78	77	81	25	22	10.1	10.2	41	42
33	305	220	172	15	00	16	40	24	296	33

8.2 ✓

49	21	98	97	80	78	83	10.5	10.3	36	36
33	31	205	167	15	00	15	187	233	30	23

8.6 ✓

16	17	103	101	88	83	87	11	11.2	30	31
35	32	24	175	15	00	15	183	23	31	33

8.8 ✓

22	24	108	104	91	76	73	11.4	11.6	35	32
34	314	220	173	15	00	25	175	226	31	35

9.4 ✓

31	28	118	117	105	97	100	12.3	12.3	41	41
35	32	244	18	15	00	15	19	234	309	35

8.6 ✓

12	14	108	108	93	70	70	11.4	11.4	35	2.3
35	324	220	183	15	00	15	18	220	318	34

9.0 ✓

22	28	110	110	95	75	75	12.0	12.0	2.8	2.8
35	325	23	188	15	00	15	18	210	332	35

10.6 ✓

48	42	125	125	112	107	112	12.7	12.7	0.5	0.5
35	317	23	17	15	00	15	17	22	352	36

Gross Sections

Sta.	B.S.	H.L.	I.S.	Grade	Gr. E.
		✓ 41.68			
T.P.	8.16	✓ 37.66	12.18	✓ 29.50	
23+00					
T.P.	5.8.8	✓ 32.27	11.27	✓ 26.39	
+39 ✓					
+41 ✓					
+50					
+66 ✓					
+69 ✓					
T.P.	1.0.9	✓ 22.09	11.27	✓ 21.00	
24+00					
+50					
25+00					
T.P.	0.82	✓ 14.04	9.97	✓ 13.22	
+50					
26+00					

Inst. W. L. Johnson

Rod. Blue 95

Chain. Blaise 11

490 x 125

Left

G L

Right

67	59	13.0	13.0	10.4	10.0	10.4	15.4	12.0	5.7	15
33	27.3	15	18	15	20	15	10.4	22	34.5	37

10.1

Note $\frac{FE}{35} = 74$
 $\frac{74}{35} = 2.11$
 $\frac{10.2}{186} = .054$
 $\frac{10.0}{15} = .667$
 $\frac{81}{20} = 4.05$
 $\frac{74}{20} = 3.7$ ✓

$\frac{95}{34} = 2.79$
 $\frac{75}{27} = 2.78$
 $\frac{91}{24} = 3.79$
 $\frac{83}{15} = 5.53$
 $\frac{75}{20} = 3.75$ ✓

8.2

10.3	10.0	8.2	8.0	8.4	10.9	11.0	2.6	2.6
33	25	18	20	15	17	22	32.5	34

Note $\frac{124}{33} = 3.76$
 $\frac{107}{23} = 4.65$
 $\frac{10.1}{17} = .594$
 $\frac{92}{20} = 4.6$ ✓

$\frac{124}{33} = 3.76$
 $\frac{165}{24} = 6.87$
 $\frac{141}{24} = 5.87$
 $\frac{14.1}{193} = .073$
 $\frac{13}{17} = .765$
 $\frac{94}{20} = 4.7$ ✓

1.5

5.7	2.8	2.1	1.4	1.2	3.4	4.0	2.2	1.3
33	19	16	20	15	16.7	21	24	23

4.4

75	81	5.1	4.2	4.5	6.8	7.6
33	27	17	20	17	20	33

8.0

11.9	1.8	7.6	7.3	7.4	9.9	12.8
33	23.1	17	20	17	20	33

2.7

4.3	4.7	6.6	2.4	2.0	2.1	5.0	6.4
33	24.6	24	17	20	17	20.9	33

5.3

10.2	9.5	5.4	4.6	5.0	8.1	7.6
33	24.1	17	20	17	21.5	33

Sta.	B. S.	H. I. ✓	F. S.	Cross Section Grade	Gr. R. ✓
T.P.	1.70	✓14.94	6.87	✓07.17	✓
B.M.	✓	✓08.87	8.14	✓00.73	✓
26+40					
26+42					
+50					
+57 ✓					
+59 ✓					
+68. ✓					
B.M.	4.76	✓05.46			
27+00					
+50					
28+00					
+50					

In. t. *M. tuberosa*.....
Rod. *B. ag.*.....
Chain. *B. ag.*
Hockey

Left

C L

Right

✓ 200.70 - 3 nails 0 17 T.F. ✓ 40' Rt. 27 + 15
 Note SE 40 40 81 11 15 51 20
 35 213 77 00 16 25 43

13 19 51
 00 77 53
 2.54

F.E. 34 20 16 24 50 F.E.
 34 17 00 78 54

37 30 24 20 ✓ 26 32 50
 37 224 18 00 16 35 53

3.9 3.9 5.7 5.8 2.5 2.1 ✓
 33 31 27 24 19 00

✓ 25 30 6.6 6.7 6.8
 19 25 28.4 33

✓ 200.70 3 nails on Tel. N. 10' 40' Rt. 27 + N
 35 35 5.4 6.0 01 10 07 10 41 50
 33 30 27 26 24.8 16 00 16 21.0 33

2.9 ✓
 27 71 30 25 28 57 72
 33 22 16 00 17 21.6 33

Rt. ✓
 93 88 46 38 41 72 80
 33 23 16 00 16 22 33

5.5 ✓
 99 100 58 52 56 88 104
 33 22 16 00 16 21.4 33

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		205.46			
29+00					
+50					
29+50	P.C.				
T.P.	463	203.42 ✓	6.67	198.79 ✓	
30					
+50					
+50					
31+00					
+50					
32+00					
+50					
33+00					

In t. *Will. Johnson*
 Rod. *R. W. G. S.*.....
 Chain. *Hack and Pearson*

Left

G L

Right

11.3 10.0 60 58 67 99 11.1
 33 22. 16 00 16 21.4 33

66 ✓

11.8 11.0 66 65 72 11.3 11.8
 33 22.4 16 00 16 21.8 33

12 ✓

112 110 74 67 97 109 119
 33 30.8 15 00 17 22.5 33

12 ✓

74 86 58 52 60 89 96
 33 70 15 00 16 21.1 33

57 ✓

93 92 54 53 56 92 94 94
 33 22 16 00 16 20.7 24 33

58 ✓

94 74 94 82 52 52 56 56 8.4
 33 31 26 23.7 16 20 16 19.6 33

58 ✓

96 78 75 49 49 50 79 77
 35 30 26.6 22 00 16 19.8 33

64 ✓

89 85 71 63 46 45 43 70 81
 33 32 28 24.5 21 00 15 19.2 33

48 ✓

83 82 63 40 39 43 72 75
 33 39 21.5 17 00 17 21.3 33

41 ✓

6.9 72 66 40 31 33 6.4 67
 33 27 21.5 16 00 16 22 33

33 ✓

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		✓03.42			
33+42.4	P.T.				
34+00					
T.P.	8.15	✓110.09	1.28	✓01.94	
+50					
35+00					
+50					
T.P.	7.45	✓206.46	10.58	199.21	
B.M.			6.70	199.76	
B.M.	6.70	✓206.51			
36+00					
+14					
+50					
37+00					
T.P.	6.23	✓201.04	11.70	194.81	
+50					

Inst. Witzleben

Rod. Brads

Chain. Johnson

Hockey

Left

GL

Right

27 ✓

53 33	58 26	64 24.5	62 24	58 21.5	57 19.8	28 15	26 20	33 16	51 20	53 23	49 24.2	53 33
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19 ✓

31 33	38 32	45 26	43 19.3	22 15	20 20	26 15	21 17.4	44 22	31 28.5	32 33
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60

56 33	70 26.5	94 24	91 18	28 15	52 20	79 15	74 16.4	98 21	81 23	8.8 33
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86 ✓

22 33	24 31.6	10.5 23	10.2 18	80 15	83 20	84 15	10.0 17.5	103 22	50 28.8	47 33
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93 ✓

26 33	26 31.0	110 21	107 17	88 15	89 20	93 15	100 16.7	112 22	45 29.8	39 33
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199.81 Spike on 6" Oak 30' Lt. 37+60

199.81 Spike on 6" Oak 30' Lt. 37+60

69 ✓

15 33	13 30.4	81 23	80 17	68 15	24 20	66 15	83 17	87 21	26 29.3	21 33
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74 ✓

02 33	06 28.2	89 22	79 17	69 15	69 20	70 15	79 17	89 23	32 29.5	24 33
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86 ✓

103 33	10 31	107 25	104 22	94 17	80 15	84 20	85 15	94 17	104 23	51 29.3	40 35
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108 ✓

48 33	52 31.7	117 28	124 23	114 17	105 15	100 20	104 15	114 17	124 23	80 28	78 33
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79 ✓

70 33	75 31.5	76 25.3	98 23	88 17	78 15	75 20	78 16	88 17	98 23	58 28.3	52 33
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Cross Sections

Sta.	B. S.	H. I. ✓	F. ✓	Grade	Gr. R.
		201.04			
38+00					
T.P.	8.34	197.08 ✓	14.30	188.74 ✓	
+50					
T.P.	7.29	194.84 ✓	11.53	185.55 ✓	
39+00					
T.B.M.			8.08	184.76 ✓	
T.B.M.	4.96	189.72 ✓			
+50					
T.P.	6.51	180.68 ✓	11.55	178.17 ✓	
40+00					
T.P.	3.55	176.17 ✓	12.06	174.62 ✓	
+50					
T.P.	6.82	173.10 ✓	9.89	166.28 ✓	
41+00					
T.P.	1.51	165.66 ✓	9.95	164.15 ✓	
+50					
42+00					
+44.9					
T.P.	6.60	160.23 ✓	12.03	153.63 ✓	

Inst. *W. Johnson*

Rod. *Barber*

Chain. *W. Johnson*

Post 1500

Left

C L

Right

11.0 ✓

$\frac{24}{38}$	$\frac{23}{337}$	129	$\frac{119}{17}$	$\frac{109}{15}$	$\frac{109}{00}$	$\frac{108}{15}$	$\frac{118}{17}$	129	$\frac{84}{23}$	$\frac{54}{279}$	$\frac{50}{324}$
-----------------	------------------	-----	------------------	------------------	------------------	------------------	------------------	-----	-----------------	------------------	------------------

10.0 ✓

$\frac{15}{37}$	$\frac{13}{344}$	126	$\frac{116}{17}$	$\frac{106}{15}$	$\frac{106}{00}$	$\frac{106}{15}$	$\frac{116}{17}$	126	$\frac{57}{23}$	$\frac{57}{301}$	$\frac{57}{326}$
-----------------	------------------	-----	------------------	------------------	------------------	------------------	------------------	-----	-----------------	------------------	------------------

10.3 ✓

$\frac{02}{38}$	$\frac{06}{347}$	125	$\frac{115}{17}$	$\frac{105}{15}$	$\frac{104}{00}$	$\frac{104}{15}$	$\frac{114}{17}$	124	$\frac{51}{23}$	$\frac{51}{31}$	$\frac{52}{33}$
-----------------	------------------	-----	------------------	------------------	------------------	------------------	------------------	-----	-----------------	-----------------	-----------------

18476 Nail on 4" d/m 30' 17 39+25

11.4 ✓

18476	Nail on 4" d/m	30'	17	39+25	$\frac{114}{00}$	$\frac{114}{15}$	$\frac{114}{17}$	13.3	$\frac{28}{23}$	$\frac{28}{29}$	$\frac{22}{32}$	$\frac{25}{35}$
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10.2 ✓

$\frac{25}{56}$	$\frac{24}{349}$	123	$\frac{113}{17}$	$\frac{103}{15}$	$\frac{103}{00}$	$\frac{103}{15}$	$\frac{113}{17}$	123	$\frac{35}{23}$	$\frac{35}{32}$	$\frac{35}{35}$
-----------------	------------------	-----	------------------	------------------	------------------	------------------	------------------	-----	-----------------	-----------------	-----------------

5.7 ✓

$\frac{28}{38}$	$\frac{33}{356}$	57	$\frac{28}{23}$	$\frac{68}{17}$	$\frac{58}{00}$	$\frac{58}{15}$	$\frac{67}{17}$	28	$\frac{67}{23}$	$\frac{47}{31}$	$\frac{40}{32}$	$\frac{40}{38}$
-----------------	------------------	----	-----------------	-----------------	-----------------	-----------------	-----------------	----	-----------------	-----------------	-----------------	-----------------

6.6 ✓

$\frac{113}{41}$	$\frac{75}{51}$	77	$\frac{67}{17}$	$\frac{67}{15}$	$\frac{67}{00}$	$\frac{67}{15}$	$\frac{77}{17}$	24	$\frac{74}{23}$	$\frac{74}{345}$	$\frac{41}{41}$	$\frac{41}{40}$
------------------	-----------------	----	-----------------	-----------------	-----------------	-----------------	-----------------	----	-----------------	------------------	-----------------	-----------------

Nail FE 46 32 31 2.5 116 FE

7.2 ✓

$\frac{83}{33}$	$\frac{50}{264}$	93	$\frac{82}{17}$	$\frac{74}{15}$	$\frac{72}{00}$	$\frac{70}{15}$	$\frac{82}{17}$	93	$\frac{13}{23}$	$\frac{13}{308}$	$\frac{09}{33}$
-----------------	------------------	----	-----------------	-----------------	-----------------	-----------------	-----------------	----	-----------------	------------------	-----------------

10.6 ✓

$\frac{107}{33}$	$\frac{111}{27}$	124	$\frac{116}{17}$	$\frac{106}{15}$	$\frac{106}{00}$	$\frac{103}{15}$	$\frac{116}{17}$	124	$\frac{88}{23}$	$\frac{88}{271}$	$\frac{00}{36.8}$
------------------	------------------	-----	------------------	------------------	------------------	------------------	------------------	-----	-----------------	------------------	-------------------

2 for sections after - Oct. - 1880 - 1881

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		160.73			
43+00					
T.P.	0.61	150.94	9.90	150.33	
43+50					
44+06.3	P.T.				
+30					
+50					
+62					
+78					
45+00					
B.M.			5.60	145.34	
+20					
+57					
+70					
T.P.	7.41	156.72	1.63	149.31	
45+20					
257					

1. *Wilschusen*.....
 Rod. *B.K. 1933*.....
 Chain. *111-111-111*

Left

GL

Right

86 ✓

$$\begin{array}{r} 90 \\ - 25 \\ \hline 65 \end{array}$$

$$\begin{array}{r} 92 \\ - 34 \\ \hline 58 \end{array}$$

$$\begin{array}{r} 111 \\ - 78 \\ \hline 33 \end{array}$$

$$\begin{array}{r} 108 \\ - 75 \\ \hline 33 \end{array}$$

$$\begin{array}{r} 58 \\ - 18 \\ \hline 40 \end{array}$$

$$\begin{array}{r} 76 \\ - 15 \\ \hline 61 \end{array}$$

$$\begin{array}{r} 96 \\ - 17 \\ \hline 79 \end{array}$$

$$\begin{array}{r} 102 \\ - 23 \\ \hline 79 \end{array}$$

$$\begin{array}{r} 119 \\ - 35 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 123 \\ - 40 \\ \hline 83 \end{array}$$

191 ✓

$$\begin{array}{r} 91 \\ - 36 \\ \hline 55 \end{array}$$

$$\begin{array}{r} 87 \\ - 31 \\ \hline 56 \end{array}$$

$$\begin{array}{r} 18 \\ - 20 \\ \hline -2 \end{array}$$

$$\begin{array}{r} 18 \\ - 20 \\ \hline -2 \end{array}$$

$$\begin{array}{r} 16 \\ - 17 \\ \hline -1 \end{array}$$

$$\begin{array}{r} 103 \\ - 30 \\ \hline 73 \end{array}$$

$$\begin{array}{r} 108 \\ - 34 \\ \hline 74 \end{array}$$

42 ✓

$$\begin{array}{r} 184 \\ - 5 \\ \hline 179 \end{array}$$

$$\begin{array}{r} 171 \\ - 39 \\ \hline 132 \end{array}$$

$$\begin{array}{r} 23 \\ - 21 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 20 \\ - 20 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 39 \\ - 18 \\ \hline 21 \end{array}$$

$$\begin{array}{r} 240 \\ - 48 \\ \hline 192 \end{array}$$

$$\begin{array}{r} 243 \\ - 55 \\ \hline 188 \end{array}$$

50 ✓

$$\begin{array}{r} 293 \\ - 60 \\ \hline 233 \end{array}$$

$$\begin{array}{r} 182 \\ - 57 \\ \hline 125 \end{array}$$

$$\begin{array}{r} 126 \\ - 44 \\ \hline 82 \end{array}$$

$$\begin{array}{r} 48 \\ - 21 \\ \hline 27 \end{array}$$

$$\begin{array}{r} 47 \\ - 20 \\ \hline 27 \end{array}$$

$$\begin{array}{r} 52 \\ - 18 \\ \hline 34 \end{array}$$

$$\begin{array}{r} 247 \\ - 49 \\ \hline 198 \end{array}$$

$$\begin{array}{r} 260 \\ - 60 \\ \hline 200 \end{array}$$

55 ✓
 1st Col 1st Col 2nd Col

$$\begin{array}{r} 280 \\ - 60 \\ \hline 220 \end{array}$$

$$\begin{array}{r} 270 \\ - 54 \\ \hline 216 \end{array}$$

$$\begin{array}{r} 234 \\ - 58 \\ \hline 176 \end{array}$$

$$\begin{array}{r} 54 \\ - 21 \\ \hline 33 \end{array}$$

$$\begin{array}{r} 47 \\ - 20 \\ \hline 27 \end{array}$$

$$\begin{array}{r} 53 \\ - 17 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 218 \\ - 44 \\ \hline 174 \end{array}$$

$$\begin{array}{r} 270 \\ - 50 \\ \hline 220 \end{array}$$

$$\begin{array}{r} 255 \\ - 53 \\ \hline 202 \end{array}$$

58 ✓

$$\begin{array}{r} 293 \\ - 58 \\ \hline 235 \end{array}$$

$$\begin{array}{r} 273 \\ - 50 \\ \hline 223 \end{array}$$

$$\begin{array}{r} 56 \\ - 20 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 56 \\ - 20 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 56 \\ - 17 \\ \hline 39 \end{array}$$

$$\begin{array}{r} 244 \\ - 45 \\ \hline 199 \end{array}$$

$$\begin{array}{r} 260 \\ - 67 \\ \hline 193 \end{array}$$

60 ✓

$$\begin{array}{r} 278 \\ - 60 \\ \hline 218 \end{array}$$

$$\begin{array}{r} 264 \\ - 48 \\ \hline 216 \end{array}$$

$$\begin{array}{r} 61 \\ - 20 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 56 \\ - 20 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 61 \\ - 17 \\ \hline 44 \end{array}$$

$$\begin{array}{r} 235 \\ - 55 \\ \hline 180 \end{array}$$

$$\begin{array}{r} 230 \\ - 20 \\ \hline 210 \end{array}$$

$$\begin{array}{r} 4050 \\ - 50 \\ \hline 4000 \end{array}$$

63 ✓

$$\begin{array}{r} 287 \\ - 60 \\ \hline 227 \end{array}$$

$$\begin{array}{r} 280 \\ - 52 \\ \hline 228 \end{array}$$

$$\begin{array}{r} 65 \\ - 20 \\ \hline 45 \end{array}$$

$$\begin{array}{r} 41 \\ - 20 \\ \hline 21 \end{array}$$

$$\begin{array}{r} 62 \\ - 16 \\ \hline 46 \end{array}$$

$$\begin{array}{r} 116 \\ - 25 \\ \hline 91 \end{array}$$

$$\begin{array}{r} 107 \\ - 25 \\ \hline 82 \end{array}$$

$$\begin{array}{r} 94 \\ - 50 \\ \hline 44 \end{array}$$

$$\begin{array}{r} 93 \\ - 52 \\ \hline 41 \end{array}$$

66 ✓

$$\begin{array}{r} 265 \\ - 56 \\ \hline 209 \end{array}$$

$$\begin{array}{r} 253 \\ - 48 \\ \hline 205 \end{array}$$

$$\begin{array}{r} 65 \\ - 20 \\ \hline 45 \end{array}$$

$$\begin{array}{r} 63 \\ - 20 \\ \hline 43 \end{array}$$

$$\begin{array}{r} 68 \\ - 16 \\ \hline 52 \end{array}$$

$$\begin{array}{r} 109 \\ - 23 \\ \hline 86 \end{array}$$

$$\begin{array}{r} 105 \\ - 45 \\ \hline 60 \end{array}$$

69 ✓

$$\begin{array}{r} 243 \\ - 50 \\ \hline 193 \end{array}$$

$$\begin{array}{r} 235 \\ - 44 \\ \hline 191 \end{array}$$

$$\begin{array}{r} 67 \\ - 19 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 64 \\ - 20 \\ \hline 44 \end{array}$$

$$\begin{array}{r} 67 \\ - 17 \\ \hline 50 \end{array}$$

$$\begin{array}{r} 114 \\ - 24 \\ \hline 90 \end{array}$$

$$\begin{array}{r} 115 \\ - 53 \\ \hline 62 \end{array}$$

$$\begin{array}{r} 102 \\ - 26 \\ \hline 76 \end{array}$$

145.30

WIL
 BOWMAN PT

12.4

95
- 54
- 55

12.4

24
- 54
- 60

Cross Sections

Sta.	B.S.	H.I. ✓	Gr. R.
BM.	416	149.46	145.30
46+00			
+5.0			
47+00			
+5.0			
+7.5			
= 48+01.9			
48+00.3	P.C.	Equation	
B.M.	616	151.46	
+5.0			
49+00			
+5.0			
T.P.	11.81	161.50 ✓	149.69 ✓
50+00			

Inst. W. L. H. K. S. ...
Rod. B. ...
Chain. P. ...
W. L. H. K. S. ...

