OFFICE OF
RAMSEY COUNTY ENGINEER
CONSTRUCTION NOTES
PRESCOTT CONNECTION

CO. PROJECT 23-60
FILE No. 4

ENGINEERS'
FIELD BOOK
No. 10403

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)÷2 or 2 ft. added to 30.6 =32.6. For slopes of 1 on 1½ see inside of back cover.

Book No 3

Proj. 4, 5, 6, 7, 3-60

10-11-24

sta 56+00 Bull
& 55+50 to Each.

BM Lower

(253/2) ← Elev 696.35 cup, 692.40 bolt → 253/3

Elev cup 690.7, 686.09 bolt.

dist 389.5 meters

253/4 {706.48 cup, 702.51 bolt. back of Cemetery

Data 1889

Index

..... Cross Sections .....

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

Inst. .....
Rod. .....
Chain. .....

Left	C	L	Right

X-Laveds-June Est. #2

Cross Sections

Sta.	B. S	H. I.	F. S.	Grade	Gr. R.
BM1	0.58	883.67		883.09	
93+75			8.0	875.7	
94			4.8	878.9	
94+50			6.6	877.1	
95			8.2	875.5	
95+50			6.5	877.2	
96			7.4	876.3	
96+35			7.8		

+50 = End Exc.

Inst.
Rod.
Chain.

6/24/24 Rain

2

Left	C	L	Right
8.7 / 23	80		7.3 / 18 8.7 / 21 8.8 / 27
Old Ground / 3	48		7.6 / 6 8.7 / 26
O. Ground / 4	6.6		7.4 / 3 7.5 / 16 8.3 / 20 8.3 / 25
O. Ground / 5	82		7.5 / 13 9.0 / 18 8.4 / 24
		6.5	6.6 / 15 7.5 / 17 8.0 / 25
		7.4	7.7 / 16 9.3 / 21 9.4 / 26
		7.8	7.7 / 15 9.5 / 20 9.6 / 23

X-Levels June Est. #2 Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M	12.68	861.09		848.41	
105+50					
105+25					
105					
TP	12.22	872.29	1.02	860.07	
104+75					
104+50					
104					
103+50					
103					
102+50					
102					
101+50					
101+30: End Excav. Abruptly					

Inst. Nesbitt
Rod. Ahlberg
Chain. Nelson — Dow

6/24/24

Left				C L		Right
Spike 15" Oak 50' L - 105+75						
			7.2 / 24	853.8 — 7.3		old Ground
3.0 / 25	3.2 / 7	5.4 / 3		855.7 — 5.4	4.0 / 19	old Ground / 26
				O. Ground / ℄	858.9 — 2.2 / 6	1.2 / 30
				O.Gr. / ℄	861.0 — 11.3 / 8	10.8 / 29
				0.G / 5	863.4 — 8.9 / 8	8.5 / 30
				0.G / 8	866.0 — 6.3 / 17	6.3 / 31
				0.G. / 4	867.7 — 4.6 / 7	4.7 / 28
				0.G / 5	868.8 — 3.5 / 8	3.5 / 29
				0.G / 2	870.2 — 2.1 / 5	1.8 / 29
				O.G. / ℄	870.9 — 1.4 / 3	1.0 / 26
		0.G / 4			871.4 — 0.9 / 2	0.8 / 24

×Levels for Zone Est. #2 ~~Cross~~ Sections

Sta.	B. S.	H I	F S.	Grade	Gr. R.
TP	11.36	844.46		833.10	
TP	11.50	855.02	0.94	843.52	
123			8.1	846.9	
122+75			4.3	850.7	
TP	2.10	854.21	2.91	852.11	
122+40			0.8	853.4	
122+20			0.9	853.2	
121+85			2.3	851.9	
121+65			3.0	851.2	
121+35			3.9	850.3	
120+80			6.5	847.7	
120+50			8.9	845.3	
120+25			9.8	844.4	

Rod. .....

Chain. ....

Left			CL		Right		
			8.1	6.4/8	3.9/14	4.8/18	4.2/33 toe
	10.0/21	6.6/7	4.3/2	4.3	3.8/10	4.9/12	4.7/30 toe
		0. Ground/15	0.8	0.4/7	4.7/11	4.7/29 toe	
	0. Ground 3.8/16	2.2/9	0.9	0.9/6	5.0/12	5.7/29 toe	
0. Ground 2.2/19	2.1/16	2.8/14	2.3	2.3/5	5.4/11	5.1/30 toe	
		3.4/18	3.0	3.2/5	5.9/11	5.7/31 toe	
	0. Ground/18	5.2/14	3.9	3.7/3	7.1/8	6.6/28 toe	
	0. Ground/24	7.3/17	6.5	8.7/7	8.3/30 toe		
	0. Ground/25	8.5/19	8.9	10.8/6	10.0/31 toe		
	0. Gr/20	10.4/19	9.8	11.9/6	11.6/30 toe		

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		854.21			
TP	0.45	845.55	9.11	845.10	
120			2.6	843.0	
119+70			3.8	841.8	
119+50			4.9	840.7	
119+25			7.0	838.6	
119			8.7	836.9	
118+50			11.6	834.0	
TP			11.03	834.52	
118+50					

Balance Complete.

Inst. Nesbitt
Rod. Ahlberg
Chain Nelson-Dorr

6/25/24

5

Left		C L	Right		
	5.2/18	2.6	4.9/7	4.4/29 ←	toe
	6.4/20	3.8	3.8/6	5.2/9	5.5/26 ← toe
	8.1/22	4.9	4.9/4	7.5/10	7.0/26 ← toe
10.1/21	7.7/12	7.0	7.0/5	8.2/15	8.3/25 ← toe
12.0/20	9.4/11	8.7	8.7/5	9.3/6	9.4/26 ← toe
15.2/20	12.8/2	11.6	11.4/28 ← toe		

X-Levels for Classification Borrow Pit

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	11.51	755.30		743.79	
1+10 = 000 of Rock					
1+25					
1+50			7.0	748.3	
1+75			5.0	750.3	
2+00			5.0	750.3	
2+25			6.0	749.3	
2+50			7.0	748.3	
+75 = 00 Rock					

Inst. .....
Rod. .....
Chain. .....