Left

G L

Right

14530

$\frac{18.2}{40}$	$\frac{18.0}{37.5}$	$\frac{5.2}{17}$	$\frac{5.4}{20}$	$\frac{5.3}{16}$	$\frac{9.0}{21.6}$	$\frac{9.5}{33}$
-------------------	---------------------	------------------	------------------	------------------	--------------------	------------------

5.4 ✓

$\frac{7.8}{33}$	$\frac{7.8}{28.2}$	$\frac{7.1}{20}$	$\frac{5.1}{16}$	$\frac{5.0}{16}$	$\frac{5.2}{16}$	$\frac{8.2}{20.4}$	$\frac{8.3}{53}$
------------------	--------------------	------------------	------------------	------------------	------------------	--------------------	------------------

5.0 ✓

$\frac{6.5}{33}$	$\frac{5.4}{25}$	$\frac{6.7}{23.1}$	$\frac{6.6}{20.9}$	$\frac{4.6}{17}$	$\frac{4.8}{17}$	$\frac{8.2}{22.7}$	$\frac{8.0}{27.4}$	$\frac{7.5}{28.2}$	$\frac{7.0}{53}$
------------------	------------------	--------------------	--------------------	------------------	------------------	--------------------	--------------------	--------------------	------------------

4.6 ✓

$\frac{11.9}{33}$	$\frac{8.9}{24.6}$	$\frac{4.2}{17}$	$\frac{4.3}{50}$	$\frac{4.3}{17}$	$\frac{7.8}{22}$	$\frac{7.8}{26.3}$	$\frac{4.7}{29.6}$	$\frac{4.1}{33}$
-------------------	--------------------	------------------	------------------	------------------	------------------	--------------------	--------------------	------------------

4.3 ✓

$\frac{2.0}{27.6}$	$\frac{2.0}{53.0}$	$\frac{2.35}{43.5}$	$\frac{4.0}{17}$	$\frac{3.8}{16}$	$\frac{7.4}{21.3}$	$\frac{7.4}{25.7}$	$\frac{6.1}{28.6}$	$\frac{6.0}{33}$
--------------------	--------------------	---------------------	------------------	------------------	--------------------	--------------------	--------------------	------------------

4.0 ✓

$\frac{13.3}{50}$	$\frac{23.0}{43}$	$\frac{3.7}{17}$	$\frac{3.5}{16}$	$\frac{3.7}{16}$	$\frac{6.8}{21.3}$	$\frac{6.8}{20.3}$	$\frac{5.5}{28}$	$\frac{5.4}{28}$
-------------------	-------------------	------------------	------------------	------------------	--------------------	--------------------	------------------	------------------

3.8 ✓

14530

$\frac{5.8}{24}$	$\frac{5.9}{31.5}$	$\frac{10.7}{21}$	$\frac{10.7}{25.5}$	$\frac{4.7}{16}$	$\frac{4.5}{16}$	$\frac{7.5}{20}$	$\frac{7.5}{24}$	$\frac{6.4}{26}$	$\frac{6.4}{33}$
------------------	--------------------	-------------------	---------------------	------------------	------------------	------------------	------------------	------------------	------------------

5.1 ✓

$\frac{5.6}{53}$	$\frac{6.0}{26}$	$\frac{7.1}{24.4}$	$\frac{7.3}{20.1}$	$\frac{3.5}{15}$	$\frac{3.2}{15}$	$\frac{3.4}{15}$	$\frac{6.1}{19.3}$	$\frac{6.1}{23}$	$\frac{4.9}{24}$	$\frac{5.0}{33}$
------------------	------------------	--------------------	--------------------	------------------	------------------	------------------	--------------------	------------------	------------------	------------------

3.9 ✓

$\frac{3.0}{33}$	$\frac{3.5}{24.7}$	$\frac{4.4}{22.4}$	$\frac{3.7}{17.6}$	$\frac{1.9}{15}$	$\frac{1.9}{15}$	$\frac{3.3}{33}$	NOTE: EF
------------------	--------------------	--------------------	--------------------	------------------	------------------	------------------	----------

2.2 ✓

$\frac{6.7}{33}$	$\frac{7.3}{28.5}$	$\frac{4.8}{22}$	$\frac{4.7}{18.5}$	$\frac{4.7}{15}$	$\frac{4.7}{15}$	$\frac{7.5}{15}$	$\frac{11.6}{19.7}$	$\frac{8.1}{24.7}$	$\frac{11.4}{27}$	$\frac{11.0}{33}$
------------------	--------------------	------------------	--------------------	------------------	------------------	------------------	---------------------	--------------------	-------------------	-------------------

10.0 ✓

Cross Sections

Sta. B.S. H. I. F. S. Grade Gr. R.

161.50 ✓

+50

51+00

T.P. 842 169.99 0.98 160.52 ✓

+50

52+00

+50

T.B.M. 462 160.37 ✓

53+00

T.P. 1168 172.77 1.91 167.09 ✓

+50

52+50

53+00

T.P. 911 181.56 6.32 174.45 ✓

54+00

+50

Gross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

19156

+60

55+00

T.P.	7.72	188.53	2.75	178.81	
------	------	--------	------	--------	--

+50

+80

56+00

+349

B.M.			0.55	187.98	
------	--	--	------	--------	--

B.M.	666	194.66			
------	-----	--------	--	--	--

55+00

+50

+80

56+74.9 P.C.

57+00

+349

Inst. Milburn
 Rod. 21005
 Chain. 21005

Left

C L

Right

(7.1)
 46 42 94 88 67 66 67 89 89 63 0.2
 32 28 207 17 14 15 17.2 22 394 35

(5.1)
 1.7 15 64 65 48 46 4.8 4.4 6.8
 33 289 22 18 15 15 19.4 22

(9.3)
 43 30 16 15 90 91 73 108 114
 34 31.8 22 184 15 15 15 23
 21 21 28 27 25 20 27 27 27
 35 34 21 18 15 15 181 22

(7.0)
 10 10 90 85 67 5 65 87 91 28 26
 54 310 22 19 15 20 15 18 21.8 32 35

(5.2)
 31 22 71 67 47 48 10 6.8 6.8 5.0 1.0 5.3
 33 267 25 192 15 20 15 18 13 25 28 33

188.00 Spike in Stamp

188.00 Spike in Stamp

(10.2) 10.2 10.0
 33 35

(15.7) 42 4.1
 36.8 37

(6.8) (10.2)
 107 107 29 62 91 118 39.3 116 37 116
 33 216 16 60 16 202 28 33 33
 115 1.2 78 78 55 107 14.3 115
 33 22.1 16 20 16 203 27 33

(6.4)
 143 155 5.4 6.1 6.9 9.8 9.9 10.3
 33 278 16 60 16 217 28 33

Cross Sections

Sta; B. S. H. I. ✓ F. S. Grade Gr. R.

19466

59+00

+50

T.P. 10.7 ✓ 224.84 ✓ 0.54 ✓ 194.12 ✓

59+00

+50

60+00

+105 P.T.

+50

T.B.M. ✓ 1.12 ✓ 203.72 ✓

T.P. 11.19 ✓ 212.73 ✓ 3.30 ✓ 211.54 ✓

59+50

T.P. 7.90 ✓ 220.34 ✓ 0.29 ✓ 212.44 ✓

60+00

60+105 P.T.

60+50

11. E. H.W.

Rod. BY 192

Chain. Becking Paper 500

PROFESSIONAL PAPER FOR ENGINEERS

Left

C L

Right

121	112	25	3.2	3.2	6.7	70
35	512	18		18	74	33

3.2

44	36	10	0.7	19	4.2	45	31	29	26
33	256	19		15	19.3	205	246	31	33

0.7

107	111	76	8.3	25	116	115	52	53
33	218	76		20	20	23	304	33

8.3

22	61	5.5	5.8	6.8	5.4	8.8
33	17	15		16	18.8	24.2

5.8

41	37	2.6	3.3	4.3	5.7	5.9
33	168	15		15	18.5	20

3.3

39	35	0.1	2.9	3.3	4.9	5.1
33	164	15		15	18.8	25

2.9

27	12	0.1	1.3	1.9	2.5	3.4
33	183	15		15	18.4	23

1.3

103.74 1001 on Cor. F.P. at 30' Lt.

36	36
382	20

12.7

13	54
405	44

18.8

41	43
403	24

15.3

34	34
383	21

16.8

Cross Sections

Sta:	B. S.	H. I. ✓	F. S.	Grade	Gr. R. ✓
		✓ 22034			
T.P.	5.40	✓ 214.53	11.21	209.13	✓
T.B.M.			10.81	203.72	
60+605					
+82					
61+00					
+11					
+50					
62+00		✓			✓
T.P.	8.81	223.02	0.32	214.21	
62+50					
+65					
63+00					
+50					
B.M.			0.79	222.23	✓

Inst. Melsthusen
 Rod. BUNAS
 Chain. 7650m
Parasalt

PROBATIONARY SURVEYING

Left

G L

Right

V0372

10.0

122	111	74	113	104	122	123	718
33	183	15	15	15	186	22	372

9.4

114	110	112	107	90	93	95	111	113	13	89
33	263	236	185	76	20	15	18	22	33	36

8.0

116	104	50	83	66	101	104	48	31
33	20	76	20	78	18	22	29	33

7.4

111	101	75	79	76	85	97	90	86	40
33	213	11	20	78	180	22	25	28	34

5.5

111	109	58	60	60	29	55	11	67
33	244	16	20	76	143	20	283	33

3.0

37	61	68	35	32	52	52	34	33
33	247	76	20	17	20	24	276	33

9.0

28	31	111	130	94	78	78	117	119	91	91
36	306	22	186	15	20	76	204	25	318	34

6.2

94	10	105	105	88	90	92	112	112	84	84
33	34	32	199	15	20	15	206	248	31	34

6.5

24	31	89	31	68	69	70	84	91	78	84
34	273	214	184	74	20	15	78	236	20	33

4.0

36	39	62	55	40	32	42	55	59	50	51
33	21	203	174	15	20	15	177	21	238	33

V77,25

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
B.M.	11.01	✓ 733.26			
64+00					
+20					
+34					
+50 ✓					
+75					
65+00		✓			
T.P.	9.43	✓ 735.62	6.07	✓ 727.19	
+25					
+33 ✓					
+36 ✓					
+50					
+55 ✓					
+58 ✓					

Inst. W. Schuster
 Rod. B. 11215
 Chain. Peapack
Hockley

PROFESSIONAL SURVEYING INSTRUMENTS

Left

C L

Right

✓ 25 ✓ 25 ✓ 25

25	11.2	11.4	12.9	12.5	11.3	11.4	11.4	13.2	13.2	13.1	13.2
26	25	23	24	17	15	15	15	17	21	22	23

11.8 ✓

10.8 ✓

10.1

10.5	10.3	11.8	11.6	10.1	10.3	10.5	11.8	12.4	12.9	12.5
33	34.5	24	25	15	0.0	15	16	20	23.5	35

21	21	15	12.8	29	29	10.9	11.3	12.1	16	24
32	32	33	18	15	30	15	16.4	24	25.6	33

26	27	10.6	10.2	8.5	27	23	10.8	11.0	4.3	4.8
33	37.5	24	18	15	0.0	15	16	24.3	25.5	33

8.2 ✓

6.7	23	24	23	24	27	28	2.2	2.7	0.5	0.6
33	26	23	19	15	0.0	15	16	21.4	30.6	33

3.6

5.8	5.8	8.3	7.9	6.1	4.3	6.5	8.5	8.8	+2.0	+2.0
33	27	23	19	15	0.0	15	16.4	22	31.0	33

6.8 ✓

7.9 ✓

2.5	5.7	10.1	2.4	23	25	25	10.3	10.3	1.4	1.0
33	24	24	19	15	0.0	15	18	21	31	34

✓	12	23	10.3	10.6	15	2.0	2.0	15
	0.0	15	19	21.3	25.6	3.2	3.2	41

✓	21	6.7	5.4	2.3	0.8
	0.0	15	27.7	10	28

6.6 ✓

26	26	25	6.5	6.5	6.7
33	20.8	16	0.0	15	33

✓	6.1	6.2	6.1	4.5	1.3
	0.0	15	23	33	6.0

✓	0.3	6.4	9.4	9.6	7.2	1.0
	0.0	16	21.5	24	27	33

W. S. F. E

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

735.62

+662

66+00

+162

+50

T.P.	6.13	740.72	1.03	734.59	
------	------	--------	------	--------	--

67+00

+50

68+00

T.P.	6.84	746.52	1.04	739.68	
= +83.9					
+645	P.T.	Equation			

69+00

+50

Inst. Wilkinson
 Rod. Rx 1995
 Chain. Pearson
 14056221/1

29

REPRODUCTION PROHIBITED

Left

CL

Right

5.8 ✓

25	25	5.8	5.8	6.1	25	2.8	7.5	6.1
33	11.5	7	60	76	22	24.5	27.5	33

4.1 ✓

86	86	3.9	4.2	4.8	25	2.2		
33	11.7	7	60	78	24.4	39		

3.3 ✓

81	7.8	2.7	3.4	3.9	21	2.5	2.5	3.3
33	22.6	16	60	18	25.7			

1.6 ✓

25	3.4	1.8	1	2.5	8.6	2.5		
33	20.3	16	60	78	28	33		

4.3 ✓

4.0	4.3	5.6	5.6	3.9	2.2	5.4	8.9	11.2
33	24.2	23	19	15	60	18	23.3	35

(25)

2.6	2.5	2.2	3.7	2.1	2.4	5.3	5.4	4.6	5.8
33	25	20.5	19	15	60	77	20.5	24	26

(14)

2.1	2.3	3.2	3.5	4.7	1.4	2.0	3.2	3.6	1.2	2.1
33	24.8	22.5	18.5	15	60	16	19.7	25	28.5	33

(11)

2.9	5.1	6.0	8.8	8.8	6.5	7.2	8.9	8.9	4.9	5.1
33	30	27	25	27.7	18	15	60	17	20.7	25

(13)

4.2	4.4	6.1	6.4	9.1	8.5	6.9	7.2	9.0	9.3	5.5	5.8
33	27.3	26	25	30	18	15	60	15	19	23	28.5

(19)

7.5	7.8	7.1	8.0	8.6	7.1	8.2				
33	15	60	78	19	63	25.5				33

Cross Sections

Sta. B.S. H.I. ✓ F.S. Grade Gr. R.

✓46.5 ✓

71+00

+50

T.P. 5.69 247.50 2.71 ✓36.81 ✓

71+00

+50

72+00

+50

B.M. ✓ 257 ✓34.93 ✓

B.M. 2.09 237.04 234.95

73+00

+50

74+00

+50

75+00

Inst. Wilscon
 Rod. Buag
 Chain. Hanson

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Left

C L

Right

(46)

92	86	167	164	86	84	87	102	102	87	82
33	23	24	178	15	80	15	16.6	22	24	33

(92)

141	78	98	113	112	74	72	95	111	112	110	110
33	24	23.5	21	177	15	80	15	16.5	24	24	33

(59)

81	63	65	81	78	61	61	61	78	80	50	50
33	28	22.7	21	18	15	80	15	16.9	21	24	33

(63)

90	68	83	91	62	66	65	80	83	17	12
33	23	21	18	15	80	15	16.6	21	28	33

(72)

103	97	98	94	75	77	71	93	95	41	35
33	23	24	18	15	80	15	17	21	27	33

(78)

150	127	78	77	78	106	106	81	76
33	21.3	16	80	15	18	21	23.6	33

73495 spike on stump 30' RT 73+20

73495 spike on stump 30' RT 73+20

94	21	30	2	39	52	16	24	23		
33	25	16	80	15	18	21	23	33		
94	76	64	56	36	38	63	63	31	26	24
33	21	20	16	80	15	18	21	24	29	33

(43)

97	17	45	43	45	69	19	27	20
33	19.6	16	80	15	18	22	26.8	33

(49)

93	76	50	50	50	78	78	22	10
33	19.6	14	80	15	18	22	26.8	33

(56)

121	114	84	76	60	57	61	76	76	64	
33	39	22	19.8	16	80	15	18	21	22	33

Cross Sections

Sta: B.S. H.I. ✓ F.S. Grade Gr.R.

237.04

+38.5

+88.5

P.C.

76+00

+50

T.P.

4.49

230.88 ✓

6.65

230.39 ✓

77+00

+50

+78.8

78+00

T.P.

5.59

230.43 ✓

10.04

224.84 ✓

+50

79+00

T.P.

1.33

221.27 ✓

10.99

219.94 ✓

+50

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
80+00		221.77			
+50					
81+00		✓			✓
T.P.	3.67	214.90	10.04	211.43	
+50		✓			✓
T.B.M.	52.8	210.81	9.37	205.53	
82+00					
+50					
83+00		✓			✓
T.P. ✓	216	202.11	10.56	199.95	
+29.6	P.C.				
+50					
84+00					
+54					

In t. W. Johnson
 Rod. ...
 Chain. ...

Left

C L

Right

(4.9)

4.3	3.7	2.4	2.3	5.4	5.3	5.4	7.1	7.3	7.9	3.7
33	245	22	18	15	10	15	174	21	245	33

(1.5)

4.5	4.3	7.8	9.8	7.5	7.4	7.5	9.8	9.7	6.8	5.7
33	263	21	176	15	10	15	17	20	236	33

(10.1)

Make F.E.

8.4	8.5	1.3	1.4	1.0	7.7	7.9	9.0			
33	205	21	186	15	10	15	33			

(6.3)

4.1	2.8	1.8	1.4	6.1	6.0	6.1	8.6	8.6	0.1	+0.8
33	256	20.7	175	15	10	15	18	22	30	33

W.A.S.S.Y

70.1 / 6.0 F.P. 33' Lt 82+25

(4.5)

3.9	3.7	2.3	2.3	4.8	4.8	4.8	7.0	7.0	10.3	+0.8
33	236	21	17	15	10	15	186	27	29	33

(7.4)

7.8	7.3	9.7	8.8	7.5	7.3	7.3	9.5	9.5	3.1	2.2
33	225	21	174	12	10	15	18	23	276	33

(10.0)

7.9	7.1	12.8	12.1	9.6	9.6	7.7	10.0	12.1	6.8	6.6
33	136	21	174	15	10	15	18	21	26	33

(3.7)

2.7	2.7	5.5	5.5	2.7	2.7	2.7	4.9	4.9	0.7	0.6
33	234	21	17	15	10	15	173	21	25	33

(3.7)

4.2	3.7	4.7	4.7	3.5	3.7	3.5	5.0	5.0	2.8	2.6
33	233	21	175	15	10	15	17	21	245	33

(6.0)

7.2	6.5	8.2	8.3	6.0	6.0	6.1	8.0	8.1	5.1	4.9
33	223	21	17	15	10	15	18	21	246	33

(6.0)

10.3	9.1	10.3	10.0	7.8	7.7	7.8	10.0	10.0	7.7	7.1
33	32	20	17	15	10	15	18	21	24	33

Sta.	B. S.	H. I.	Cross Sections		
			F. S.	Grade	Gr. R.
		207.11 ✓			
T.P.	166	195.26 ✓	851	193.60 ✓	
B.M.			526 ✓	190.00 ✓	
B.M.	526	195.26			
85+00					
+50					
86+00					
+50					
87+00					
+50					
88+00					
B.M.	054	190.54 ✓			
+50					
89+00					

Inst. Wilburzen

Rod. Biggs

Chain. Peak 50.7

HOCKLEY

Left

C L

Right

190.00 Spike in Stamp 20' RT. 85+50

5.4	3.4	4.7	4.7	4.5	4.5	4.3	4.4	3.3	2.5
33	23	21	17	15	15	17.5	22	23	33

4.3

63	44	60	61	35	36	37	59	64	50	50
33	24	19	16.1	15	20	16	18.5	23.4	24	33

5.4

58	60	70	69	47	52	52	77	77	58	61
33	22	21	17	15	20	15	19	22	23.8	33

6.4

71	68	77	80	61	58	58	77	83	71	74
33	22	21	17.8	15	20	15	18	24	25	33

7.5

84	79	90	88	68	62	66	87	91	79	71
33	24	21	14.4	15	20	15	19	23	28.4	33

8.5

85	82	102	101	58	79	79	99	100	90	92
33	22.4	22.5	17.4	15	20	15	19.3	23	24	33

9.6

82	87	115	115	95	76	75	109	113	96	77
33	24.6	21	16.3	15	20	15	19.2	24	25	33

5.9

190.00 Spike in Stamp 20' RT. 85+50

2.5	3.5	5.6	5.6	6.2	61	60	75	75	5.4	5.5
33	26	21	17	15	20	15	18	23	21.6	33

7.3

41	2.5	9.8	9.7	2.6	75	76	87	89	5.3	5.3
33	2.8	22	18	15	20	18	18	21	25	33

Cross Sections.

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		190.54			
89+50		✓		✓	
T.P.	435	193.94	10.95	179.59	
90+00					
+50					
91+00					
+50		✓		✓	
T.P.	193	174.65	11.22	172.72	
+76.0					
94+26.0					
+76.0					
93+26.0					
+76.0		✓		✓	
T.P.	0.94	167.41	8.18	166.47	

In-t. Wilkinson

Rod. Bylars

Chain. Hobson
Pearson

Left

C L

Right

(0.0)

3.4	3.6	1.4	1.4	9.0	8.8	8.8	10.5	10.9	5.5	4.4
33	29.4	21	17.6	15	00	15	18	22	27	33

(4.0)

0.0	0.1	7.8	7.1	4.5	4.3	4.2	6.3	6.7	0.5	0.3
33	26.8	21	18	15	00	15	18	21	29	33

(5.9)

2.8	2.4	9.3	8.9	6.5	6.7	6.3	8.3	8.3	3.2	2.6	1.9
33	27	21	17	15	00	15	18	21	26.4	29	33

(7.7)

5.8	5.6	10.5	10.4	7.9	7.5	7.7	10.0	10.0	8.3	6.8
33	25	21	17	15	00	16	18	22	23.8	33

(0.5)

10.4	10.6	12.1	11.9	10.1	10.0	10.0	12.0	12.2	10.4
33	23.4	41	17	15	00	16	19	27	33

(1.2)

3.2	3.0	3.6	3.6	1.2	1.5	1.4	3.9	4.1	2.8
33	23.4	22.8	10.4	15	00	16	21	30	23

(3.1)

6.3	6.1	3.2	3.1	3.1	3.1	5.4	5.2	4.5
33	24.2	16		16	16	19.6	28	33

(4.9)

7.2	7.2	4.6	5.3	5.3	7.1	8.0	8.3
33	20.7	16	00	16	30	30	33

(6.8)

7.9	8.1	6.2	6.9	7.3	7.1	10.2
33	19.8	16	00	17.4	20.2	33

(8.6)

8.4	8.7	9.7	9.6	9.2	8.4	8.8	10.9	12.4
33	24.3	23.4	19.2	16	00	18	20.7	33

Cross Sections

Sta.	B. S.	H. I. ✓	F. S.	Grade	Gr. R.
		167.41			
94+00					
+50					
95+00					✓
B.M.		✓	5.13	162.28	
B.M.	5.07	167.31			
+49.6		✓			
T.P.	5.27	162.57	19.01	157.30	✓
+99.6					
96+49.6					
+56					
+77.8					
+92.7		✓			✓
T.P.	5.00	157.62	9.95	152.62	
+90					

Inst. Wilson
Rod. Buss
Chain. Raymond
Hockey

Left

C L

Right

(2.3)

$\frac{17}{33}$	$\frac{22}{283}$	$\frac{35}{226}$	$\frac{30}{27}$	$\frac{21}{16}$	$\frac{20}{00}$	$\frac{5.9}{15}$	$\frac{4.4}{22.7}$	$\frac{5.3}{23.2}$	$\frac{4.1}{24.3}$	$\frac{5.2}{33}$
-----------------	------------------	------------------	-----------------	-----------------	-----------------	------------------	--------------------	--------------------	--------------------	------------------

(2.2)

$\frac{42}{33}$	$\frac{37}{24}$	$\frac{4.9}{23.6}$	$\frac{3.5}{20.5}$	$\frac{4.0}{15}$	$\frac{3.5}{00}$	$\frac{5.3}{15}$	$\frac{6.3}{20}$	$\frac{2.7}{24.2}$	$\frac{5.5}{25.6}$	$\frac{4.6}{33}$
-----------------	-----------------	--------------------	--------------------	------------------	------------------	------------------	------------------	--------------------	--------------------	------------------

(6.0)

$\frac{5.7}{33}$	$\frac{5.6}{22.4}$	$\frac{6.5}{21.6}$	$\frac{6.5}{17}$	$\frac{5.4}{15}$	$\frac{6.0}{00}$	$\frac{6.7}{17}$	$\frac{5.0}{18.5}$	$\frac{8.5}{25.5}$	$\frac{6.5}{26.8}$	$\frac{6.5}{33}$
------------------	--------------------	--------------------	------------------	------------------	------------------	------------------	--------------------	--------------------	--------------------	------------------

16 2.24

(7.8)

$\frac{5.0}{33}$	$\frac{4.9}{15}$	$\frac{8.8}{21}$	$\frac{8.5}{17}$	$\frac{2.3}{15}$	$\frac{7.2}{00}$	$\frac{9.0}{19}$	$\frac{10.2}{21.5}$	$\frac{10.4}{25.5}$	$\frac{5.0}{30.5}$	$\frac{5.0}{33}$
------------------	------------------	------------------	------------------	------------------	------------------	------------------	---------------------	---------------------	--------------------	------------------

(5.0)

$\frac{3.6}{33}$	$\frac{3.2}{24}$	$\frac{6.9}{4}$	$\frac{6.4}{17}$	$\frac{4.5}{15}$	$\frac{5.5}{00}$	$\frac{6.1}{15}$	$\frac{5.0}{20.3}$	$\frac{5.0}{23.4}$	$\frac{0.8}{30.6}$
------------------	------------------	-----------------	------------------	------------------	------------------	------------------	--------------------	--------------------	--------------------

(8.1)

$\frac{6.8}{33}$	$\frac{5.0}{25.3}$	$\frac{7.8}{21}$	$\frac{9.6}{17}$	$\frac{8.3}{15}$	$\frac{8.6}{00}$	$\frac{8.6}{15}$	$\frac{10.4}{18}$	$\frac{10.4}{22}$	$\frac{2.8}{29}$	$\frac{2.7}{33}$
------------------	--------------------	------------------	------------------	------------------	------------------	------------------	-------------------	-------------------	------------------	------------------

(8.4)

$\frac{4.4}{33}$	$\frac{5.4}{25.9}$	$\frac{10.1}{22}$	$\frac{8.5}{18}$	$\frac{5.6}{15}$	$\frac{7.5}{00}$	$\frac{8.8}{15}$	$\frac{10.8}{18.7}$	$\frac{10.8}{22}$	$\frac{2.9}{29.3}$	$\frac{2.9}{33}$
------------------	--------------------	-------------------	------------------	------------------	------------------	------------------	---------------------	-------------------	--------------------	------------------

(9.4)

$\frac{10.7}{36}$	$\frac{9.5}{25.8}$	$\frac{11.2}{21.6}$	$\frac{11}{18.4}$	$\frac{8.6}{15}$	$\frac{7.8}{00}$	$\frac{7.5}{15}$	$\frac{11.7}{18.6}$	$\frac{11.9}{22}$	$\frac{8.4}{19.6}$	$\frac{11.0}{33}$
-------------------	--------------------	---------------------	-------------------	------------------	------------------	------------------	---------------------	-------------------	--------------------	-------------------

(10.1)

$\frac{12.6}{33}$	$\frac{11.7}{28.5}$	$\frac{12.0}{24.6}$	$\frac{11.7}{18.5}$	$\frac{10.4}{15}$	$\frac{10.4}{00}$	$\frac{10.6}{15}$	$\frac{12.2}{18}$	$\frac{12.6}{23}$	$\frac{9.7}{30.8}$	$\frac{9.6}{34}$
-------------------	---------------------	---------------------	---------------------	-------------------	-------------------	-------------------	-------------------	-------------------	--------------------	------------------

(5.4)

$\frac{7.9}{33}$	$\frac{7.3}{20}$	$\frac{11.2}{18.4}$	$\frac{6.1}{15}$	$\frac{6.0}{00}$	$\frac{0.0}{15}$	$\frac{2.5}{19}$	$\frac{8.0}{24}$	$\frac{0.4}{30.8}$	$\frac{0.0}{33}$
------------------	------------------	---------------------	------------------	------------------	------------------	------------------	------------------	--------------------	------------------

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
		157.62			
97+00					
+37.7	P.C.				
T.P.	2.51	150.41	9.72	147.90	
+65					
+82.7					
B.M.			0.50	149.91	
B.M.	0.54	150.42			
T.P.	4.74	144.54	10.62	139.80	
98+00					
+37.9					
+50					
98+87.9	End of Project.				

Inst. Wilschusen

Rod. 511985

Chain. Wackner

Left

C L

Right

(6.1)

7.8	8.1	8.1	4.6	4.6	6.3	8.5	8.8	7.8	7.3
33	32	18	16	10	15	18	22	23.5	33

(5.4)

5.8	7.0	10.1	10.3	9.3	9.4	9.6	10.5	11.4
33	30	22	20.3	16	20	16	33	23

(3.5)

12.6	11.6	4.4	4.5	4.7	4.7	5.3	5.6
36	27	18	20	16	26	32	40

(4.7)

12.4	13.0	14.2	2.0	6.3	6.0	6.8	6.7
38	30	32	33.3	12	12	20.6	33

Roads to Blind Here

149.88 Top of Hyd. N.E. Cor. Atlantic-Burns Ave

149.88 Top of Hyd. N.E. Cor. Atlantic-Burns Ave

(0.1)

7.5	7.7	1.0	1.3	1.7	1.7	1.7
37	32	22	20	14	25	33

Roads to Blind Here

(2.8)

4.2	7.1	10.3	2.8	1.1	2.1	3.5	5.5
37	33	31.5	23	20	15	25	33

(3.7)

7.3	4.4	11.1	4.7	4.4	4.6	4.3	4.7	6.5
39	36	30.4	22	20	15	21	28	33

(6.4)

12.6	15.5	2.2	6.4	4.6	6.9	8.5	9.0	9.6	6.2	5.6
35	28	21	18	20	16	19	19.2	26	31.5	33

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
------	-------	-------	-------	-------	-------

36+45

0+15 = 0+00

+

0+02

0+08

0+11

0+26

36+30

0+15 = 0+00

0+01

0+06

0+11

0+19

Inst. *Michelson*
 Rod. *Lucas*
 Chain. *Hackney*
Pearson

UNIVERSITY MICROFILMS INTERNATIONAL

Left

C L

Right

Rt.

$$\begin{array}{r} 202 \\ 12 \\ \hline -01 \\ -02 \\ \hline 10 \end{array}$$

$$\begin{array}{r} -18 \\ 14 \\ \hline -03 \\ - \\ \hline 12 \end{array} \quad \begin{array}{r} 202 \\ 10 \\ \hline -01 \\ -03 \\ \hline 9 \end{array} \quad \begin{array}{r} -12 \\ 13 \\ \hline \end{array}$$

$$\begin{array}{r} -24 \\ 13 \\ \hline -03 \\ - \\ \hline 11 \end{array} \quad \begin{array}{r} 202 \\ 10 \\ \hline -02 \\ - \\ \hline 10 \end{array} \quad \begin{array}{r} -18 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} 111 \\ 18 \\ \hline 00 \\ 11 \end{array} \quad \begin{array}{r} 202 \\ 10 \\ \hline +02 \\ + \\ \hline 10 \end{array} \quad \begin{array}{r} +27 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} +29 \\ 7 \\ \hline 107 \\ 00 \end{array} \quad \begin{array}{r} +13 \\ 6 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ 10 \\ \hline Lt. \\ -01 \\ -04 \\ \hline 00 \end{array} \quad \begin{array}{r} -04 \\ 10 \\ \hline \end{array}$$

$$\begin{array}{r} -15 \\ 11 \\ \hline -01 \\ 8 \\ \hline 01 \end{array} \quad \begin{array}{r} -04 \\ 10 \\ \hline \end{array} \quad \begin{array}{r} -27 \\ 11 \\ \hline \end{array}$$

$$\begin{array}{r} -15 \\ 10 \\ \hline 00 \\ 7 \end{array} \quad \begin{array}{r} 202 \\ 00 \\ \hline -02 \\ 9 \end{array} \quad \begin{array}{r} -26 \\ 10 \\ \hline \end{array}$$

$$\begin{array}{r} +13 \\ 12 \\ \hline +01 \\ 8 \\ \hline 10 \end{array} \quad \begin{array}{r} 202 \\ 10 \\ \hline -02 \\ 9 \end{array} \quad \begin{array}{r} +08 \\ 11 \\ \hline \end{array}$$

$$\begin{array}{r} +13 \\ 7 \\ \hline +29 \\ 00 \end{array} \quad \begin{array}{r} +08 \\ 7 \\ \hline \end{array}$$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
------	-------	-------	-------	-------	-------

33+98

0+15 = 0+00

0+03

0+09

0+12

0+22

0+32

28+16

0+15 = 0+00

0+02

0+07

0+09

0+19

Inst. Wilsbuser
 Rod. Bugs
 Chain. Revised
Hocamp

Left

C L

Right

84 of 2

$\frac{-0.5}{13}$ $\frac{0.0}{00}$ $\frac{0.0}{13}$

$\frac{-2.4}{19}$ $\frac{+0.1}{10}$ $\frac{0.0}{00}$ $\frac{-0.2}{11}$ $\frac{-1.6}{18}$

$\frac{-2.7}{13}$ $\frac{-0.1}{10}$ $\frac{+0.2}{00}$ $\frac{0.0}{11}$ $\frac{-1.5}{12}$

$\frac{+1.3}{14}$ $\frac{0.0}{10}$ $\frac{+0.3}{00}$ $\frac{+0.3}{9}$ $\frac{+2.0}{12}$

$\frac{+2.0}{9}$ $\frac{+0.7}{8}$ $\frac{+1.0}{00}$ $\frac{+0.8}{7}$ $\frac{+2.3}{8}$

$\frac{+3.0}{6}$ $\frac{+2.4}{00}$ $\frac{+2.6}{6}$

14 of 2

$\frac{-0.3}{12}$ $\frac{0.0}{00}$ $\frac{+0.1}{11}$

$\frac{-2.5}{13}$ $\frac{-0.8}{12}$ $\frac{0.0}{00}$ $\frac{-0.2}{10}$ $\frac{-1.6}{12}$

$\frac{-2.6}{12}$ $\frac{-0.1}{10}$ $\frac{+0.2}{00}$ $\frac{+0.1}{9}$ $\frac{-1.5}{12}$

$\frac{0.0}{11}$ $\frac{+0.8}{00}$ $\frac{+0.5}{7}$ $\frac{+1.0}{10}$

$\frac{+1.8}{7}$ $\frac{+1.4}{00}$ $\frac{-1.6}{7}$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