6/26/26

Left		C L	Right	
Spk 36 Tree - L - 35+30,				
	746.7			
8.0 / 19	8.6 / 6		11.0 / 14	9.5
	2.9 / 22	7.0	7.7 / 17	8.5
	0.0 / 18	5.0	6.0 / 8	7.7
	0.0 / 19	5.0	5.5 / 8	7.1
	1.4 / 23	6.0	6.5 / 7	6.6
	3.9 / 22	7.0		6.3

Levels for Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
TP	11.03	844.13		833.10	
TP	12.73	856.30	0.56	843.57	
B.M.			0.29	856.01 (856.33)	
TP	12.55	866.09	2.76	853.54	
122+20	00 of Rock.				
121+85					
121+65					
121+35					
120+80					
120+60					
120+25					
TP	0.41	855.48	11.02	855.07	
120+80					
120+64					

Inst.
Rod.
Chain.

Left	C L	Right	
Hub.			
Nail 6" twin oak. 75' R - 123+50			
	851.1 / 15.0 / 7	857.9 / 8.2 / 4.2	26.6
	848.6 / 17.5 / 16	858.1 / 8.0 / 4.4	26.9
	847.6 / 18.5 / 12	857.5 / 8.6 / 4.0	27.5
		860.6 / 5.5 / 4.7	28.5
		862.6 / 3.5 / 4.8	
		854.1 / 12.0 / 4.0	29.7

865
9.0 Present Elev. Rock
5 True " " old Ground at ℄.

(7.2) Present Elev. Rock
True Elev Rock old Ground

Cont from Page 7

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		855.48			
120+50					
120+75					
120+00	00 Rock Excav.				

Inst. ....

Rod. ....

Chain. ....

Left	C L		Right	
	843.8 / 11.7	Present Elev Rock. True Elev old Ground	54.5 / 1.0 / 36	18.6
	36.9 / 18.6		19.1	

Levels June Est. #2

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	4.90	861.23		856.33	
126+50			10.0	851.2	
126+75			8.5	852.7	
127			7.0	854.2	
127+50 = 00 for Classification			0.2	861.0	
TP	12.85	873.07	1.01	860.22	
128			7.6	65.5	
+25			6.0	67.1	
+50			4.1	69.0	
129			3.4	69.7	
+50			1.7	71.4	
130 = 00 for Classification			0.5	72.6	
+50			0.0	73.1	

Inst. .....
Rod. .....
Chain. .....

6/27/24

Left	C L	Right
0. Ground / 22 — 7.2 / 20	10.0	
0. Ground / 24 — 4.8 / 21	8.5	
0. Ground / 27 — 3.5 / 22	7.0	
0.1 / 29	0.2	1.1 / 25
top Rock: 7.0 / 31 — 6.5 / 26 — 8.7 / 7	7.6	8.2 / 15 — 13.2
top Rock: 4.9 / 32 — 5.8 / 15 — 6.8 / 8	6.0	7.0 / 35 — 12.0
top Rock: 3.0 / 33 — 4.0 / 32	4.1	6.2 / 33 — 10.6
top Rock: 1.7 / 32 — 3.4 / 30 — 3.4 / 21	3.4	4.7 / 28 — 8.2
top Rock: 1.3 / 29 — 2.5 / 28 — 2.2 / 21	1.7	3.1 / 26 — 5.7
1.7 / 26	0.5	1.7 / 27
0.8 / 26	0.0	0.0 / 24

Levels for May Est. #1

Gross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		873.07			
TP	11.08	883.70	0.45	872.62	
131+00	Profile Grade.				
	Balance Cut Complete to 136+00				
TP	11.53	894.07	1.16	882.54	
136+50			6.5	887.6	
137			4.5	889.6	
+50			3.8	890.3	
138			4.4	889.7	
+50			5.2	888.9	
139			6.5	887.6	
			5.37	888.70	

Balance to end project complete

Inst. Nesbitt
Rod. Ahlberg
Chain. Nelson Dow.

6/27/24

10

Left	C L	Right
8.6 / 22	6.5	6.5 / 29
6.2 / 27	4.5	3.2 / 31
5.2 / 26	3.8	3.9 / 30
5.7 / 27	4.4	2.6 / 30
7.0 / 26	5.2	5.1 / 27
7.7 / 26	6.5	5.8 / 26

(888.89 Elev. Spike a 10" Boxelder 75' R - 142+75

Levels for Proposed Grade Change

Gross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM	0.38	883.71			
130+50				872.36	11.3
130				869.86	13.8
TP	2.31	874.37	11.65	872.06	
129+50				867.36	7.0
129				864.86	9.5
128+50				862.36	12.0
128+25				861.11	13.3
128				859.86	14.5
TP	1.90	867.33	8.94	865.43	
127+75				858.61	8.7
127+50	End Rock Excav.			857.36	10.0
127				854.86	12.4
126+75				853.64	13.7
	4.59		20.59		

Inst. Nesbitt
Rod. Ahlberg-Nelson
Chain. Level

7/10/24

Left			C L	Right		
Nail in F.P. 35' R - 130 + 50 (El. 883.33)						
11.2 / 26	11.2 / 20	10.4 / 17	73.7 / 10.0	10.1 / 17	11.3 / 18	11.3 / 23
		12.0 / 25	74.0 / 9.7	13.4 / 3	13.8 / 16	15.2 / 18	15.2 / 23
		3.8 / 27	2.5 / 4	67.6 / 6.8	7.8 / 18	7.9 / 18	7.9 / 22
3.9 / 30	(top Rock) 7.0 / 4		4.2 / 4	67.0 / 7.4	9.4 / 4	9.1 / 22 ← top Rock
		← top Rock 5.3 / 31	4.4 ← / 4	64.1 / 10.3	12.6 / 5	12.5 / 23	(11.0 / 25 top R)
		← top Rock 6.0 / 32	6.5 ← / 4	61.7 / 12.7	14.5 / 3	14.4 / 23	(12.6 / 26 top R ←)
(top R 8.6 / 31	9.3 / 7	(top R 10.3 / 7)	6.9.4 / 14.0	15.9 / 8	15.3 / 23	(14.8 top R / 25 ←
		(top R 5.3 / 6)	88.8.0 / 9.3	9.7 / 15	10.3 / 17	10.4 ← / 21 top Rock
2.6 / 31	2.2 / 10					
	6.0 / 27	5.5 / 7	9.4 / 2	85.7.8 / 9.5	9.8 / 14	10.6 / 16	10.8 / 21
		11.9 / 20	5.5.1 / 12.2	11.7 / 16		
		14.3 / 19	5.4.2 / 13.1	13.5 / 17		

Cross Sections

Sta.	B.S.	H.I. 867.33	F.S.	Grade	Gr. R.
TP	2.15	856.46	13.02	854.31	
126+50				852.46	4.0
126+25				851.34	5.1
B.M.			4.65	851.81	
126				850.27	6.2
125+75				849.25	7.21
125+50				848.29	8.17
125+25				847.37	9.09
125				846.51	9.95
TP	0.15	844.56	12.05	844.41	
124+75				845.70	-1.1
124+50				844.94	-0.4
124+41				844.60	-0.04
124+25				844.23	0.33
124+07				843.70	

Inst. ....
Rod. ....
Chain. ....

Left				C L	Right	
	Old Ground / 23	5.6 / 21	4.0 / 7	852.8 / 3.7	3.6 / 18	
1.2 / 385	9.3 / 32	9.4 / 21	4.6 / 13	851.9 / 4.6	4.6 / 16.5	

Top Northeast Corner Cul. Coping 126+15 ?

{851.81 / 850.81}

Equation in Levels has been omitted here. Corner

Left				C L	Right	
			5.6 / 16	850.9 / 5.6	5.5 / 17	
			6.6 / 18	849.6 / 6.9	6.5 / 19	
			8.3 / 20	848.5 / 8.0	8.1 / 20	
			10.7 / 23	846.9 / 9.6	10.9 / 22	
			15.4 / 29	844.7 / 11.8	14.3 / 26	
		6.9 / 34	5.4 / 22	840.6 / 4.0	4.7 / 29	
		12.6 / 37	11.8 / 16	835.3 / 9.3	6.6 / 14	6.3 / 30
		12.8 / 37	11.8 / 16	835.4 / 9.2	6.5 / 15	6.0 / 30
13.4 / 41	11.3 / 14		7.3 / 8	837.6 / 7.0	5.2 / 9	5.7 / 28
		10.0 / 33	9.4 / 14	843.3 / 1.3	0.8 / 1	1.0 / 19

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
TP	10.34	844.56 854.07	0.83	843.73	
123+75				842.97	11.1
123+50				842.41	11.7
BM.	2.11	858.44		856.33	
123				841.46	
TP	1.33	851.53	8.24	850.20	
122+75				841.02	
122+40				840.78	
122+20				840.10	
121+85				839.51	
121+65				839.17	
121+35				838.60	
120+80				837.60	
120+50				836.94	
120+25				836.40	

Levels for sub grade Exc.

Inst. .....
Rod. .....
Chain. .....

Left			C L					Right
		15.9 / 26	15.5 / 9	842.3 / 11.8	10.3 / 3	10.1 / 18	13.3 / 23	13.4 / 31	old Ground / 32
			13.8 / 20	841.4 / 12.7	10.4 / 7	9.8 / 255		
Nail OAK 75' R. 123+50								
			16.0 / 20	42.6 / 15.8	15.8 / 3	9.1 / 7	8.0 / 31	
		6.4 / 20	8.1 / 17	43.8 / 8.0	8.0 / 3	1.0 / 10	1.0 / 31	
			8.5 / 23	43.9 / 7.6	7.6 / 3	1.0 / 8	1.7 / 29	
			9.0 / 23	42.8 / 8.7	0.6 / 10	2.4 / 20	2.2 / 29	
			9.3 / 25	42.3 / 9.2	1.4 / 9	2.4 / 30		
			9.4 / 26	41.8 / 9.7	1.9 / 7	2.9 / 29		
		10.5 / 24	10.7 / 8	44.0 / 7.5	4.5 / 8	3.8 / 27		
	1		10.8 / 19	41.0 / 10.5	5.0 / 5	4.5 / 26		
			11.7 / 18	40.6 / 10.9	7.5 / 7	7.3 / 29		
	15.0 / 22	15.2 / 17	14.7 / 15	37.4 / 14.1	8.3 / 5	9.2 / 29		

Levels for Subgrade Etc.

Cross Sections

Sta.	B.S.	H.I. 851.53	F.S.	Grade	Gr. R.
IP	2.95	841.82	12.66	838.87	
120				835.76	
119+70				835.10	
119+50				834.44	
119+25				833.80	
119				832.99	
118+50				831.41	
IP	2.51	834.22	10.11	831.71	
118+20				830.41	
118				829.75	
117+80				829.20	
117+50				828.20	
117+35				827.60	
117+20				827.10	
116+86.8				826.00	

Inst. .....
Rod. .....
Chain. .....

Left C L Right

6.0 / 21	5.9 / 17	4.7 / 14	37.2 / 4.6	4.6 / 3	00 / 8	00 / 29
7.4 / 21	6.8 / 15	5.8 / 13	36.4 / 5.4	5.4 / 3	1.4 / 10	1.2 / 27
8.5 / 21	8.2 / 16	6.5 / 14	6.0 / 5	35.4 / 6.4	7.7 / 15	
9.2 / 21	8.6 / 15	8.0 / 14	6.9 / 3	33.5 / 8.3	8.4 / 12	9.3 / 15	9.6 / 18
10.5 / 22	10.6 / 16	8.9 / 13	8.0 / 2	32.7 / 9.1	9.6 / 13	10.6 / 15	10.6 / 19
13.6 / 22	13.0 / 16	10.9 / 13	10.9 / 2	30.2 / 11.6	11.8 / 14	13.0 / 17	13.0 / 22
5.5 / 21	5.0 / 16	4.0 / 14	29.5 / 4.7	4.4 / 14	5.8 / 17	5.5 / 21	
6.9 / 22	6.1 / 17	4.9 / 15	29.9 / 4.3	4.8 / 17	5.3 / 20	5.4 / 25	
		6.4 / 23	29.5 / 4.7	5.0 / 23		
	6.0 / 23	5.0 / 2	28.5 / 5.7	6.4 / 23		