12+34

0+15-0+00

0+03

0+10

0+17

10+75

0+15-0+00

0+03

0+08

0+13

7+12

0+15-0+00

0+03

0+08

0+10

Inst. Wilshusen

Rod. Biggs

Chain. Unexpl
Peavson

Left

C L

Right

400 $\frac{1}{2}$

$$\begin{array}{r} -0.1 \\ \frac{14}{14} \end{array} \quad \begin{array}{r} 103 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} 10.5 \\ \frac{15}{15} \end{array}$$

$$\begin{array}{r} -15 \\ \frac{12}{12} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{14}{14} \end{array} \quad \begin{array}{r} 105 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} +0.4 \\ \frac{13}{13} \end{array} \quad \begin{array}{r} -0.6 \\ \frac{15}{15} \end{array}$$

$$\begin{array}{r} -17 \\ \frac{13}{13} \end{array} \quad \begin{array}{r} 102 \\ \frac{10}{10} \end{array} \quad \begin{array}{r} 107 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} +1.0 \\ \frac{9}{9} \end{array} \quad \begin{array}{r} -0.6 \\ \frac{12}{12} \end{array}$$

$$\begin{array}{r} 70.8 \\ \frac{7}{7} \end{array} \quad \begin{array}{r} +1.0 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} +1.5 \\ \frac{8}{8} \end{array}$$

RT. of $\frac{1}{2}$

$$\begin{array}{r} 104 \\ \frac{12}{12} \end{array} \quad \begin{array}{r} -0.1 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -0.3 \\ \frac{13}{13} \end{array}$$

$$\begin{array}{r} -10 \\ \frac{18}{18} \end{array} \quad \begin{array}{r} 102 \\ \frac{14}{14} \end{array} \quad \begin{array}{r} -0.2 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -0.5 \\ \frac{11}{11} \end{array} \quad \begin{array}{r} -1.6 \\ \frac{14}{14} \end{array}$$

$$\begin{array}{r} -17 \\ \frac{13}{13} \end{array} \quad \begin{array}{r} -1.0 \\ \frac{10}{10} \end{array} \quad \begin{array}{r} -0.6 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -1.0 \\ \frac{11}{11} \end{array} \quad \begin{array}{r} -2.3 \\ \frac{13}{13} \end{array}$$

$$\begin{array}{r} -11 \\ \frac{8}{8} \end{array} \quad \begin{array}{r} -1.0 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -1.5 \\ \frac{7}{7} \end{array}$$

Lt. of $\frac{1}{2}$

$$\begin{array}{r} -0.1 \\ \frac{13}{13} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{11}{11} \end{array}$$

$$\begin{array}{r} -15 \\ \frac{15}{15} \end{array} \quad \begin{array}{r} -0.2 \\ \frac{12}{12} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -0.2 \\ \frac{10}{10} \end{array} \quad \begin{array}{r} -1.4 \\ \frac{15}{15} \end{array}$$

$$\begin{array}{r} -10 \\ \frac{14}{14} \end{array} \quad \begin{array}{r} -0.3 \\ \frac{12}{12} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} 0.0 \\ \frac{9}{9} \end{array} \quad \begin{array}{r} -0.9 \\ \frac{12}{12} \end{array}$$

$$\begin{array}{r} +2.8 \\ \frac{12}{12} \end{array} \quad \begin{array}{r} +0.3 \\ \frac{10}{10} \end{array} \quad \begin{array}{r} +0.1 \\ \frac{20}{20} \end{array} \quad \begin{array}{r} -0.5 \\ \frac{11}{11} \end{array} \quad \begin{array}{r} +1.2 \\ \frac{13}{13} \end{array}$$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
0+24					
0+00					
0+15=0+00					
0+03					
0+08					
0+16					
11+90					
0+15=0+00					
1+03					
0+08					
0+10					
0+30					
17+06					
0+16=0+00					
0+04					

Inst. *W.L.S. 4507*Rod. *.....*Chain. *.....*

40

Left

C L

Right

$$\begin{array}{r} +1.6 \\ \hline 7 \end{array} \quad \begin{array}{r} +0.7 \\ \hline 4 \end{array} \quad \begin{array}{r} +0.7 \\ \hline 00 \end{array} \quad \begin{array}{r} +0.8 \\ \hline 4 \end{array} \quad \begin{array}{r} +2.0 \\ \hline 6 \end{array}$$

174 of $\frac{d}{c}$

$$\begin{array}{r} -0.6 \\ \hline 20 \end{array} \quad \begin{array}{r} 0.5 \\ \hline 00 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 16 \end{array}$$

$$\begin{array}{r} -2.0 \\ \hline 21 \end{array} \quad \begin{array}{r} -0.6 \\ \hline 17 \end{array} \quad \begin{array}{r} -1 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 20 \end{array} \quad \begin{array}{r} -2.3 \\ \hline 22 \end{array}$$

$$\begin{array}{r} -1.3 \\ \hline 16 \end{array} \quad \begin{array}{r} -0.3 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.1 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 16 \end{array} \quad \begin{array}{r} -2.4 \\ \hline 22 \end{array}$$

$$\begin{array}{r} -0.5 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 00 \end{array} \quad \begin{array}{r} 0.0 \\ \hline 10 \end{array}$$

174 of $\frac{d}{c}$

$$\begin{array}{r} +0.3 \\ \hline 14 \end{array} \quad \begin{array}{r} 0.0 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.3 \\ \hline 13 \end{array}$$

$$\begin{array}{r} -1.5 \\ \hline 14 \end{array} \quad \begin{array}{r} 0.5 \\ \hline 12 \end{array} \quad \begin{array}{r} -0.2 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.4 \\ \hline 12 \end{array} \quad \begin{array}{r} -1.8 \\ \hline 15 \end{array}$$

$$\begin{array}{r} -1.7 \\ \hline 13 \end{array} \quad \begin{array}{r} -0.2 \\ \hline 10 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.3 \\ \hline 11 \end{array} \quad \begin{array}{r} -2.0 \\ \hline 12 \end{array}$$

$$\begin{array}{r} -1.4 \\ \hline 13 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 10 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.8 \\ \hline 11 \end{array} \quad \begin{array}{r} -1.2 \\ \hline 12 \end{array} \quad \begin{array}{r} -0.2 \\ \hline 14 \end{array}$$

$$\begin{array}{r} -1.5 \\ \hline 7 \end{array} \quad \begin{array}{r} -1.0 \\ \hline 00 \end{array} \quad \begin{array}{r} -1.0 \\ \hline 9 \end{array}$$

174 of $\frac{d}{c}$

$$\begin{array}{r} -0.6 \\ \hline 10 \end{array} \quad \begin{array}{r} -0.7 \\ \hline 00 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 15 \end{array}$$

$$\begin{array}{r} -2.0 \\ \hline 12 \end{array} \quad \begin{array}{r} -1.2 \\ \hline 12 \end{array} \quad \begin{array}{r} -1.2 \\ \hline 00 \end{array} \quad \begin{array}{r} -1.3 \\ \hline 11 \end{array} \quad \begin{array}{r} -2.7 \\ \hline 12 \end{array}$$

Sta.	B. S.	H. I.	F. S.	Cross Sections Grade	Gr. R.
0+09					
0+15					
27+07					
0+16 = 0+00					
0+05					
0+27					
33+21					
0+16 = 0+00					
0+05					
0+18					
33+25					
0+15 = 0+00					
0+03					
0+08					
0+09					

Inst. W. E. Huson
 Rod. Ryans
 Chain. Parkway Hackney

Left

CL

Right

$\frac{-26}{13}$ $\frac{-20}{12}$ $\frac{-20}{20}$ $\frac{-20}{11}$ $\frac{-25}{12}$

$\frac{-25}{6}$ $\frac{-25}{20}$ $\frac{-25}{2}$

Ht. of ϕ
 $\frac{-10}{10}$ $\frac{-07}{20}$ $\frac{00}{12}$

$\frac{-22}{14}$ $\frac{-17}{10}$ $\frac{-14}{20}$ $\frac{-11}{10}$ $\frac{-35}{12}$

$\frac{-40}{7}$ $\frac{-40}{20}$ $\frac{-40}{7}$

Ht. of ϕ

$\frac{-11}{13}$ $\frac{-07}{20}$ $\frac{-07}{13}$

$\frac{-36}{13}$ $\frac{-18}{11}$ $\frac{-16}{20}$ $\frac{-18}{12}$ $\frac{-25}{15}$

$\frac{-35}{7}$ $\frac{-31}{20}$ $\frac{-28}{7}$

Ht. of ϕ

$\frac{-11}{10}$ $\frac{-08}{20}$ $\frac{-13}{12}$

$\frac{-21}{12}$ $\frac{-11}{10}$ $\frac{-11}{20}$ $\frac{-17}{11}$ $\frac{-25}{13}$

$\frac{-22}{13}$ $\frac{-13}{12}$ $\frac{-16}{20}$ $\frac{-17}{11}$ $\frac{-27}{12}$

$\frac{-10}{10}$ $\frac{-16}{20}$ $\frac{-17}{11}$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
34+42					
0+15=0+00					
0+04					
0+11					
0+12					
34+63					
0+15=					
0+03					
0+06					
0+12					
41+57					
0+15=0+00					
0+02					
0+07					
0+13					

H. V. Whitstrusen

Rod. *Ed. ...*Chain. *...*

Left

G L

Right

Lt.

$$\begin{array}{r} -0.6 \\ \hline 13 \end{array} \quad \begin{array}{r} +0.2 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 12 \end{array}$$

$$\begin{array}{r} -1.5 \\ \hline 12 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 13 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 10 \end{array} \quad \begin{array}{r} -0.1 \\ \hline 9 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 15 \end{array}$$

$$\begin{array}{r} -1.4 \\ \hline 12 \end{array} \quad \begin{array}{r} 0.0 \\ \hline 9 \end{array} \quad \begin{array}{r} +0.6 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.5 \\ \hline 7 \end{array} \quad \begin{array}{r} -1.7 \\ \hline 10 \end{array}$$

$$\begin{array}{r} +0.2 \\ \hline 11 \end{array} \quad \begin{array}{r} +0.7 \\ \hline 10 \end{array} \quad \begin{array}{r} +1.0 \\ \hline 8 \end{array}$$

Rt.

$$\begin{array}{r} -0.1 \\ \hline 12 \end{array} \quad \begin{array}{r} 0.0 \\ \hline 10 \end{array} \quad \begin{array}{r} 0.0 \\ \hline 13 \end{array}$$

$$\begin{array}{r} -1.1 \\ \hline 15 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 13 \end{array} \quad \begin{array}{r} +0.1 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.2 \\ \hline 11 \end{array} \quad \begin{array}{r} -0.8 \\ \hline 12 \end{array}$$

$$\begin{array}{r} -1.0 \\ \hline 12 \end{array} \quad \begin{array}{r} -0.3 \\ \hline 11 \end{array} \quad \begin{array}{r} +0.2 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.2 \\ \hline 10 \end{array} \quad \begin{array}{r} -1.2 \\ \hline 14 \end{array}$$

$$\begin{array}{r} +0.6 \\ \hline 9 \end{array} \quad \begin{array}{r} +0.1 \\ \hline 8 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 10 \end{array} \quad \begin{array}{r} +0.1 \\ \hline 6 \end{array}$$

Lt.

$$\begin{array}{r} +0.8 \\ \hline 13 \end{array} \quad \begin{array}{r} -1.1 \\ \hline 10 \end{array} \quad \begin{array}{r} -1.0 \\ \hline 11 \end{array}$$

$$\begin{array}{r} -1.0 \\ \hline 13 \end{array} \quad \begin{array}{r} +0.6 \\ \hline 13 \end{array} \quad \begin{array}{r} -0.2 \\ \hline 10 \end{array} \quad \begin{array}{r} -0.7 \\ \hline 11 \end{array} \quad \begin{array}{r} -2.5 \\ \hline 12 \end{array}$$

$$\begin{array}{r} -1.0 \\ \hline 13 \end{array} \quad \begin{array}{r} +0.3 \\ \hline 11 \end{array} \quad \begin{array}{r} -0.5 \\ \hline 10 \end{array} \quad \begin{array}{r} -1.0 \\ \hline 11 \end{array} \quad \begin{array}{r} -2.5 \\ \hline 12 \end{array}$$

$$\begin{array}{r} +0.5 \\ \hline 13 \end{array} \quad \begin{array}{r} -0.7 \\ \hline 10 \end{array} \quad \begin{array}{r} -1.1 \\ \hline 9 \end{array}$$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
------	-------	-------	-------	-------	-------

41+58

0+15 = 0+00

0+03

0+07

0+16

46+81

0+16 = 0+00

0+05

0+36

49+47

0+15 = 0+00

0+03

0+07

0+11

Inst. *W. L. Wood*
 Rod. *B. S. S. S.*
 Chain. *100 ft*

Left		G L		Right	
			PT		
		-0.6	103	+1.1	
		$\frac{12}{12}$	$\frac{00}{00}$	$\frac{10}{10}$	
-3.0	-0.7	00	+1.0	-0.4	
$\frac{14}{14}$	$\frac{13}{13}$	$\frac{00}{00}$	$\frac{10}{10}$	$\frac{11}{11}$	
-3.0	-0.8	103	+1.2	-1.2	
$\frac{14}{14}$	$\frac{12}{12}$	$\frac{00}{00}$	$\frac{11}{11}$	$\frac{12}{12}$	
		0.0	+1.0	+1.2	
		$\frac{10}{10}$	$\frac{00}{00}$	$\frac{10}{10}$	
			PT.		
		0.0	-0.5	-0.6	
		$\frac{12}{12}$	$\frac{00}{00}$	$\frac{14}{14}$	
-2.7	-0.6	-0.5	-0.5	-2.8	
$\frac{12}{12}$	$\frac{10}{10}$	$\frac{00}{00}$	$\frac{13}{13}$	$\frac{16}{16}$	
-3.3	-1.8	-1.2	-1.0	-2.4	
$\frac{14}{14}$	$\frac{10}{10}$	$\frac{00}{00}$	$\frac{7}{7}$	$\frac{10}{10}$	
			PT.		
		0.0	-0.5	-0.7	
		$\frac{11}{11}$	$\frac{10}{10}$	$\frac{12}{12}$	
-1.6	-0.4	-0.5	-0.8	-3.0	
$\frac{13}{13}$	$\frac{11}{11}$	$\frac{00}{00}$	$\frac{11}{11}$	$\frac{14}{14}$	
-1.8	-0.8	-1.0	-1.2	-2.8	
$\frac{12}{12}$	$\frac{10}{10}$	$\frac{00}{00}$	$\frac{11}{11}$	$\frac{13}{13}$	
		-0.7	-1.0	-1.5	
		$\frac{11}{11}$	$\frac{00}{00}$	$\frac{11}{11}$	

Cross Sections

Sta.

B. S.

H. I.

Grade

Gr. R

54+41

0+15 = 0+00

0+03

0+08

0+14

0+34

69+79

0+15 = 0+00

0+04

0+08

0+14

66+63

0+15 = 0+00

0+03

0+07

Inst.
 Rod.
 Chain.

94

Left

G L

Right

			14.		
	-1.0		-0.2	+0.7	
	13		00	16	
	-3.0	-1.0	00	00	-1.8
	13	11	00	16	19
	-3.1	-0.2	+0.1	00	-1.8
	13	11	00	16	18
	+2.4	+0.8	+0.5	+0.9	+3.0
	13	8	00	8	11
	+2.4		+2.1	+3.2	
	11		00	9	
			174.		
	+0.4		-0.4	-0.9	
	14		00	13	
	-1.5	-0.2	-0.4	-1.1	-2.7
	13	14	00	11	14
	-1.5	-0.4	-1.1	-1.2	-2.9
	13	11	00	16	12
	-0.3		-1.0	-1.5	
	7		00	10	
			14		
	-0.4		+0.3	+0.8	
	14		10	12	
	-3.0	-0.8	+0.4	+0.3	-1.2
	14	12	00	11	12
	-2.3	-0.4	+0.2	+0.1	-1.0
	13	12	00	12	14

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

0+09

0+21

68+90

0+15 = 0+00

0+03

0+08

0+13

0+25

69+50

0+15 = 0+00

0+03

0+08

0+11

69+77

0+15 = 0+00

Inst.
 Rod.
 Chain.

Left

C L

Right

$\begin{array}{r} -27 \\ \underline{-12} \\ 15 \end{array}$ $\begin{array}{r} -0.7 \\ \underline{-10} \\ 10 \end{array}$ $\begin{array}{r} 106 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} 408 \\ \underline{12} \\ 396 \end{array}$

$\begin{array}{r} 0.0 \\ \underline{8} \\ 8 \end{array}$ $\begin{array}{r} 106 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} 410 \\ \underline{12} \\ 398 \end{array}$

~~174~~
 $\begin{array}{r} -04 \\ \underline{5} \\ 1 \end{array}$ $\begin{array}{r} -04 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -04 \\ \underline{4} \\ 0 \end{array}$

$\begin{array}{r} -20 \\ \underline{5} \\ 15 \end{array}$ $\begin{array}{r} -07 \\ \underline{3} \\ 4 \end{array}$ $\begin{array}{r} -03 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -07 \\ \underline{3} \\ 4 \end{array}$ $\begin{array}{r} -18 \\ \underline{5} \\ 13 \end{array}$

$\begin{array}{r} -20 \\ \underline{4} \\ 16 \end{array}$ $\begin{array}{r} -04 \\ \underline{3} \\ 1 \end{array}$ $\begin{array}{r} -02 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -03 \\ \underline{3} \\ 0 \end{array}$ $\begin{array}{r} -18 \\ \underline{5} \\ 13 \end{array}$

$\begin{array}{r} +13 \\ \underline{4} \\ 9 \end{array}$ $\begin{array}{r} +01 \\ \underline{2} \\ 3 \end{array}$ $\begin{array}{r} 00 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} 0.0 \\ \underline{2} \\ 2 \end{array}$ $\begin{array}{r} +18 \\ \underline{4} \\ 14 \end{array}$

$\begin{array}{r} -05 \\ \underline{5} \\ 0 \end{array}$ $\begin{array}{r} +05 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} +05 \\ \underline{5} \\ 0 \end{array}$

~~14~~
 $\begin{array}{r} +01 \\ \underline{11} \\ 10 \end{array}$ $\begin{array}{r} -03 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -06 \\ \underline{14} \\ 8 \end{array}$

$\begin{array}{r} -17 \\ \underline{12} \\ 5 \end{array}$ $\begin{array}{r} -03 \\ \underline{10} \\ 7 \end{array}$ $\begin{array}{r} -03 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -07 \\ \underline{11} \\ 4 \end{array}$ $\begin{array}{r} -20 \\ \underline{13} \\ 7 \end{array}$

$\begin{array}{r} -17 \\ \underline{11} \\ 6 \end{array}$ $\begin{array}{r} -06 \\ \underline{9} \\ 3 \end{array}$ $\begin{array}{r} -05 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -06 \\ \underline{10} \\ 4 \end{array}$ $\begin{array}{r} -24 \\ \underline{12} \\ 12 \end{array}$

$\begin{array}{r} -03 \\ \underline{9} \\ 6 \end{array}$ $\begin{array}{r} -03 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -05 \\ \underline{10} \\ 5 \end{array}$

~~174~~
 $\begin{array}{r} -02 \\ \underline{12} \\ 10 \end{array}$ $\begin{array}{r} 00 \\ \underline{00} \\ 00 \end{array}$ $\begin{array}{r} -01 \\ \underline{11} \\ 10 \end{array}$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

0+03

0+08

0+10

73+17

0+15-0+15

0+04

0+07

0+09

74+52

0+15-0+00

0+15

0+34

74+10

0+15

0+02

Inst.
 Rod.
 Chain.