Grade

X-Levels for Rock Classification

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM	0.70	738.74		738.04	
TP	1.55	727.29	13.00	725.74	
27+90					
28+15					
+38					
+62					

Inst. Nesbit
Rod. Ohlberg-Nelson
Chain. Dorr

7/15/24

15

Left	C L	Right	
Nail Cottonwood 45' R-30+30			
top Rock 8.0 / 3	19.3 / 8.0	6.6 / 36	17.3
top Rock 7.3 / 4	20.6 / 7.3	4.3 / 33	16.6
top Rock 7.2 / 10	21.1 / 6.2	4.2 / 32	15.9

Levels for McBeth App. 110+50 L

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		833.91			
0+00 = Point 15' L 110+50					
0+25			2.4	831.5	
0+50			5.7	828.2	
0+75			7.7	826.2	
1+00			10.4	823.5	
TP	2.11	826.52	9.50	824.41	
1+25			6.1	820.4	
1+50			8.0	818.5	
1+75			9.0	817.5	
1+95			9.4	817.1	
2+15			10.3	816.2	
2+40			11.5	815.0	

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right

McBath Opp. Left 110+50 ..... Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		834.07			
0+00				831.9	2.2
0+04.3				831.9	2.2
0+25				831.9	2.2
0+50		Void		829.93	4.2
0+75				827.97	6.1
	2.40	826.5	9.95	824.12	
1				826.00	0.5
+25		See page 25		824.04	2.5
+50				822.07	4.4
+75				820.11	6.4
+95				818.54	8.0
2+15				816.97	9.5
+40				815.00	11.5

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
$\left(\frac{-1.5}{10.3}\right)\ \frac{3.7}{10.3}$	4.4	$\frac{4.9}{12.1}\ \left(\frac{-2.7}{12.1}\right)$
$\left(\frac{00}{8.0}\right)\ \frac{2.2}{8}$	2.5	$\frac{3.5}{9.8}\ \left(\frac{-1.2}{9.8}\right)$
$\left(\frac{-1.2}{9.8}\right)\ \frac{5.4}{9.8}$	5.9	$\frac{6.1}{10.4}\ \left(\frac{-1.9}{10.9}\right)$
$\left(\frac{-1.5}{10.3}\right)\ \frac{7.6}{10.3}$	7.8	$\frac{7.9}{10.7}\ \left(\frac{-1.8}{10.7}\right)$
$\left(\frac{-3.3}{13.0}\right)\ \frac{3.8}{13.0}$	3.0	$\frac{3.3}{12.2}\ \left(\frac{-2.8}{12.2}\right)$
$\left(\frac{-3.7}{13.6}\right)\ \frac{6.2}{13.6}$	6.1	$\frac{5.9}{13.1}\ \left(\frac{-3.4}{13.1}\right)$
$\left(\frac{-3.8}{13.7}\right)\ \frac{8.2}{13.7}$	8.0	$\frac{7.9}{13.3}\ \left(\frac{-3.5}{13.3}\right)$
$\left(\frac{-2.8}{12.2}\right)\ \frac{9.4}{12.2}$	9.0	$\frac{9.0}{11.9}\ \left(\frac{-2.6}{11.9}\right)$
$\left(\frac{-1.5}{10.3}\right)\ \frac{9.5}{10.3}$	9.4	$\frac{9.5}{10.3}\ \left(\frac{-1.5}{10.3}\right)$
$\left(\frac{-0.5}{8.8}\right)\ \frac{10.0}{8.8}$	10.3	$\frac{10.0}{8.8}\ \left(\frac{+0.5}{8.8}\right)$
$\left(\frac{00}{8}\right)\ \frac{11.2}{8}$	11.5	$\frac{11.2}{8}\ \left(\frac{00}{8}\right)$

7/22-24 Rock Levels 39 – 48

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
48					
47+50					
47					
46+50					
46					
45+50					
45					
44+50					
44					
43+50					
43					
42					

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
		3.3 Rock
		3.5 "
		3.6 "
		3.6 "
		6.0 "
		4.4 "
		4.6 "
		5.5 - 1.5 Dirt
		4.3 - 2.2 "
		3.5 0.5 "
		7.0 - 5.3 "
		5.0 "

4/22-24 Rock Levels 39-48

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
41+50					
39+70					
39+25					
39					

Inst.
Rod.
Chain.

Left	C L	Right
		5.6 - 4.5
		5.0 - 3.0
		6.0 - 1.3
		5.5 - 1.0

Levels for Joly Est. Borrow Pit

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	1.08	851.89		850.81	
TP	1.03	843.66	9.26	842.63	
120+15	Beginning Dalite on Lt.				
120+25					
120+80					
121+35					
121+65					
122+20					
122+40					
122+75					
+80	End Dalite on Lt				

Inst. ....
Rod. ....
Chain. ....

Left	C L	Right

Top Culv Coping.

0.6 ↓			
	$\frac{9.8}{37}$	$\frac{6.6}{32}$	$\frac{6.4}{18}$
0.6 ↓			
	$\frac{8.0}{40}$	$\frac{6.0}{37}$	$\frac{5.8}{17}$
	0.6 ↓		
		$\frac{53}{44}$	$\frac{5.1}{22}$
0.6 ↓			
$\frac{5.9}{54}$	$\frac{48}{51}$	$\frac{48}{46}$	$\frac{43}{23}$
		0.6.	
		$\frac{3.4}{43}$	$\frac{3.1}{22}$
		0.6 ↓	
		$\frac{2.7}{47}$	$\frac{25}{23}$
		0.6 ↓	
		$\frac{2.1}{36}$	$\frac{0.9}{16}$

X-Levels for July Est #3

Cross Sections

Sta.	B. S.	H I	F. S.	Grade	Gr. R.
BM.	0.28	738.32		738.0	
	0.20	726.53	11.99	726.33	
27+50 = Beginning Excav. July Est.					
27-79					
+90					
28					
+15					
+38					
+62					
+67					
29					
+60					
TP	8.31	728 64	6.20	720.33	
30 to 32					
32+~~70~~ 39+70					

Inst. Nesbitt
Rod. Nelson
Chain: Ahlberg-Dow

7/ 21

Left	C L	Right
	toe Slope 7189 / 8.5	toe 76 / 33
toe Slope 7.2 / 5	719.2 / 7.3	toe 8.0 / 33
toe 7.6 / 10	719.4 / 7.1	toe 7.5 / 30
toe 7.1 / 23	719.6 / 6.9	toe 6.7 / 31 Rock to Surface
6.4 / 33	720.3 / 6.2	8.0 toe / 31 " " "
toe 8.0 / 31 — 6.7 / 4	716.7 / 9.8	9.0 toe / 34 " " "
toe 8.0 / 32 — 4.7 / 4	716.7 / 9.8	9.0 toe / 34 " " "
5.3 / 30 — 5.6 / 3	716.8 / 10.2	9.5 toe / 33 " " "
toe 8.9 / 29	716.0 / 10.6	10.3 toe / 29

Cut 1.0 to Grade
" 0.0 to Grade

X-Lev'ds App. South Hertzell St 32t for July est

.... Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		728.64			
TP	6.65	735.11	0.18	728.46	
0+17					
+37					
+67					
+77					

Inst. ....
Rod. ....
Chain. ....

Left	C L	Right
+00	728.0	+00
6.9 / 14	7.1	6.9 / 16
6.7 / 14	728.3 / 6.8	6.2 / 16
5.8 / 13	729.1 / 6.0	5.3 / 16
5.6 / 13	729.4 / 5.7	5.3 / 15

July Est.

7/25/24 x Levels Rock 27+79 – 33

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	2.51	740.55		738.04	
27+79					
28+62					
28+67					
29					
29+50					
30					
30+25					
30+50					
31					
TP	5.61	743.65		738.04	
31+50					
32					

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
	30.8	17.3 / 39
	28.3	12.4 / 41
	28.1	12.4 / 40
	26.6	9.5
	24.1	8.3 / 39
	21.6	11.2 / 26
	30.3	10.2 / 33
	19.1	10.9 / 34
	16.6	9.0 / 34
	17.2	9.7 / 29
	14.7	8.5 / 22

x Level & Rock 27+79. 33

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
32+50					
33					

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
	12.2	8.5 / 74
	9.7	7.3 / 76

Levels for M.S.B.C.T. Approach

Cross Sections

Sta.	B. S.	H. I.	F. S.	Elev Grade	Gr. R.
B.M.	0.49	826.20		825.71	
0+25				821.5	
0+50				828.2	
0+75			0.0	826.2	
1			3.2	823.0	
+25			5.5	820.7	
+50			7.3	818.9	
+75			8.3	817.9	
2			8.7	817.5	
+25			10.0	816.2	
+50			11.7	814.5	
+75			13.3	812.9	
3			14.6	811.6	
+25			14.6	811.6	
+50			14.5	811.7	
B.M.		Elev:	832.98		

Inst. .....
Rod. .....
Chain. .....

7/28/24

25

Left	C L	Right

Tie point Nail 24" Oak 50' L ~ 110+50

McBeth App. 110-50

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM	3.50	829.21		825.71	
0+00				31.9	
0+25 -0.0				31.9	
0+50				30.15	-.10
0+75				28.40	0.8
1				26.65	2.56
+50 -7.00 %				23.15	6.06
2				19.65	9.56
P	0.60	818.81	11.00	818.21	
+25				17.90	0.9
+75 -6.2 %				14.80	4.0
3				13.26	5.55
+25				11.72	7.1
+50					

Void

See page 29

In. t. .....
Rod. .....
Chain. .....

7/28/24

Left	C L	Right
	16' Top.	
0.0 / 8	-0.3	-1.2 / 9.8
-1.6 / 10.4	-2.0	-2.2 / 11.3
-1.7 / 10.6	-2.2	-2.6 / 11.9
-3.2 / 12.8	-3.7	-3.4 / 13.1
-4.3 / 14.5	-4.3	-4.4 / 14.6
-2.4 / 11.6	-2.1	-2.9 / 12.4
-1.8 / 10.7	-1.7	-2.1 / 11.2
-2.7 / 12.1	-2.0	-1.7 / 10.6
-2.4 / 11.6	-1.6	-1.2 / 9.8
-0.6 / 8.9	-0.1	0.0 / 8.0

X-Sec for New Alignment
88 to 95

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
	7.66	882.40		874.74	
89				77.80	
+50				77.60	4.8
90				7740	5.0
+50				7690	5.5
91				76.10	6.3
+25				7562	
+50				75.15	7.2
PI	0.26	870.43	12.23	870.17	
92				74.20	8.2
+25				73.73	
+50				73.37	-3.06
+75				73.23	
93				73.40	3.0
PI	11.67	881.10	1.00	869.43	
+25				73.75	

200' V.C. - 17 : 0.60

200' V.C.

Inst. .....
Rod. .....
Chain. .....

8/1/24

Left	C L	Right
		−a7 2.0
−2.0 / 18.0	6.4 / 18.0 — 6.3 / 16 — 5.0 / 13 — 5.1	−0.5 1.0
(−4.1 / 17.7)	6.2 / 17.7 — 6.2 / 17 — 5.4 / 13 — 5.3	+0.1
(−0.1 / 17.9)	6.9 / 17.9 — 7.2 / 15 — 5.9 / 9 — 5.7	+0.7
(00 / 19)	6.9 / 16 — 7.5 / 15 — 7.5 / 10 — 6.6 / 6 — 6.4	+0.9 +0.9
(00 / 19)	8.2 / 18 — 8.7 / 17 — 8.3 / 10 — 7.4 / 6 — 7.2	+0.9
(7.0 / 38.5)	16.0 / 30.5 — 14.4 / 23 — 12.0 / 15 — 8.1 / 6 — 7.9	+0.7
−10.4 / 3		+0.4
−18.4 / 33.7		
−15.4 / 42.1		−0.3 2.1
		−0.4 2.2

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
93+25				73.75	
+50				74.47	
+75				75.30	
94				76.17	
+25				76.80	
+50				77.17	
+75				77.30	
95				77.17	
+25				76.80	

+4.8%

150' V.C.

-2.0%

Inst. ....
Rod. ....
Chain. ....