Left

G L

Right

$\begin{array}{r} -1.4 \\ \hline 13 \end{array}$ $\begin{array}{r} -0.5 \\ \hline 12 \end{array}$ $\begin{array}{r} 10 \\ \hline 10 \end{array}$ $\begin{array}{r} 0.0 \\ \hline 10 \end{array}$ $\begin{array}{r} -1.6 \\ \hline 13 \end{array}$

$\begin{array}{r} -4.0 \\ \hline 12 \end{array}$ $\begin{array}{r} 0.0 \\ \hline 10 \end{array}$ $\begin{array}{r} 10.1 \\ \hline 10 \end{array}$ $\begin{array}{r} -0.1 \\ \hline 10 \end{array}$ $\begin{array}{r} -1.5 \\ \hline 12 \end{array}$

$\begin{array}{r} +0.1 \\ \hline 10 \end{array}$ $\begin{array}{r} +0.3 \\ \hline 00 \end{array}$ $\begin{array}{r} 0.0 \\ \hline 8 \end{array}$

Pl.

$\begin{array}{r} 0.0 \\ \hline 9 \end{array}$ $\begin{array}{r} +0.2 \\ \hline 00 \end{array}$ $\begin{array}{r} +0.1 \\ \hline 10 \end{array}$

$\begin{array}{r} -2.8 \\ \hline 12 \end{array}$ $\begin{array}{r} -0.8 \\ \hline 11 \end{array}$ $\begin{array}{r} -0.6 \\ \hline 00 \end{array}$ $\begin{array}{r} -0.2 \\ \hline 7 \end{array}$ $\begin{array}{r} -2.2 \\ \hline 12 \end{array}$

$\begin{array}{r} -2.7 \\ \hline 13 \end{array}$ $\begin{array}{r} -0.2 \\ \hline 10 \end{array}$ $\begin{array}{r} -0.1 \\ \hline 00 \end{array}$ $\begin{array}{r} -0.6 \\ \hline 10 \end{array}$ $\begin{array}{r} -3.0 \\ \hline 12 \end{array}$

$\begin{array}{r} -0.4 \\ \hline 7 \end{array}$ $\begin{array}{r} -0.3 \\ \hline 00 \end{array}$ $\begin{array}{r} -0.4 \\ \hline 7 \end{array}$

Lt.

$\begin{array}{r} -0.1 \\ \hline 10 \end{array}$ $\begin{array}{r} -0.2 \\ \hline 00 \end{array}$ $\begin{array}{r} -0.6 \\ \hline 0 \end{array}$

$\begin{array}{r} -1.3 \\ \hline 11 \end{array}$ $\begin{array}{r} -0.7 \\ \hline 8 \end{array}$ $\begin{array}{r} -0.6 \\ \hline 00 \end{array}$ $\begin{array}{r} -0.9 \\ \hline 7 \end{array}$ $\begin{array}{r} -2.3 \\ \hline 12 \end{array}$

$\begin{array}{r} -5.9 \\ \hline 6 \end{array}$ $\begin{array}{r} -5.3 \\ \hline 5 \end{array}$ $\begin{array}{r} -4.0 \\ \hline 00 \end{array}$ $\begin{array}{r} -2.4 \\ \hline 4 \end{array}$ $\begin{array}{r} -5.0 \\ \hline 6 \end{array}$

Pl.

$\begin{array}{r} 0.0 \\ \hline 12 \end{array}$ $\begin{array}{r} +0.5 \\ \hline 00 \end{array}$ $\begin{array}{r} +0.9 \\ \hline 13 \end{array}$

$\begin{array}{r} -1.8 \\ \hline 12 \end{array}$ $\begin{array}{r} 0.0 \\ \hline 10 \end{array}$ $\begin{array}{r} 10.5 \\ \hline 00 \end{array}$ $\begin{array}{r} +0.6 \\ \hline 4 \end{array}$ $\begin{array}{r} -0.9 \\ \hline 12 \end{array}$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. I
------	-------	-------	-------	-------	-------

0+07

0+10

0+16

0+25

0+32

0+15=0+100

0+03

0+08

0+11

0+17

0+31

79+79

0+15=0+00

0+03

Inst.
 Rod.
 Chain.

Left

C L

Right

$$\begin{array}{r} -18 \\ 11 \end{array} \begin{array}{r} 00 \\ 10 \end{array} \begin{array}{r} 287 \\ 00 \end{array} + \begin{array}{r} 05 \\ 72 \end{array} \begin{array}{r} -12 \\ 14 \end{array}$$

$$\begin{array}{r} +39 \\ 15 \end{array} \begin{array}{r} 205 \\ 12 \end{array} \begin{array}{r} 205 \\ 00 \end{array} + \begin{array}{r} 10 \\ 7 \end{array} \begin{array}{r} +20 \\ 10 \end{array}$$

$$\begin{array}{r} +28 \\ 14 \end{array} \begin{array}{r} 108 \\ 12 \end{array} \begin{array}{r} 204 \\ 00 \end{array} + \begin{array}{r} 04 \\ 5 \end{array} \begin{array}{r} 205 \\ 7 \end{array} \begin{array}{r} +10 \\ 8 \end{array}$$

$$\begin{array}{r} 208 \\ 10 \end{array} \begin{array}{r} 00 \\ 00 \end{array} \begin{array}{r} -03 \\ 7 \end{array}$$

$$\begin{array}{r} 114 \\ -10 \\ 10 \end{array} \begin{array}{r} -03 \\ 00 \end{array} \begin{array}{r} +01 \\ 13 \end{array}$$

$$\begin{array}{r} -24 \\ 12 \end{array} \begin{array}{r} -12 \\ 10 \end{array} \begin{array}{r} -03 \\ 00 \end{array} \begin{array}{r} 00 \\ 11 \end{array} \begin{array}{r} -10 \\ 14 \end{array}$$

$$\begin{array}{r} -29 \\ 12 \end{array} \begin{array}{r} -08 \\ 10 \end{array} \begin{array}{r} 00 \\ 00 \end{array} \begin{array}{r} 00 \\ 11 \end{array} \begin{array}{r} -11 \\ 13 \end{array}$$

$$\begin{array}{r} +02 \\ 11 \end{array} \begin{array}{r} 201 \\ 9 \end{array} \begin{array}{r} 204 \\ 00 \end{array} \begin{array}{r} +08 \\ 7 \end{array} \begin{array}{r} +24 \\ 7 \end{array}$$

$$\begin{array}{r} +26 \\ 8 \end{array} \begin{array}{r} +08 \\ 6 \end{array} \begin{array}{r} +10 \\ 00 \end{array} \begin{array}{r} +12 \\ 6 \end{array} \begin{array}{r} +31 \\ 7 \end{array}$$

$$\begin{array}{r} +24 \\ 7 \end{array} \begin{array}{r} 215 \\ 00 \end{array} \begin{array}{r} +00 \\ 8 \end{array}$$

$$\begin{array}{r} 114 \\ +04 \\ 13 \end{array} \begin{array}{r} 202 \\ 00 \end{array} \begin{array}{r} -00 \\ 13 \end{array}$$

$$\begin{array}{r} -10 \\ 14 \end{array} \begin{array}{r} +03 \\ 11 \end{array} \begin{array}{r} +02 \\ 00 \end{array} \begin{array}{r} -07 \\ 12 \end{array} \begin{array}{r} -19 \\ 15 \end{array}$$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
------	-------	-------	-------	-------	--------

0+08

0+11

90+50

0+15 = 0+00

0+03

0+06

0+07

91+00

0+15 = 0+00

0+04

0+10

0+12

0+25

0+47

Inst.
Rod.
Chain.

.....

Left

GL

Right

$-\frac{0.8}{14}$	$+\frac{0.4}{12}$	$+\frac{0.5}{00}$	$-\frac{0.5}{9}$	$-\frac{0.3}{11}$
	$+\frac{1.0}{9}$	$+\frac{0.7}{00}$	$+\frac{0.2}{9}$	
	$-\frac{0.4}{2}$	$-\frac{0.1}{00}$	$-\frac{0.7}{3}$	
$-\frac{1.5}{6}$	$-\frac{0.5}{7}$	$-\frac{0.5}{00}$	$-\frac{0.8}{3}$	$-\frac{2.0}{5}$
$-\frac{1.5}{6}$	$-\frac{0.8}{5}$	$-\frac{0.5}{00}$	$-\frac{1.0}{4}$	$-\frac{2.4}{5}$
	$-\frac{0.5}{5}$	$-\frac{0.7}{00}$	$-\frac{1.0}{4}$	
		RT.		
	$-\frac{1.0}{11}$	$-\frac{0.3}{00}$	$+\frac{0.1}{11}$	
$-\frac{3.8}{12}$	$-\frac{1.1}{11}$	$-\frac{0.4}{00}$	$-\frac{0.4}{9}$	$-\frac{1.4}{12}$
$-\frac{3.3}{14}$	$-\frac{1.0}{11}$	$-\frac{0.2}{00}$	0.0	$-\frac{2.4}{12}$
	$-\frac{1.0}{11}$	$-\frac{0.5}{00}$	$+\frac{0.5}{12}$	$+\frac{0.2}{14}$
	$+\frac{0.4}{10}$	$+\frac{1.0}{00}$	$+\frac{1.2}{9}$	$+\frac{2.7}{11}$
	$+\frac{2.8}{12}$	$+\frac{0.5}{00}$	$+\frac{3.0}{9}$	

Sta.	B. S.	H. I.	Cross Sections		Gr. R
			F. S.	Grade	

87+39

0+15=0+00

0+03

0+08

0+09

0+23

95+75

0+15=0+00

0+06

0+08

0+09

97+11

0+15=0+00

0+03

0+07

0+08

Inst.
 Rod.
 Chain.

.....

Left

G L

Right

Lt.

$\frac{-02}{12}$ $\frac{-04}{00}$ $\frac{-1}{12}$

$\frac{-10}{14}$ $\frac{-05}{14}$ $\frac{-06}{00}$ $\frac{-14}{10}$ $\frac{-32}{13}$

$\frac{-22}{14}$ $\frac{-09}{11}$ $\frac{-10}{00}$ $\frac{-17}{11}$ $\frac{-30}{12}$

$\frac{104}{11}$ $\frac{00}{9}$ $\frac{-57}{00}$ $\frac{-10}{10}$ $\frac{-05}{11}$

$\frac{-08}{7}$ $\frac{-10}{00}$ $\frac{-12}{11}$

Lt.

$\frac{-09}{10}$ $\frac{-03}{00}$ $\frac{+03}{11}$

$\frac{-30}{14}$ $\frac{-12}{9}$ $\frac{-06}{00}$ $\frac{-06}{10}$ $\frac{-20}{14}$

$\frac{-30}{13}$ $\frac{-12}{11}$ $\frac{-09}{00}$ $\frac{-12}{9}$ $\frac{-23}{11}$

$\frac{-16}{8}$ $\frac{-10}{00}$ $\frac{-10}{10}$

Lt.

$\frac{-04}{14}$ $\frac{-05}{00}$ $\frac{-05}{10}$

$\frac{-12}{12}$ $\frac{-07}{11}$ $\frac{-11}{00}$ $\frac{-15}{12}$ $\frac{-28}{14}$

$\frac{-13}{12}$ $\frac{-10}{11}$ $\frac{-13}{00}$ $\frac{-14}{9}$ $\frac{-31}{12}$

$\frac{-10}{11}$ $\frac{-10}{00}$ $\frac{-13}{11}$

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
11+00					
10+00					
9+00					
8+00					
7+00					
6+00					
5+00					
4+00					
3+00					
2+00					
1+00					
0+00					

Inst.
 Rod.
 Chain.

Left

GL

Right

+18.P. 30'
 +05.P.P. 28'

⊙

F44

F.36

F.33'

F31'

F.31'

+41.T.P. 29'
 +34.F.P. 28'
 +13.1'

-X-X-X-X

⊙

F.35'

+13.T.P. 29'
 +06.F.P. 28'
 F.40'

⊙

F.35'

F.34'
 +27.F.P. 28'
 +25.F.P. 28'

⊙

F-33'

F-34'

⊙

F-33'

+46.A.P. 28'
 +41.T.P. 28'
 F-31'

⊙

+65.1150 38
 +50.1150 28
 F-32'

+15.P.A. 30'
 +00.T.P. 30' - F.31'

⊙

F.31
 +75.1150 26'

+28.F.L. 38

+14.T.P. 15

F.5. 0 0 0 -X-X-X-X-X

⊙

+05.M.P. 16
 F-32

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
21+00					
20+00					
19+00					
18+00					
17+00					
16+00					
15+00					
14+00					
13+00					
12+00					
11+00					

Inst.
Rod.
Chain.

Left

CL

Right

402.99 29'

106.79
F. 174.49 - 28'
+ 62

502.17 F.C. Tel



Wash. 488-120

Cultivated

H77



H77



Pasture

Woods

F. 34'

F. 34'

F. 34'

F. 34'

F. 33'

F. 35'

F. 44'

Cross Sections

Sta. B. S. H. I. F. S. Grade Gr. R.

Inst.
Rod.
Chain.

52

.....

Left

GL

Right

Cross Sections

Sta. B. S. H. I. ^{1/2} F. S. Grade Gr. R.

1871
1872
1873

Cross Sections

Sta. B. S. H. I. F. S. Grade Gr. R.

Inst.
Rod.
Chain.

.....

Left C L

Right

Cross Sections

.....
Sta. B. S. H. I. F. S. Grade Gr. R!

Inst.
Rod.
Chain.

.....

Left

C L

Right

The page contains a large grid of graph paper. A vertical red line runs down the center of the page, dividing it into two equal halves. The grid consists of approximately 20 columns and 30 rows of small squares. The labels 'Left', 'C L', and 'Right' are positioned at the top of the grid, indicating the different sections for data recording.

..... Cross Sections

Sta. B. S.

Gr. R.

Inst.
Rod.
Chain.

.....

Left

G L

Right

The page contains a large grid of graph paper. A vertical red line runs down the center of the page, dividing it into two equal halves. The left half is labeled 'Left' and the right half is labeled 'Right'. The grid consists of small squares, with approximately 20 columns on each side of the red line and 30 rows. The grid is mostly empty, with a few faint marks and a small dark spot in the upper right corner of the right-hand section.

 Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. E.
------	-------	-------	-------	-------	--------

Cross Sections

Sta.

B. S.

11'

Gr. R.

Inst.
Rod.
Chain.

.....

Left

C L

Right

The page contains a large grid of graph paper. A vertical red line runs down the center of the page, dividing it into two equal halves. The left half is labeled 'Left' and the right half is labeled 'Right'. The grid consists of approximately 20 columns and 30 rows of small squares. The labels 'Left', 'C L', and 'Right' are positioned at the top of their respective sections. The 'C L' label is centered between the two main sections.

Cross Sections

.....
Sta. B. S. H. I. F. S. Grade Gr. R.

Inst.
Rod.
Chain.

59

~~.....~~

Left

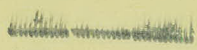
G L

Right

Cross Sections

Sta. B. S. H. I. F. S. Grade Gr. R.

net
rod.
chain.



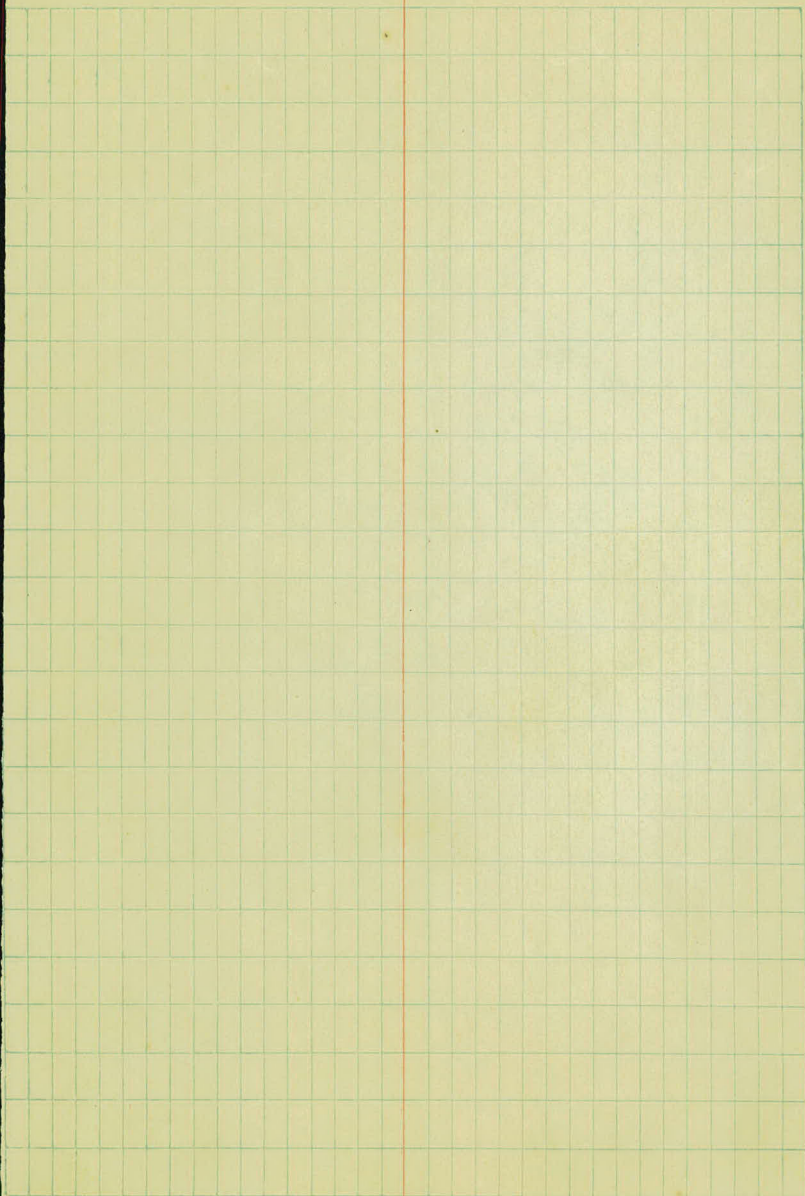
Left

C L

Right

The page contains a large grid of graph paper. A vertical red line runs down the center of the page, dividing it into two equal halves. The left half is labeled 'Left' and the right half is labeled 'Right'. The grid consists of approximately 20 columns and 30 rows of small squares. The paper is aged and has a yellowish tint.