Left	C L	Right
		-0.4 2.2
		-0.6 2.2
		-1.1 2.2
		-1.1 2.44
		-1.0 2.0
		-0.8 2.0
		-0.7 1.2
		-0.4

X-Sec. M's Bch. App. L+110+50

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
	0.43	833.41			
0+00				831.90	1.5
+16					
+25				830.10	3.3
+50				828.30	5.1
+75				826.50	6.9
				824.70	8.7
TP	1.30	822.40	12.31	821.10	
+25				822.90	
+50				821.10	1.3
+75				819.30	
2+00				817.50	4.9
+25				816.5	5.9
+75				812.9	9.5
3				811.5	10.9
+25				811.7	10.7

-1.2 o/o

Inst. .....
Rod. .....
Chain. .....

Arrogons
2-Normons

29

8/5/24

Left	C L	Right
832.98		
+00 / 12	+0.0	+00 / 12
+1.8 / 13.8	+1.9 / 8 +1.5	+0.2 / 12.2
+0.4 / 12.4	0.0	+0.0 / 12
+0.3 / 12.3	-0.4	-0.5 / 8.8
-1.4 / 10.1	-1.7	-1.3 / 10.0
-2.4 / 11.6	-2.3	-2.2 / 11.3
-0.5 / 8.8	0.0	-0.6 / 8.9
-0.2 / 8.3	-0.3	-0.6 / 8.9
-0.6 / 8.9	00	00 / 8
-0.4 / 8.6	0.0	+0.5 / 8
-0.6 / 8.9	00	00 / 8

Levels for Classification

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM.	7.47	855.88		848.41	
106+50					
105+25					
IP	13.22	867.42	1.68	854.20	
105					
104+75					
104+50					
104					

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
18/26	4.0	4.0/25
on slope/0.0	0.6	on slope/0.0
10.0/on slope		10.8/on slope
7.8/on slope		9.0/on slope
45/on slope	4.2	
3.1/on slope	2.9	

8/11-24 Levels for Classification.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
	10.50	858.91		848.41	
105+60 = 00 Rock					
105+50					
105+25					
105 TP	10.54	868.84	0.61	858.30	
104+75					
104+50					
104+25					
104					
103+50					
103+20 = 00 Rock					

Note: 101+80 to 103+00 Ditch on Rt. is Rock.

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
3.8 / 24	7.6	8.1
3.0 / 26		3.2 / 29 — 6.8
1.3 / 30		2.6 / 27 — 5.6
9.5 / 28		9.4 / 29 — 14.2
5.5 / 29	5.9	4.7 / 29 — 13.0
4.0 / 30	5.0	3.5 / 29
4.0 / Stone	4.0	3.0 / 30 — 10.5
4.7 / 27		4.2 / 28 — 8.0

Add. X-Sec. Notes for Borrow Pit.

99+50 — Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
	7.48	880.18		872.70	
99+25 =	00 of Borrow				
99+50				76.30	3.9
100				75.17	5.0
100+50				73.80	6.4
101				72.17	8.0
TP.	1.34	874.04	7.48	872.70	
101+50				70.30	3.7
102				68.17	5.8
102+50				65.80	8.2
103				63.30	10.7
103+50				60.80	
104				58.30	
+25				57.05	
+50				55.80	

Inst. Nesbitt
Rod. Nelson
Chain. Ohlberg-Dow

8/12/24

Left | C L | Right

-3.0/68.9   -2.1/64   +0.6/45   +1.9/26.9

-3.0/71   -1.5/65   +4.4/37   (+4.8/29.8)   +4.9/29.8

-2.6/63   -1.6/61   -0.2/56   +2.7/44   (+4.7/29.7)   +5.1/29.7

-2.3/37.5   +0.2/30   (+1.0/26.0)   +1.7/26.0

-2.2/42.5   +0.6/35   (+2.0/27.0)   +2.8/27.0

-2.2/43.7   -0.9/41   +2.4/34   (+3.7/28.7)   +4.5/28.7

-2.2/59   +0.5/53   +3.3/47   +6.2/37   (+6.7/31.7)   +7.5/31.7

-2.2/64.8   +1.7/57   +4.9/50   +6.7/44   (+8.8/33.8)   +9.6/33.8

(+13.7/38.7)   +14.2/38.7

(+16.3/41.3)   [illegible]/41.3

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM. +0.3%	4.67	893.56		888.89	
140+50 ✓				87.65	5.91
141 ✓ 100' V.C.				87.54	6.02
+50 ✓ -1.8%				86.90	6.66
+70				86.58	6.98
142 ✓				86.23	7.33
+25 ✓ 100' V.C.				86.06	7.50
+50 ✓ 0.0%				86.00	7.60
+75				86.07	
+83				86.14	
143 ✓ 100' V.C.				86.33	7.23
+20				86.63	
+50 ✓ +2.6%				87.30	6.26

Cross Sections

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right
		+0.9
00 / 17.2		00 / 15
00 / 20		00 / 17
00 / 28		00 / 18
		+1.6 / 37
00 / 31		
+3.2 / 28		+3.6 / 30
00 / 20		00 / 17

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		89.56			
14+				88.30	5.26
	100' V.C.				
+50	-0.25%			88.70	

Inst. .....
Rod. .....
Chain. .....

34

Left C L Right

+0.9

Levels for Est. Dirt Moved for Cattle Pass
outlet 79+40 (Davis)

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. P
0+00 = End Apron Jo. End Pass					
0+44.5 End Grading					
B.M.	6.37	878.36		871.99	
0+00					
0+05					
0+15					
0+25					
0+44.5					

Inst. .....
Rod. .....
Chain. .....

35

8/19/24

Left			C L	Right		

Ke 36' Tree 65'L · 79+50

Top Floor End Apron

1.6 / 17	1.6 / 8	8.2 / 8	8.18	7.6 / 7	2.6 / 7	2.9 / 17
2.1 / 15	2.0 / 8	3.5 / 6	5.7 / 5	6.7	5.3 / 4	3.4 / 5	2.2 / 9	2.1 / 15
3.0 / 14	2.7 / 9	4.8 / 4	4.3	4.2 / 5	3.1 / 8	3.0 / 15		
4.6 / 16	4.2 / 8	6.5 / 5	6.6	3.8 / 12	4.1 / 21			
	6.6 / 10	9.0 / 6	8.6	7.9 / 10				

Levels for Ent to Cattle Pass 48+50

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. F
BM.	0.67	817.54		816.87	
TP	0.57	808.38	9.73	807.81	
0+00	Point 25' N. of N end Cattle Pass.				
0+20					
0+40					
TP	4.76	812.57	0.57	807.81	
0+60					
0+70					
BM.	6.00	798.83		792.33	
0+00					
0+20					
0+40					
0+60					
0+76					

Inst. ....
Rod. ....
Chain. ....

8/30/24 36

Left | C L | Right

801.6
10.2 / 73 — 6.8 / 7
04.9
Abrupt 7
7.0 / 30 — 3.5 / 8
Abrupt.
07.5
3.5 / 25 — 0.9 / 9 — 0.9 / 5
06.0
6.8 / 10 — 6.6 / 4
05.4
14.7 / 15 — 14.6 / 5 — 7.2 / 6
89.6
11.1 / 20.5 — 11.1 / 18 — 8.7 / 14
92.9
8.0 / 29 — 8.3 / 17.5 — 7.1 / 17 — 5.4 / 17
96.4
6.9 / 31.5 — 6.5 / 21 — 1.9 / 10
98.8
6.2 / 20 — 4.3 / 17.5 — 3.0 / 13.5 — 2.1 / 13 — 1.6 / 11 — 00 / 10 — 00 / 6

Same

Slope Stakes Hanson Dpp 46+00 Lt

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM.	4.94	782.01		777.07	
46+00 Begin App.				782.1	-0.1
+50				777.1	
47				772.1	

Inst.
Rod.
Chain.

Left	C L	Right
F 12.2 / 56.3		
F 8 ℄ / 60		
F 00 / 51.8		

Levels to Est Amount Left at Under Xing 27+60

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	3.84	741.88		738.04	
TP	1.86	731.08	12.66	729.22	
0+00 - 27+68 S			4.4	726.7	
			4.-		
0+05-S			4.7	726.4	
0+10-S			5.2	725.9	
0+20-S			3.0	728.1	
0+30-S			2.9	728.2	
0+50-S			2.8	728.3	
0+60-S			2.7	728.4	
0+00-N			5.1	726.0	
0+20-N			3.2	727.8	
0+30-N			3.3	727.8	
0+38-N			3.4	727.7	
0+45-N			3.3	727.8	
0+60-N			3.2	727.9	

Inst. ....
Rod. ....
Chain. ....

9/4/24

Left | C L | Right

Spike Cottonwood 45 R - 30+30

toe/20 12.9/8 4.4/4.5 **4.4** 4.4/4 13.0/9 toe/17

toe/20 12.4/10 5.0/7 **4.7** 4.7/4 12.2/6 toe/16

toe/22 9.7/10 3.2/6 5.4/5 **5.2** 5.7/5 10.4/8 toe/17

toe/21 8.8/13 3.8/10 **3.0** 3.3/4 7.8/9 toe/19

Back Slope

8.5/23 5.0/15 3.0/5 **2.9** 3.7/5 10.0/10 toe/19

B. Slope

3.0/7 2.5/5 **2.8** 3.2/5 10.4/12 toe/22

2.7 3.1/8 on B. Slope 10.1/18 on Slope toe Slope 25

toe/25 12.4/10 5.6/5 **5.1** 5.5/5 toe/21

on Slope

12.3/30 11.0/13 3.7/5 **3.3** 3.7/6 17.0/11 toe/25

on Slope

10.0/22 9.6/12 3.4/5 **3.3** 3.1/6 9.3/10 toe/25

6.3/18 7.6/15 7.5/11 3.3/5 **3.4** 3.3/7 8.6/10 toe/25

Back Slope

5.1/12 3.3/4 **3.3** 3.5/8 8.4/10 toe/21

3.2 3.5/25 Back Slope 10.4/15 on Slope

Levels to Est. Sub-Grade Ex.

28 to 34 Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	0.25	744.04		743.79	
34+00					
+50					
33+00 T.P.	1.10	732.64	12.50	731.54	
+50					
32+00					
+50					
31+00					
+50					
T.P.	7.09	727.59	12.14	720.50	
+ 25					
30+00					
+50					
29+00					

Inst. Nelson
Rod. Ahlberg
Chain. Dorr

44¹

9/8/24

Left	C L	Right
Tree Lt. 35+50		
2.6/28 7.7/24 7.7/22.5 5.3/14	6.8	5.3/19 7.8/22 3.5/26.5
3.1/31 8.8/25 8.8/21 7.5/16.6	8.0	8.1/16 10.5/20 4.4/21
2.4/32.5 11.8/24 17.0/20.5 10.2/15	11.4	11.6/13 17.0/15 12.0/23 5.7/29
0.0/26 7.3/22 7.4/18 1.8/10.5	1.4	1.3/17 2.3/20 2.3/25.5 0.0/28.5
4.6/29	4.4	3.9/17 4.7/19 5.2/25 0.0/30.5
0.0/30.5 7.9/23 8.1/19 7.7/15	7.7	7.7/17 8.6/21 8.3/25 0.0/33
0.0/36 10.6/17 11.0/22 9.9/18	10.1	10.5/9.5 11/10.5 11.0/12.0 10.6/13 11.7/17 11.9/23 0.0/34
0.7/37 12.6/29 17.9/17 12.6/14	17.4	11.9/18 13.0/23 12.8/26.5 0.0/40
0.0/30 4.9/23 4.0/15 3.4/14	3.4	2.7/17.5 3.4/22 3.3/28 0.0/32.5
6.0/31 6.0/29 5.9/20 4.8/16	4.5	3.4/19 4.0/21 2.3/30 0.0/33
0.0/35.5 7.4/27 7.6/18 6.8/16.5	6.6	5.8/19 6.4/20 5.6/27 0.9/36
0.0/35 9.4/24.4 9.3/19.5 8.1/17	8.0	7.6/19 8.6/23.3 8.6/29.9 0.0/37

Levels for E st. Sub-Grade EX.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
+67					
+ 62					
97 +50					
+ 38					
+ 15					
78+00					