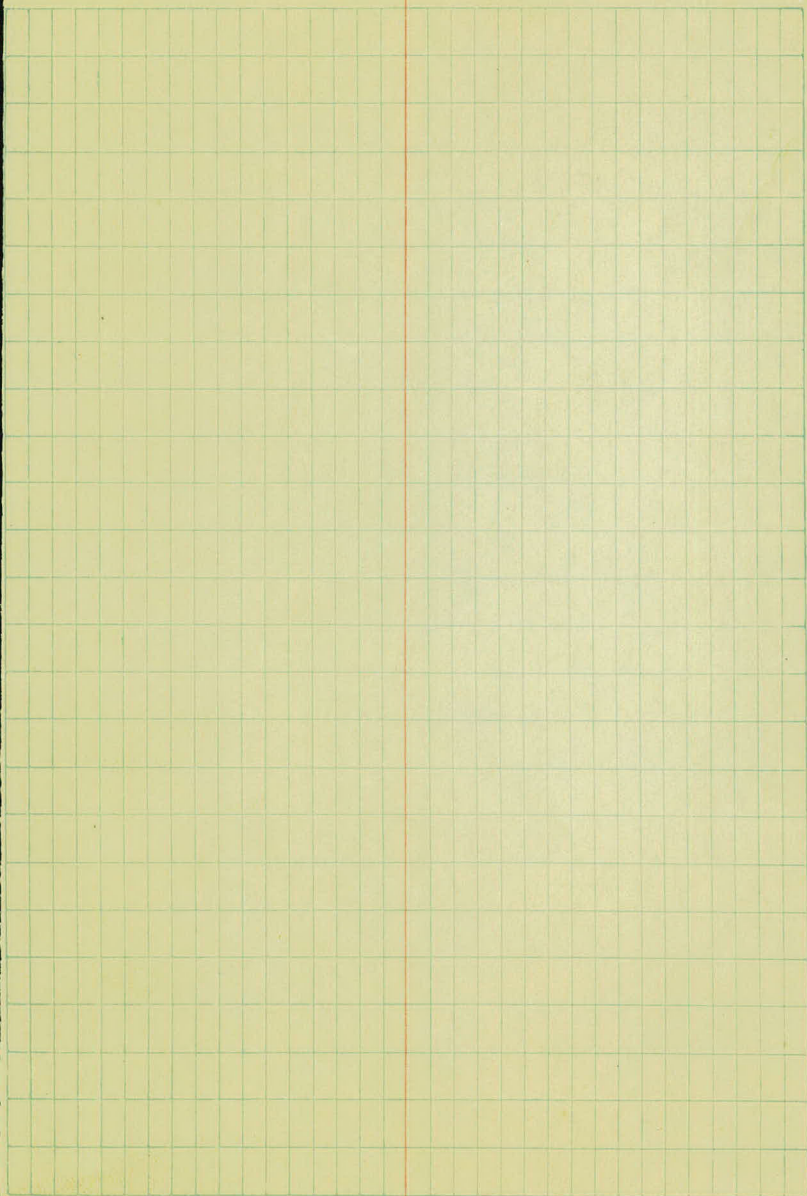
Sta	Size	Kind	Length	Location	£
52+95	18"	C.M.	(49) 52'	✓	£
52+45	18"	P-3	40'	✓	£
36+45	12"	C.M.	24'	✓	RT.
36+30	12"	C.M.	20'	✓	Lt.
33+95	12"	C.M.	24'	✓	RT.
49+16	12"	C.M.	24'	✓	Lt.
12+34	15"	C.M.	24'	✓	Lt.
11+75	12"	C.M.	24'	✓	RT.
7+12	12"	C.M.	24'	✓	Lt.
0+94	30"	P-3.	(52) 50'	✓	£
0+60	18"	C.M.	(4) 44'	✓	RT.
11+94	12"	C.M.	24'	✓	Lt.
17+06	12"	C.M.	24'	✓	RT.
24+20	(12) 15"	"	24'	✓	RT.



Sta	Size	Kind	Length	Location	
26+50	15"	C.M.	28'	✓	RT.
26+50	15"	C.M.	24'	✓	Lt.
27+07	15"	C.M.	22'	✓	RT.
29+29	18"	C.M.	(49) 48'	✓	£
33+21	14"	C.M.	24'	Lt. ✓	
33+75	14"	C.M.	24'	✓	RT.
41+57	24"	C.M.	24'	Lt. ✓	
41+58	24"	C.M.	24'	✓	RT.
46+81	14"	C.M.	24'	✓	RT.
49+47	15"	C.M.	24'	✓	RT.
54+41	18"	C.M.	30'	Lt. ✓	
63+29	12"	C.M.	24'	✓	RT.
65+45	15"	C.M.	24'	✓	RT.

The image shows a page of graph paper with a grid of small squares. A vertical red line is drawn on the left side, creating a margin. The grid covers most of the page area.

Sta.	Size	Kind	Length	Location	⊕
66+63	12"	C.M.	24'	✓ Lt.	
68+90	8"	V.P.	7'		Rt.
69+50	12"	C.M.	24'	✓ Lt.	
69+77	12"	C.M.	24'	✓	Rt.
73+17	12"	C.M.	24'	✓	Rt.
77+10	12"	C.M.	24'	✓	Rt.
79+62	12"	C.M.	25' ^{rt'}	✓	Rt.
79+79	12"	C.M.	24'	✓ Lt.	
81+50	10"	V.P.	10'	Lt.	
91+00	12"	C.M.	24'	✓	Rt.
93+39	12"	C.M.	24'	✓ Lt.	
95+25	12"	C.M.	24'	✓ Lt.	
97+11	12"	C.M.	24'	✓ Lt.	
99+70	30"	P-3	72'	✓	⊕



$5\frac{1}{9}$

$43+12$

$41+43$

$41+33$

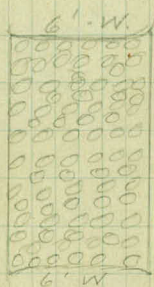
$36+00$

14.

Rubble stone Gutter

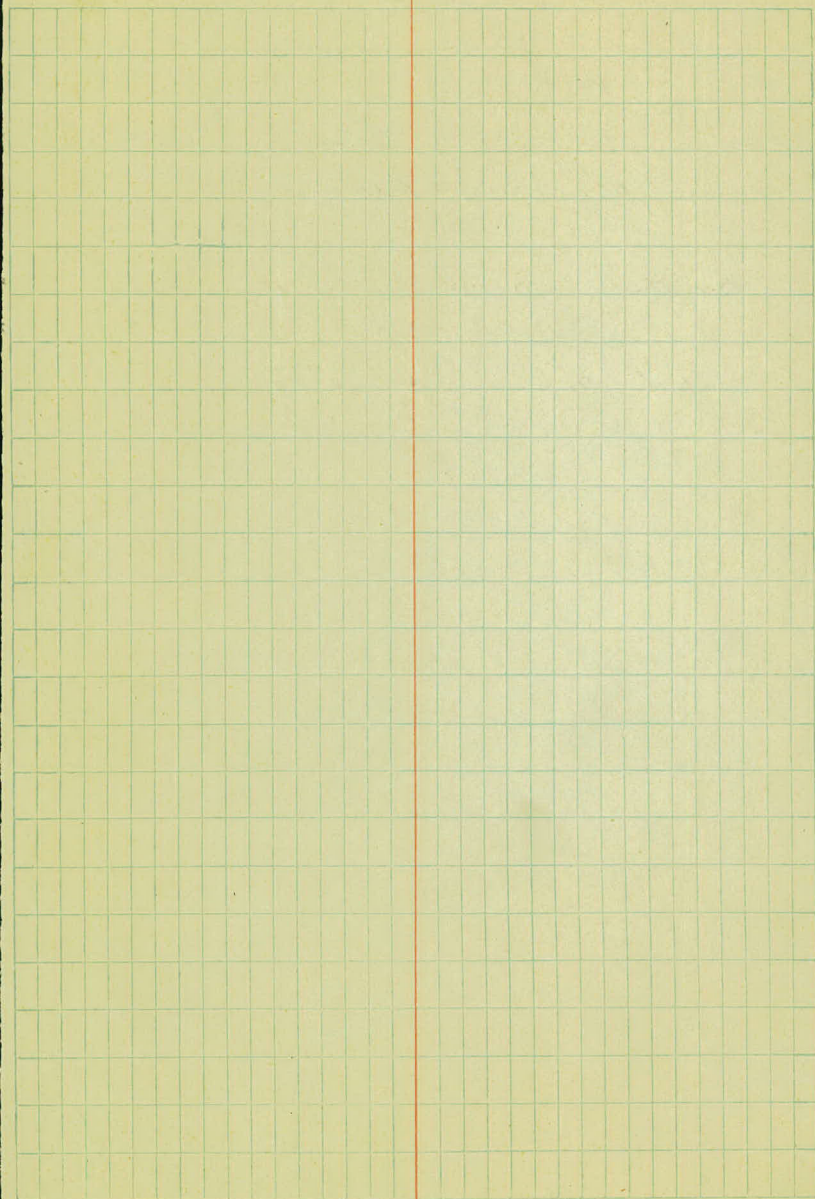


Note -
Rubble stone gutter
is 6' wide
and 1' in depth.



B.M. 2

Sta		Description	Elev.
57+85	40	ft. Lt. Spike in T.P.	293.08
43+50	40	" Rt. Nail in T.P.	294.60
33+25	35	" Rt. Spk. in Stump	312.21
26+50	35	" Rt. Spk on 12" Oak	296.08
13+50	50	" Lt. Spk. on 16" Oak	240.29
N.W. of Mont.		Spike on 36" Maple	217.61
13+09?		Top of Mont	242.03



Sta

43+25

Gutter



41+70

41+47

36+00

Rt.

Rubble stone Gutter

Note

Rubble stone gutter
is - 6' wide
and 1' in depth

6.0

1.49'

6.0
1.0

6.0

5.47

6.0

y

Sta.

4+00

3+00

2+00

1+00

0+00

Lt.

E

Rt.

67

+20-Tree-30'

94-33'

+86-Tree-30'

+81-Tree-30'

+81-Tree-30'

94-33'

+85-Tree-30'

+81-Tree-29'

+80-Tree-29'

+89-Tree-29'

F.L.-32'

+76-Tree-31'

+88-Tree-28'

F.L.-32'

+74-Cult.-2-53'
23-50'

+65-Tree-25'

+28-Tree-28'

F.L.-33'

Final Topography

F.L.-31'

Pasture

Cultivated

F.L.-31'

Cultivated

F.L.-31'

Pasture

130-Tree-30'

F.L.-32'

+31-Tree-28'
+28-Tree-28'
P.P.-30' +14
P.P.-28' +12

FF C.C.C.

Final Topography

Project: 24-56

Sta 0+00 to Sta 55+00

From City Limits to E.Co. Line

579.
8+00

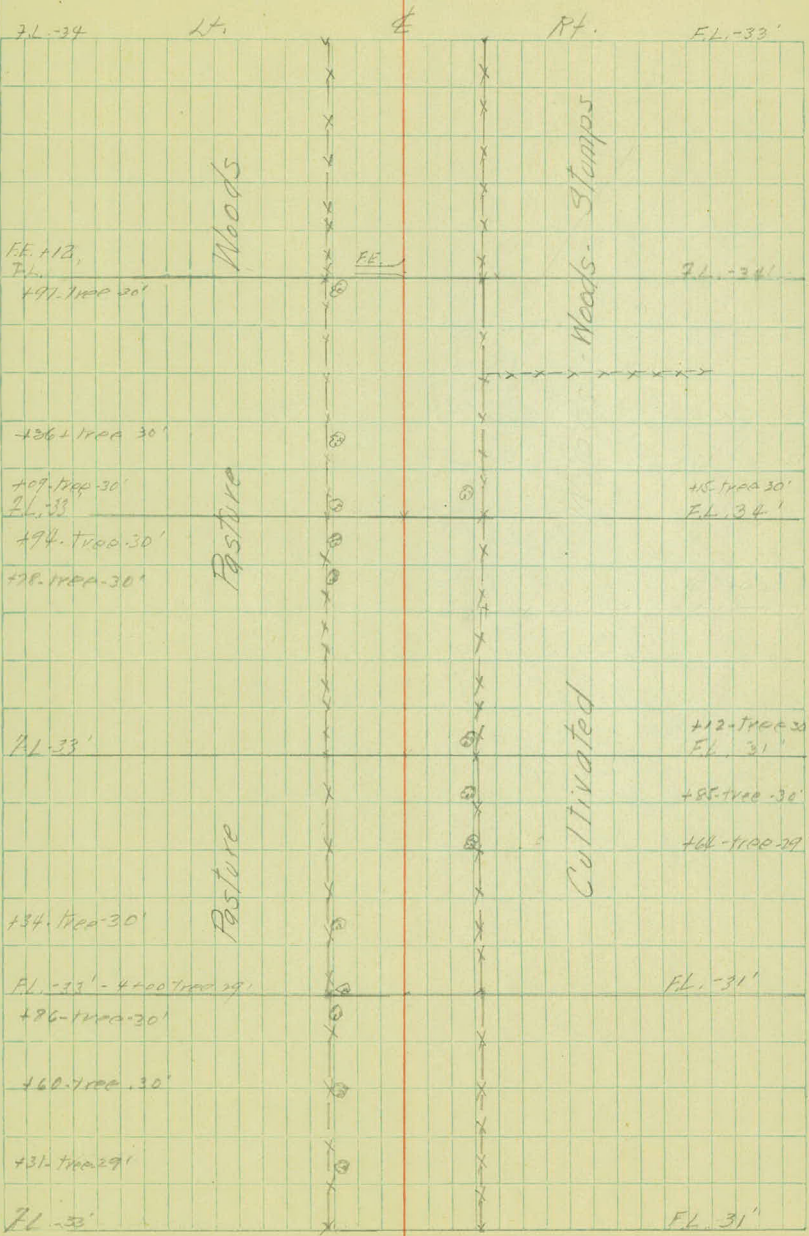
7+00

6+00

5+00

4+00

3+00



13+00

12+00

11+00

10+00

9+00

8+00

FL-35'

LH.

E

Rt.

FL-39'

+39. FE

Log M. by. 17'
FL-36

Woods

FE

o

Stamps

FL-35'

FL-34

Woods

FE

Woods

FL-31

+35 F.H.

FL-34'

Woods

Stamps

FL-31'

FL-34

Woods

FL-32

FL-34

FL-33

Sta.

18+00

17+00

16+00

15+00

14+00

13+00

FL. 36'

FL. 36'

Pasture

Stumps

FL. 36'

FL. 36'

Woods

FL. 36'

FL. 36'

Woods

Stumps

FL. 34'

FL. 38'

Woods

Stumps

FL. 35'

FL. 38'

Woods

Woods

477 - Tree 30

452 - Tree 30
451 - Tree 30

FL. 35'

FL. 39'

23+00

22+00

21+00

20+00

19+00

18+00

Lt.

Rt.

FL. 43'

FL. 40'

FL. 41'

FL. 39'

FL. 36'

FL. 36'

Pasture

Pasture

Pasture

Pasture

Pasture

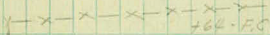
Woods Stumps

+ 51. Trans 25'

+ 62. 50 - 33'

FL. 33

FL. 36'



Sta.

28+00

27+00

26+00

25+00

24+00

23+00

Lt.

±

Rt.

FL-32



Farm yard

Cultivated - Berry bushes
99x-100'

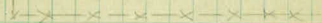


Woods

26.-33

FC. +34.33'

W.M.



FL-34'

Meadow

Stumps

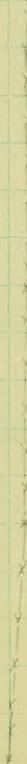
FL-33'

FL-34'

Pasture

Pasture

FL-42'



33+00

32+00

31+00

30+00

29+00

28+00

Lt.

±

Rt.

Cultivated

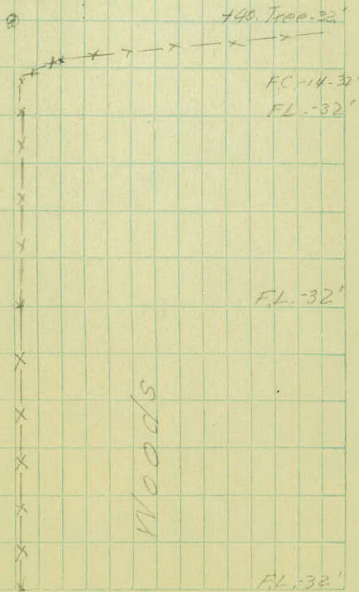
Woods

Cultivated

Woods

Cultivated

Woods



F.L. +16

RE

FL -32'

38+00

37+00

36+00

35+00

34+00

33+00

H. F. R.

Cultivated

Cultivated

Cultivated

Orchard

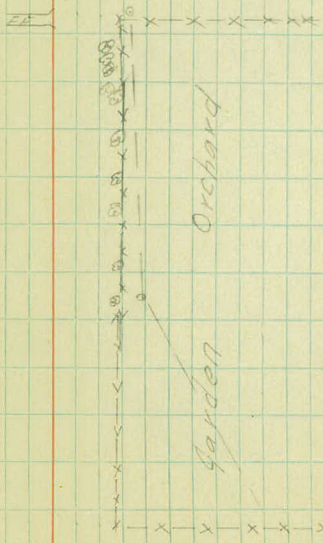
Garden

Cultivated

Barren
ford

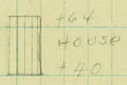
FE. #30

+77-M. 6x.



- +45- FE
- +29- EC- 27
- +32- T.P. 33
- +18- 1000 28
- +105- 1000 28
- FL. -30'
- +95- 1000 28
- +26- 1000 28
- +77- 1000 28
- +60- 1000 28
- +47- 1000 28
- +24- Tree 28
- +10- 1000 28
- +12- T.P. 37
- FL. -28'

+98- F.E.



33+10-7-1000 28

43+00

42+00

41+00

40+00

39+00

38+00

4.

4

74

Cultivated

Cultivated

+43-T.P.-31'

+50-T.P.-31'

Cultivated

Cultivated

+23-31'-T.P.

48+00

47+00

46+00

45+00

44+00

43+00

H.

d

Rt.

Cultivated

Cultivated

Cultivated

Cultivated

+ 81 - T.P. - 31

+ 22 - T.P. - 31

+ 65 - T.P. - 31

+ 07 - T.P. - 30



53+00

52+00

51+00

50+00

49+00

48+00

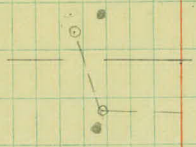
Lt.

4

Rt.

5190+95-34'
T.P. +88-44'

901 Pole +84-33'
5191+50-34'



E. Co. Line

+75

+55 T.P. 30'

Cultivated

Cultivated

+98 T.P. 31'

Cultivated

Cultivated

+92 T.P. 31'

55+00

54+00

53+00

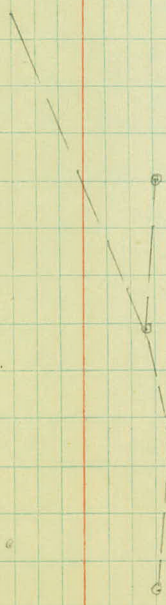
H.

E

Rt.

Cultivated

Cultivated

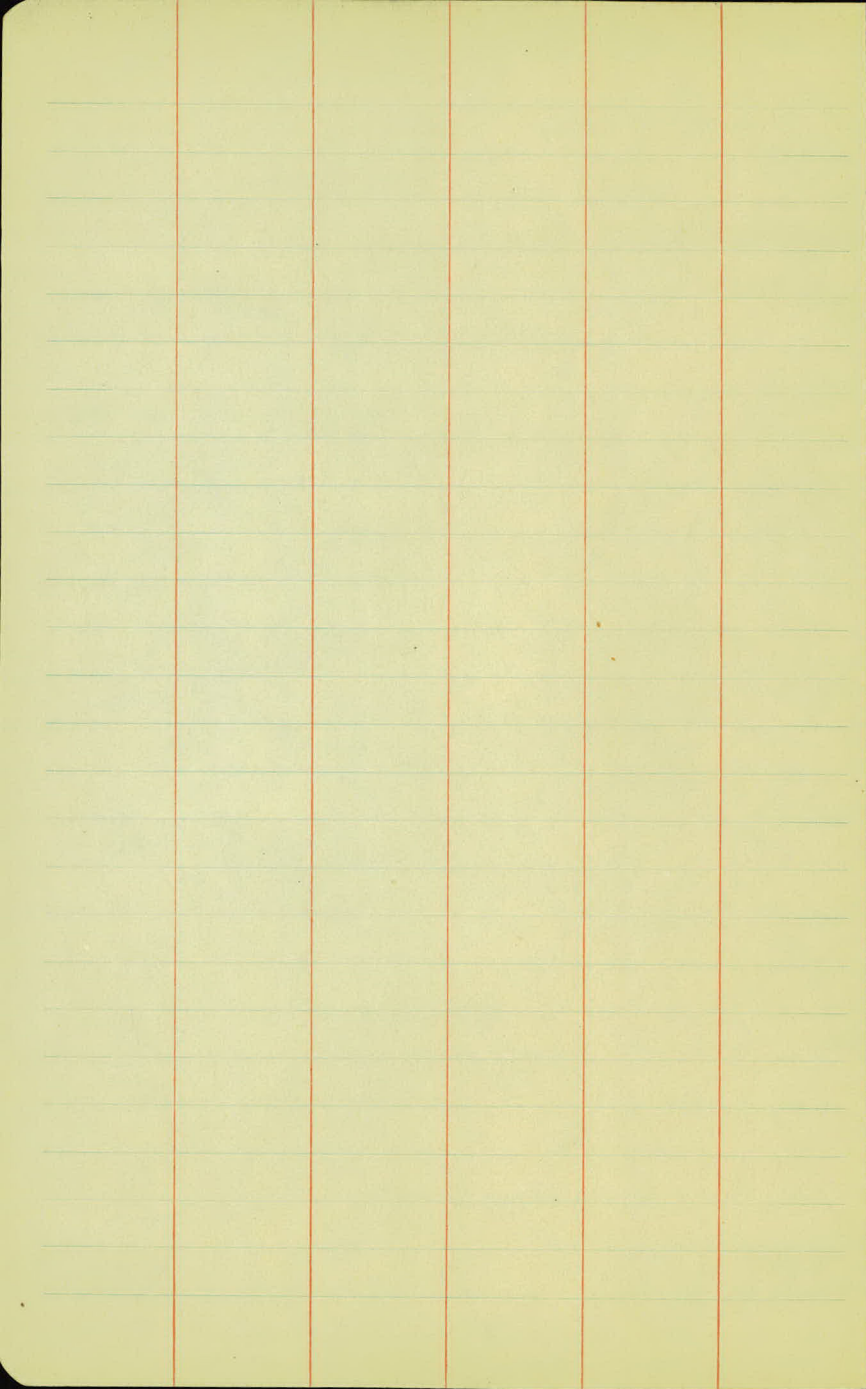


5500-T.P. 31'

+39-T.P. 27'

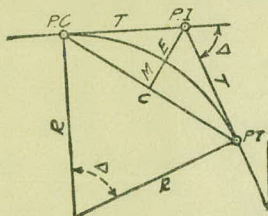
+95-T.P. 36'

+28-T.P. 30'



DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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CURVE FORMULAS

Radius = $R = \frac{50}{\sin. \frac{D}{2}}$ (1) Degree of Curve = D and $\sin. \frac{D}{2} = \frac{50}{R}$ (2)

Tangent = $T = R \tan \frac{\Delta}{2}$ (3) Length of Curve = $L = 100 \frac{\Delta}{D}$ (4)

Middle ordinate = $M = R(1 - \cos. \frac{\Delta}{2})$ (5) = $R \text{vers} \frac{\Delta}{2}$ (6)

External = $E = T \tan \frac{\Delta}{4}$ (7) = $R \div \cos. \frac{\Delta}{2} - R$ (8) = $R \text{exsec} \frac{\Delta}{2}$ (9)

Long Chord = $C = 2 R \sin. \frac{\Delta}{2}$ (10) Δ = Central Angle

EXPLANATION AND USE OF TABLES

Stations.—Given P. I. = Sta. 161 + 60.35 to find Sta. of P. C. and P. T. $\Delta = 62^\circ 10'$ $D = 8^\circ 20'$. From Table IV for 1° curve $T = 3454.1$ and $\div 8\frac{1}{3} = 414.49$ ft. From Table V correction = .36 or $T = 414.85$ ft. P. C. = Sta. P. I. - $T = 157 + 45.50$. Also from (4) $L = 746.00$ and P. T. = Sta. P. C. + $L = 164 + 91.50$.

Offsets.—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent offset for 100 ft. = 7.27 ft. Distance = $158 - \text{Sta. P. C.} = 54.50$, hence offset = $7.27 (54.50 \div 100)^2 = 2.16$ ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus $(54.50)^2 \div (2 \times 688.26) = 2.16$ ft.

Deflections.—Deflection angle = $\frac{1}{2} D$ for 100 ft., $\frac{1}{4} D$ for 50 ft., etc. For c ft. = (in minutes) $.3 \times C \times D^\circ$ or = defl. for 1 ft. from Table III $\times C$. For Sta. 158 of above curve = $.3 \times 54.5 \times 8\frac{1}{3} = 136.2'$ or $2^\circ 16.2'$, or = $2.50 \times 54.5 = 136.2'$ from Table III. For Sta. 159 deflection angle = $2^\circ 16.2' + 8^\circ 20' \div 2 = 6^\circ 26.2'$, etc.

Externals.—May be found in similar manner to tangents. Thus E for curve above is 91.37. For from Table IV for 1° curve $E = 960.6$ for $8^\circ 20' = 960.6 \div 8\frac{1}{3} = 91.27$ and from Table V correction = .10 or $E = 91.37$ ft. Or suppose $\Delta = 32^\circ$ and E is measured and found to be 42 ft. What is D ? From Table IV $E = 230.9$ and $\div 42 = 5.5$ or $D = 5^\circ 30'$.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

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

TABLE II.—INCHES IN DECIMALS OF A FOOT.

1-16	3-32	¼	3-16	¼	5-16	¾	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

TABLE III.—RADI, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
20	17188.8	.073	.291	0.10	20'	781.84	1.600	6.395	2.20
30	11459.2	.109	.438	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25					
1	5729.65	.218	.873	0.30	8	716.78	1.746	6.976	2.40
10	4911.15	.255	1.018	0.35	20	688.16	1.819	7.266	2.50
20	4297.28	.291	1.164	0.40	30	674.69	1.855	7.411	2.55
30	3819.83	.327	1.309	0.45	40	661.74	1.892	7.556	2.60
40	3437.87	.364	1.454	0.50					
50	3125.36	.400	1.600	0.55	9	637.28	1.965	7.846	2.70
					20	614.56	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
					40	593.42	2.110	8.426	2.90
2	2864.93	.436	1.745	0.60					
10	2644.58	.473	1.891	0.65	10	573.69	2.183	8.716	3.00
20	2455.70	.509	2.036	0.70	30	546.44	2.292	9.150	3.15
30	2292.01	.545	2.181	0.75	11	521.67	2.402	9.585	3.30
40	2148.79	.582	2.327	0.80	30	499.06	2.511	10.02	3.45
50	2022.41	.618	2.472	0.85	12	478.34	2.620	10.45	3.60
					30	459.28	2.730	10.89	3.75
3	1910.08	.655	2.618	0.90	13	441.68	2.839	11.32	3.90
10	1809.57	.691	2.763	0.95	30	425.40	2.949	11.75	4.05
20	1719.12	.727	2.908	1.00	14	410.28	3.058	12.18	4.20
30	1637.28	.764	3.054	1.05	30	396.20	3.168	12.62	4.35
40	1562.88	.800	3.199	1.10					
50	1494.95	.836	3.345	1.15	15	383.07	3.277	13.05	4.50
					30	370.78	3.387	13.49	4.65
4	1432.69	.873	3.490	1.20	16	359.27	3.496	13.92	4.80
10	1375.40	.909	3.635	1.25	30	348.45	3.606	14.35	4.95
20	1322.53	.945	3.718	1.30	17	338.27	3.716	14.78	5.10
30	1273.57	.982	3.926	1.35	18	319.62	3.935	15.64	5.40
40	1228.11	1.018	4.071	1.40	19	302.94	4.155	16.51	5.70
50	1185.78	1.055	4.217	1.45					
					20	287.94	4.374	17.37	6.00
5	1146.28	1.091	4.362	1.50	21	274.37	4.594	18.22	6.30
10	1109.33	1.127	4.507	1.55	22	262.04	4.814	19.08	6.60
20	1074.68	1.164	4.653	1.60	23	250.79	5.035	19.94	6.90
30	1042.14	1.200	4.798	1.65	24	240.49	5.255	20.79	7.20
40	1011.51	1.237	4.943	1.70					
50	982.64	1.273	5.088	1.75	25	231.01	5.476	21.64	7.50
					26	222.27	5.697	22.50	7.80
6	955.37	1.309	5.234	1.80	27	214.18	5.918	23.35	8.10
10	929.57	1.346	5.379	1.85	28	206.68	6.139	24.19	8.40
20	905.13	1.382	5.524	1.90	29	199.70	6.360	25.04	8.70
30	881.95	1.418	5.669	1.95	30	193.18	6.583	25.88	9.00
40	859.92	1.455	5.814	2.00					

Note. Chord Deflection=2 times tangent deflection.

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	53.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.33	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10'	3386.3	925.9	10'	4099.5	1315.6	10'	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62	3442.7	954.8	72	4162.8	1352.6	82	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63	3511.1	990.2	73	4239.7	1398.0	83	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64	3580.3	1026.6	74	4317.6	1444.6	84	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65	3650.2	1063.9	75	4396.5	1492.4	85	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66	3720.9	1102.2	76	4476.5	1541.4	86	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.8
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.2	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67	3792.4	1141.4	77	4557.6	1591.6	87	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68	3864.7	1181.6	78	4639.8	1643.0	88	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69	3937.9	1222.7	79	4723.2	1695.8	89	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70	4011.9	1265.0	80	4807.7	1749.9	90	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92	5933.2	2518.5	102	7075.5	3374.9	112	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93	6037.8	2594.0	103	7203.2	3474.4	113	8656.6	4651.8
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94	6144.3	2671.6	104	7333.6	3576.8	114	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95	6252.8	2751.3	105	7467.0	3682.3	115	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96	6363.4	2833.2	106	7603.5	3791.0	116	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97	6476.2	2917.3	107	7743.2	3902.9	117	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98	6591.2	3003.8	108	7886.2	4018.2	118	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99	6708.6	3092.7	109	8032.7	4137.1	119	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	5808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100	6828.3	3184.1	110	8182.8	4259.7	120	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table IV) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°	.11	.22	.34	.47	.58	.69	.79	.81	.92	1.04	1.29	1.42	1.54	1.66
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

FOR EXTERNALS ADD

Central Angle.	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.266	.353	.440	.528	.617	.707	.797	.877	.971	1.07	1.18	1.29
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.380	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32

VIII

TABLE VI.—CORRECTIONS FOR SUB-CHORDS AND LONG CHORDS.

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.96	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.43
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

NOTE.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25°.06 for each chord. Long chords are useful in passing obstacles.

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.037	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

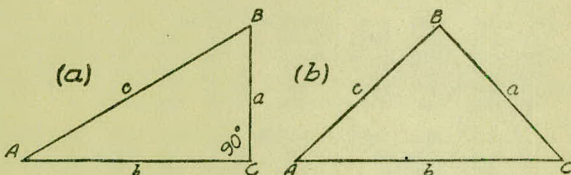
SLOPE REDUCTIONS.

When distances are measured on a slope they may be reduced to the equivalent horizontal distance by the following approximate rule:— subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction= $15^2 \div 2 \times 250.3 = .45$ (by slide rule) or horizontal distance= $250.3 - .45 = 249.85$. When vertical angle= $V. A.$ is measured horizontal distance= $\text{slope distance} - \text{slope distance} (1 - \text{Cos. } V. A.)$. Thus for slope distance of 248.7 ft. and $V. A.$ of $4^\circ 20'$ from Table VIII $\text{Cos.} = .99714$ and correction= $1 - .99714 = .00286$ per foot or total of $.286 \times 2\frac{1}{2}$ (near enough) = .57 and horizontal distance= $248.7 - .57 = 248.13$ ft.

See fig. (a).

TRIGONOMETRICAL FORMULAS.

$$\begin{aligned} \sin. & A = \frac{a}{c} \\ \cos. & A = \frac{b}{c} \\ \tan. & A = \frac{a}{b} \\ \cot. & A = \frac{b}{a} \\ \sec. & A = \frac{c}{b} \\ \text{cosec.} & A = \frac{c}{a} \end{aligned}$$



FORMULA FOR SOLVING TRIANGLES.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	$\sin. A = \frac{a}{c}, \cos. B = \frac{a}{c}, b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan. A = \frac{a}{b}, \cot. B = \frac{a}{b}, c = \sqrt{a^2 + b^2}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot. A, c = \frac{a}{\sin. A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan. A, c = \frac{b}{\cos. A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin. A, b = c \cos. A$
Given	Sought.	Oblique triangles. See fig. (b).
A, B, a	b	$b = \frac{a \sin. B}{\sin. A}$
A, a, b	B	$\sin. B = \frac{b \sin. A}{a}$
a, b, C	$A - B$	$\tan. \frac{1}{2}(A - B) = \frac{(a - b) \tan. \frac{1}{2}(A + B)}{a + b}$
a, b, c	A	$\left\{ \begin{aligned} &\text{If } s = \frac{1}{2}(a + b + c), \sin. \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{bc}} \\ &\cos. \frac{1}{2} A = \sqrt{\frac{s(s - a)}{bc}}, \tan. \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{s(s - a)}} \\ &\sin. A = \frac{2\sqrt{s(s - a)(s - b)(s - c)}}{bc} \end{aligned} \right.$
A, B, C, a	area	$\text{area} = \frac{a^2 \sin. B \sin. C}{2 \sin. A}$
A, b, c	area	$\text{area} = \frac{1}{2} b c \sin. A$
a, b, c	area	$s = \frac{1}{2}(a + b + c), \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
0	0	0	∞	1	90	8	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	1	50	10	.1421	.1435	6.968	.98986	50
20	.0058	.0058	171.9	.99998	40	20	.1449	.1465	6.827	.98944	40
30	.0087	.0087	114.6	.99996	30	30	.1478	.1495	6.691	.98902	30
40	.0116	.0116	85.94	.99993	20	40	.1507	.1524	6.561	.98858	20
50	.0145	.0145	68.75	.99989	10	50	.1536	.1554	6.435	.98814	10
1	.0175	.0175	57.29	.99985	89	9	.1564	.1584	6.314	.98769	81
10	.0204	.0204	49.10	.99979	50	10	.1593	.1614	6.197	.98723	50
20	.0233	.0233	42.96	.99973	40	20	.1622	.1644	6.084	.98676	40
30	.0262	.0262	38.19	.99966	30	30	.1650	.1673	5.976	.98629	30
40	.0291	.0291	34.37	.99958	20	40	.1679	.1703	5.871	.98580	20
50	.0320	.0320	31.24	.99949	10	50	.1708	.1738	5.769	.98531	10
2	.0349	.0349	28.64	.99939	88	10	.1736	.1763	5.671	.98481	80
10	.0378	.0378	26.43	.99929	50	10	.1765	.1793	5.576	.98430	50
20	.0407	.0407	24.54	.99917	40	20	.1794	.1823	5.485	.98378	40
30	.0436	.0437	22.90	.99905	30	30	.1822	.1853	5.396	.98325	30
40	.0465	.0466	21.47	.99892	20	40	.1851	.1883	5.309	.98272	20
50	.0494	.0495	20.21	.99878	10	50	.1880	.1914	5.226	.98218	10
3	.0523	.0524	19.08	.99863	87	11	.1908	.1944	5.145	.98163	79
10	.0552	.0553	18.07	.99847	50	10	.1937	.1974	5.066	.98107	50
20	.0581	.0582	17.17	.99831	40	20	.1965	.2004	4.989	.98050	40
30	.0610	.0612	16.35	.99813	30	30	.1994	.2035	4.915	.97992	30
40	.0640	.0641	15.60	.99795	20	40	.2022	.2065	4.843	.97934	20
50	.0669	.0670	14.92	.99776	10	50	.2051	.2095	4.773	.97875	10
4	.0698	.0699	14.30	.99756	86	12	.2079	.2126	4.705	.97815	78
10	.0727	.0729	13.73	.99736	50	10	.2108	.2156	4.638	.97754	50
20	.0756	.0758	13.20	.99714	40	20	.2136	.2186	4.574	.97692	40
30	.0785	.0787	12.71	.99692	30	30	.2164	.2217	4.511	.97630	30
40	.0814	.0816	12.25	.99668	20	40	.2193	.2247	4.449	.97566	20
50	.0843	.0846	11.83	.99644	10	50	.2221	.2278	4.390	.97502	10
5	.0872	.0875	11.43	.99619	85	13	.2250	.2309	4.331	.97437	77
10	.0901	.0904	11.06	.99594	50	10	.2278	.2339	4.275	.97371	50
20	.0929	.0934	10.71	.99567	40	20	.2306	.2370	4.219	.97304	40
30	.0958	.0963	10.39	.99540	30	30	.2334	.2401	4.165	.97237	30
40	.0987	.0992	10.08	.99511	20	40	.2363	.2432	4.113	.97169	20
50	.1016	.1022	9.788	.99482	10	50	.2391	.2462	4.061	.97100	10
6	.1045	.1051	9.514	.99452	84	14	.2419	.2493	4.011	.97030	76
10	.1074	.1080	9.255	.99421	50	10	.2447	.2524	3.962	.96959	50
20	.1103	.1110	9.010	.99390	40	20	.2476	.2555	3.914	.96887	40
30	.1132	.1139	8.777	.99357	30	30	.2504	.2586	3.867	.96815	30
40	.1161	.1169	8.556	.99324	20	40	.2532	.2617	3.821	.96742	20
50	.1190	.1198	8.345	.99290	10	50	.2560	.2648	3.776	.96667	10
7	.1219	.1228	8.144	.99255	83	15	.2588	.2679	3.732	.96593	75
10	.1248	.1257	7.953	.99219	50	10	.2616	.2711	3.689	.96517	50
20	.1276	.1287	7.770	.99182	40	20	.2644	.2742	3.647	.96440	40
30	.1305	.1317	7.596	.99144	30	30	.2672	.2773	3.606	.96363	30
40	.1334	.1346	7.429	.99106	20	40	.2700	.2805	3.566	.96285	20
50	.1363	.1376	7.269	.99067	10	50	.2728	.2836	3.526	.96206	10
					82						74
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
or						or					
16	.2756	.2867	3.487	.96126	74	24	.4067	.4452	2.246	.91355	66
10	.2784	.2899	3.450	.96046	50	10	.4094	.4487	2.229	.91236	50
20	.2812	.2931	3.412	.95964	40	20	.4120	.4522	2.211	.91116	40
30	.2840	.2962	3.376	.95882	30	30	.4147	.4557	2.194	.90996	30
40	.2868	.2994	3.340	.95799	20	40	.4173	.4592	2.177	.90875	20
50	.2896	.3026	3.305	.95715	10	50	.4200	.4628	2.161	.90753	10
17	.2924	.3057	3.271	.95615	73	25	.4226	.4663	2.145	.90631	65
10	.2952	.3089	3.237	.95545	50	10	.4253	.4699	2.128	.90507	50
20	.2979	.3121	3.204	.95459	40	20	.4279	.4734	2.112	.90383	40
30	.3007	.3153	3.172	.95372	30	30	.4305	.4770	2.097	.90259	30
40	.3035	.3185	3.140	.95284	20	40	.4331	.4806	2.081	.90133	20
50	.3062	.3217	3.108	.95195	10	50	.4358	.4841	2.066	.90007	10
18	.3090	.3249	3.078	.95106	72	26	.4384	.4877	2.050	.89879	64
10	.3118	.3281	3.048	.95015	50	10	.4410	.4913	2.035	.89752	50
20	.3145	.3314	3.018	.94924	40	20	.4436	.4950	2.020	.89623	40
30	.3173	.3346	2.989	.94832	30	30	.4462	.4986	2.006	.89493	30
40	.3201	.3378	2.960	.94740	20	40	.4488	.5022	1.991	.89363	20
50	.3228	.3411	2.932	.94646	10	50	.4514	.5059	1.977	.89232	10
19	.3256	.3443	2.904	.94552	71	27	.4540	.5095	1.963	.89101	63
10	.3283	.3476	2.877	.94457	50	10	.4566	.5132	1.949	.88968	50
20	.3311	.3508	2.850	.94361	40	20	.4592	.5169	1.935	.88835	40
30	.3338	.3541	2.824	.94264	30	30	.4617	.5206	1.921	.88701	30
40	.3365	.3574	2.798	.94167	20	40	.4643	.5243	1.907	.88566	20
50	.3393	.3607	2.773	.94068	10	50	.4669	.5280	1.894	.88431	10
20	.3420	.3640	2.747	.93969	70	28	.4695	.5317	1.881	.88295	62
10	.3448	.3673	2.723	.93869	50	10	.4720	.5354	1.868	.88158	50
20	.3475	.3706	2.699	.93769	40	20	.4746	.5392	1.855	.88020	40
30	.3502	.3739	2.675	.93667	30	30	.4772	.5430	1.842	.87882	30
40	.3529	.3772	2.651	.93565	20	40	.4797	.5467	1.829	.87743	20
50	.3557	.3805	2.628	.93462	10	50	.4823	.5505	1.816	.87603	10
21	.3584	.3839	2.605	.93358	69	29	.4848	.5543	1.804	.87462	61
10	.3611	.3872	2.583	.93253	50	10	.4874	.5581	1.792	.87321	50
20	.3638	.3906	2.560	.93148	40	20	.4899	.5619	1.780	.87178	40
30	.3665	.3939	2.539	.93042	30	30	.4924	.5658	1.767	.87036	30
40	.3692	.3973	2.517	.92935	20	40	.4950	.5696	1.756	.86892	20
50	.3719	.4006	2.496	.92827	10	50	.4975	.5735	1.744	.86748	10
22	.3746	.4040	2.475	.92718	68	30	.5000	.5774	1.732	.86603	60
10	.3773	.4074	2.455	.92609	50	10	.5025	.5812	1.720	.86457	50
20	.3800	.4108	2.434	.92499	40	20	.5050	.5851	1.709	.86310	40
30	.3827	.4142	2.414	.92388	30	30	.5075	.5890	1.698	.86163	30
40	.3854	.4176	2.394	.92276	20	40	.5100	.5930	1.686	.86015	20
50	.3881	.4210	2.375	.92164	10	50	.5125	.5969	1.675	.85866	10
23	.3907	.4245	2.356	.92050	67	31	.5150	.6009	1.664	.85717	59
10	.3934	.4279	2.337	.91936	50	10	.5175	.6048	1.653	.85567	50
20	.3961	.4314	2.318	.91822	40	20	.5200	.6088	1.643	.85416	40
30	.3987	.4348	2.300	.91706	30	30	.5225	.6128	1.632	.85264	30
40	.4014	.4383	2.282	.91590	20	40	.5250	.6168	1.621	.85112	20
50	.4041	.4417	2.264	.91472	10	50	.5275	.6208	1.611	.84959	10
					66						58
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
°						°					
32	.5299	.6249	1.600	.84805	58	30	.6225	.7954	1.257	.78261	
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	
30	.5373	.6371	1.570	.84339	30						
40	.5398	.6412	1.560	.84182	20	39	.6293	.8098	1.235	.77715	
50	.5422	.6453	1.550	.84025	10	10	.6316	.8146	1.228	.77531	
						20	.6338	.8195	1.220	.77347	
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	
30	.5519	.6619	1.511	.83389	30						
40	.5544	.6661	1.501	.83228	20	40	.6428	.8391	1.192	.76604	
50	.5568	.6703	1.492	.83066	10	10	.6450	.8441	1.185	.76417	
						20	.6472	.8491	1.178	.76229	
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	
30	.5664	.6873	1.455	.82413	30						
40	.5688	.6916	1.446	.82248	20	41	.6561	.8693	1.150	.75471	
50	.5712	.6959	1.437	.82082	10	10	.6583	.8744	1.144	.75280	
						20	.6604	.8796	1.137	.75088	
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	
30	.5807	.7133	1.402	.81412	30						
40	.5831	.7177	1.393	.81242	20	42	.6691	.9004	1.111	.74314	
50	.5854	.7221	1.385	.81072	10	10	.6713	.9057	1.104	.74120	
						20	.6734	.9110	1.098	.73924	
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	
30	.5948	.7400	1.351	.80386	30						
40	.5972	.7445	1.343	.80212	20	43	.6820	.9325	1.072	.73135	
50	.5995	.7490	1.335	.80038	10	10	.6841	.9380	1.066	.72937	
						20	.6862	.9435	1.060	.72737	
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	
30	.6088	.7673	1.303	.79335	30						
40	.6111	.7720	1.295	.79158	20	44	.6947	.9657	1.036	.71934	
50	.6134	.7766	1.288	.78980	10	10	.6967	.9713	1.030	.71732	
						20	.6988	.9770	1.024	.71529	
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	
							.7071	1.	1.	.70711	
										°	
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

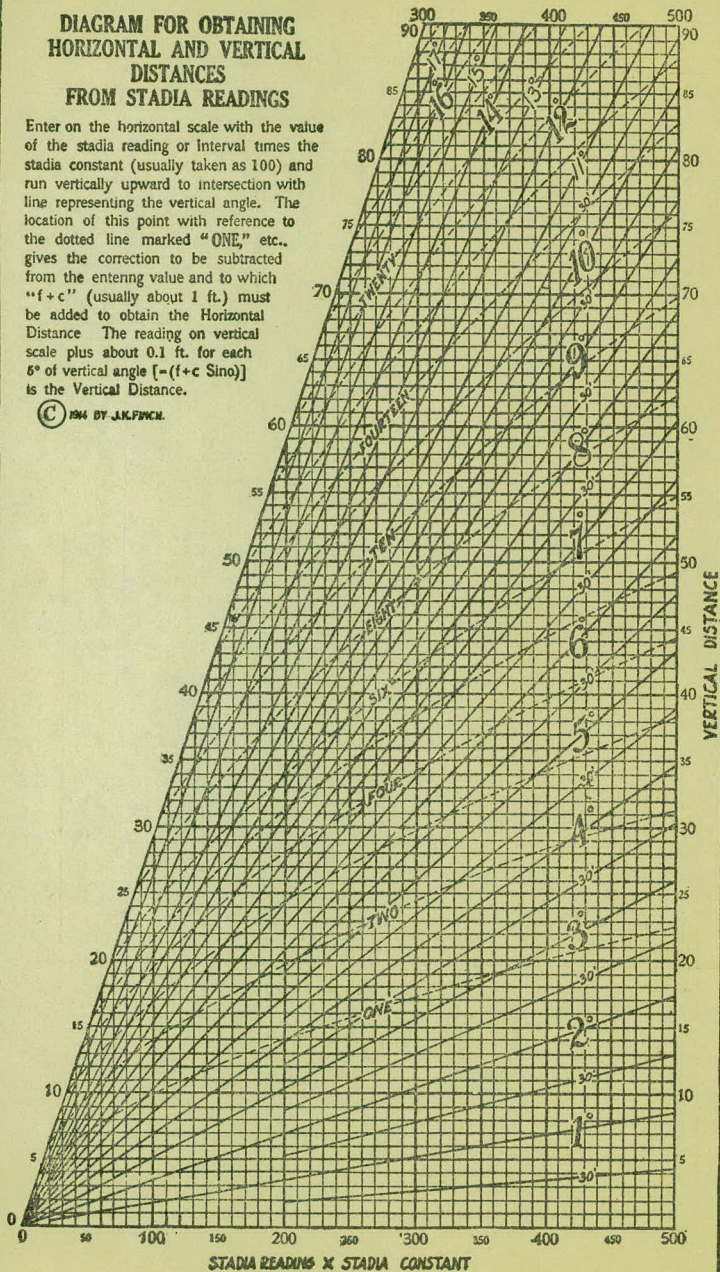
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

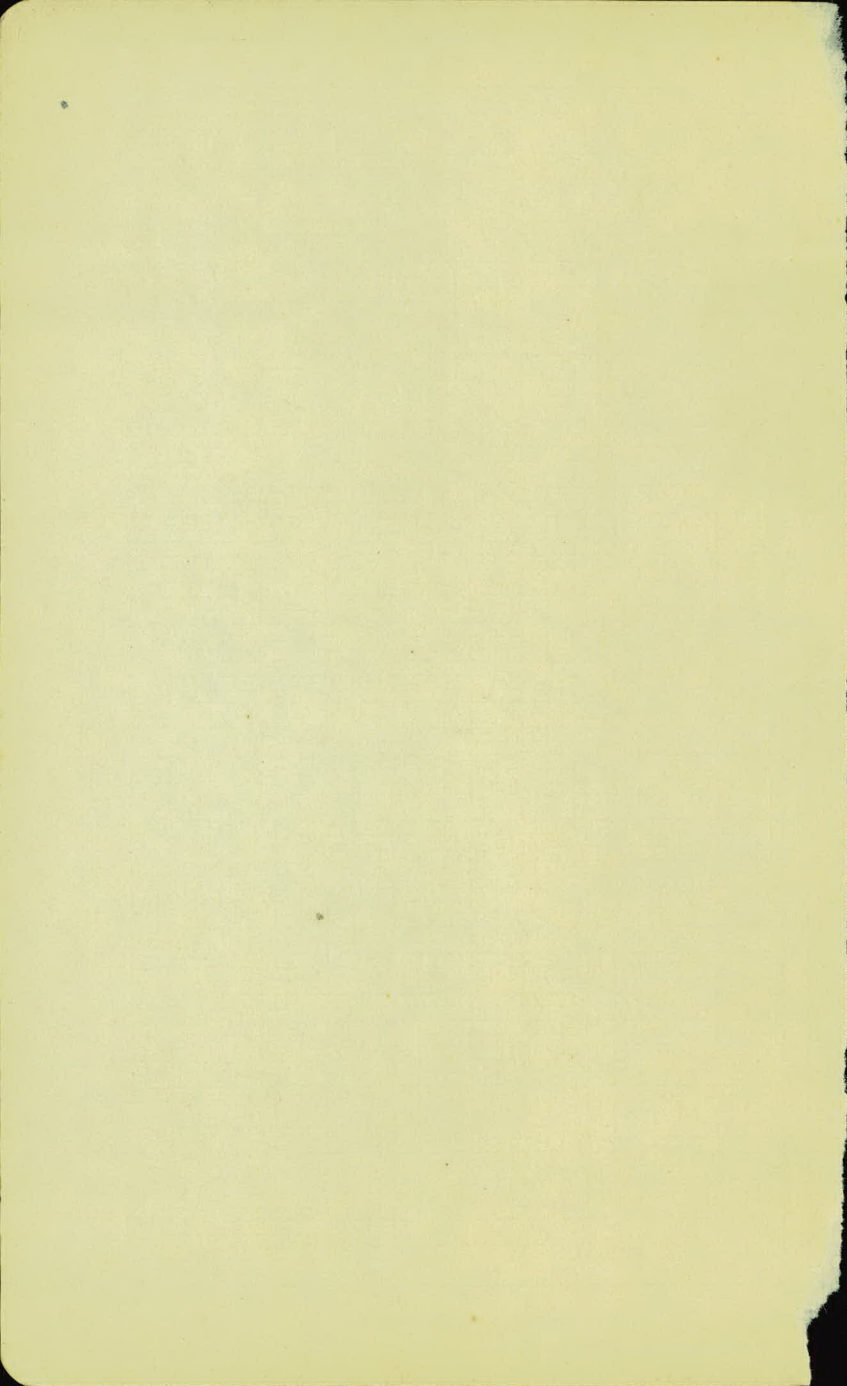
Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if $w = 16.2$ and $h = 5.3$, cu. yds. $= 1.48 + .028 + .089 = 1.597$ cu. yds. or practically 160 cu. yds. per 100 ft. If w exceeds 40 ft., use one half and multiply result by 2, if both w and h are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) $= h$, and $\frac{1}{2}$ the roadbed $= w$, add the triangles formed by taking the distance out to each break in turn ($= w$'s) by the difference between the cuts (or fills) on each side of it ($= h$'s) always subtracting the outer from the inner.

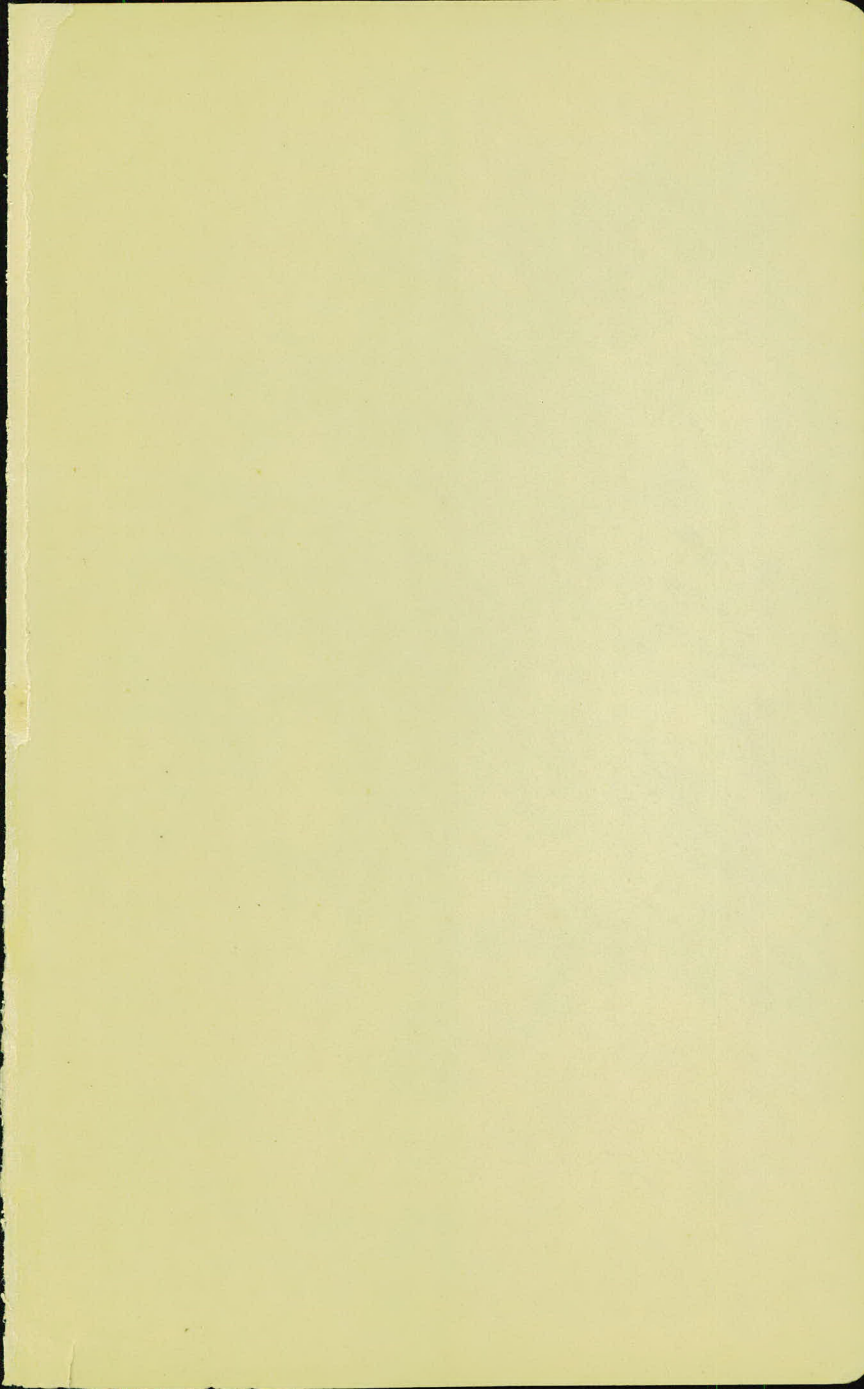
DIAGRAM FOR OBTAINING HORIZONTAL AND VERTICAL DISTANCES FROM STADIA READINGS

Enter on the horizontal scale with the value of the stadia reading or interval times the stadia constant (usually taken as 100) and run vertically upward to intersection with line representing the vertical angle. The location of this point with reference to the dotted line marked "ONE," etc., gives the correction to be subtracted from the entering value and to which " $f + c$ " (usually about 1 ft.) must be added to obtain the Horizontal Distance. The reading on vertical scale plus about 0.1 ft. for each 5° of vertical angle [$-(f + c \text{ Sino})$] is the Vertical Distance.

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U2469

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1½.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	25.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be $41.9 + (20 - 16) \times 2$ or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.