Inst. Nelson
Rod. Kahlberg
Chain 2

9/8/24

Left				C L	Right			
0.0/34	9.5/24	9.4/16		9.3	8.7/19	10.2/27.2	10.7/26	0.0/36
1.8/34	10/24	10.4/20	9.4/16	9.4	9.3/19	10/21	10.1/26.6	0.0/37
4.1/34	10.3/24	10.3/18	9.9/15	10.9	1.0/18	11/22	10.5/28.8	0.0/37
					10.2/19.5	11/22	9.6/31	0.0/39
0.0/36	11.6/25.5	11.4/21	10.1/16	10.6				
	0.0/25.5	10.7/14		11.7	11.1/28	0.0/37		
	0.0/17.5	10.8/5		11.8	11.3/26.5	0.0/37		

Elevations to figure P3-Grade -55+45

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
BM.	7.10	775.64		768.54	
0+00	300' & end 24' P3 -55+45		8.8	766.8	
0+11			9.6	766.0	
0+30			13.4	762.2	
0+50			9.2	766.4	
0+70			3.4	772.2	
TP	10.90	786.11	0.43	775.21	
0+85			7.4	778.7	
1+00			2.0	784.1	
TP	12.70	798.61	0.20	785.91	
1+20			8.7	789.9	
1+45			5.0	793.6	
1+68			1.1	797.5	

Inst. Nesbit

Rod. Nelson

Chain. Ohlberg-Dow

9/9/20

Left	C L	Right

For Estimate on 'B' Line

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
56+25					
56+50					
56+75					
57					
57+25					
57+50					
57+75					
58					
58+25					
58+60					
58+85					

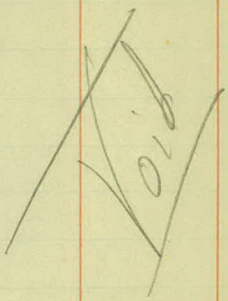
Inst. .....
Rod. .....
Chain. .....

9/13/24

Left			C L	Right				
			(2.0')					+0.8
-18.3 / 45.8			-9.8	~~-5.4 / 18.6~~	-3.8 / 21.7			
			(5.2')					
-6.4 / 25.6			-2.5	~~-2.8 / 2.0~~	~~+2.5 / 3.3~~	+8.3 / 32.5		
			(9.3')					
+1.4 / 27.2			+7.8	+11.3 / 14.7	+13.8 / 25	+19.1 / 41	+22.3 / 46.5	
			(12.0')					
+1.1 / 26.9			+11.1	+16.1 / 15	+24.0 / 33	+26.3 / 21.5	+26.2 / 50.4	
			(14.6')					
-6.5 / 25.8	+0.7 / 14		+6.5	+12.9 / 14	+18.1 / 28	+21.3 / 36	+26.7 / 51.7	
			(16.7')					
-23.3 / 57.3	-17.4 / 38	-8.5 / 16	-0.7	+6.6 / 17	+13.1 / 31	+19.3 / 46	+18.0 / 42	
			(18.0')					
51. / 66.5	-27.3 / 50	-21.3 / 29	-17.4 / 19	-14.0 / 11	-9.0	+2.1 / 12	+8.3 / 29	+14.1 / 42	+12.9 / 37.9
			(19.0')					
	-24.0 / 56.0	-21.7 / 26	-17.0 / 14.7	-3.2	+5.8 / 18	+13.5 / 34	+19.0 / 45	
			(16.8')					
-10.0 / 33.0	~~-5.5 / 41.5~~	~~-11.2 / 32~~	-7.2 / 16	+1.5	+4.7 / 6	+12.0 / 20	+23.2 / 48.2	
			(17.0')					
	+4.4 / 29.4	+8.1 / 18	+14.4	+19.9 / 17	+23.6 / 28	+28.6 / 44	+29.4 / 54.4	
			(15.0')					
	+11.2 / 36.2	+14.2 / 24	+21.7	+25.8 / 18	+28.1 / 26	+30.0 / 55.0		

..... Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
59+05					
59+25					
59+50					
60					
60+20	Same				



Inst. .....
Rod. .....
Chain. .....

Left					C L	Right		
+4.0 / 90	+7.0 / 57	+9.0 / 50	+13.2 / 38.2		+25.3	+28.0 / 14	+29.4 / 54.4	
+4.0 / R.W	+7.0 / 50	+12.5 / 37.8	+16.5 / 27	+20.1 / 15	+24.1	+26.1 / 14	+26.1 / 51.1	
+4.7 / 100	+10.3 / 66	+18.0 / 35.0	+12.8 / 25	+7.0 / 16	+7.0 / 5	+12.4 / 16	+28.4 / 22	+23.0 / 48.0
	+2.3 / 27.3	+4.3 / 21	+2.3 / 24	(9.0) +3.3	+3.1 / 13	+10.8 / 24	+10.8 / 35.8	

Levels for Form App. Lt 104I

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
BM.	7.7	856.11	848.41		
TP	12.13	867.89	0.35	855.76	
TP	7.76		2.02	865.87	
0+00	00 of Excav.				
0+08					
0+25					
0+50					
0+62					
0+70	= 00 of Excav				

Levels for Form App. Lt 104I
to Est. Ydg.

~~TP~~ 0	7.76			865.87	
0+08					
0+25					
0+50					
0+62					
0+70	00 Excav				

See page 54 This Book

Inst. .....
Rod. .....
Chain. .....

9/5/24

Left	C L	Right
11.0 / 6	3.4	1.4 / 20
8.8 / 6	3.7	2.1 / 15
6.0 / 10	3.0	0.6 / 8
4.2 / 8	2.1	0.2 / 7

H.U.6.

11.0 / 6	10.6	10.3 / 7	Old Ground / 2.0
8.9 / 6	8.7	8.5 / 8	O.G. / 15
6.0 / 10	5.7	5.7 / 4	O.G. / 8
4.2 / 8	4.0	3.9 / 4	O.G. / 7

New Grade- 55+00 to 63+08

55 to 67 Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. F
B.M.	4.00	819.72		815.72	
56+00				823.70	-4.0
+25				824.87	-5.2
TP	12.19	831.73	0.18	819.54	
+50				826.05	5.6
+75				827.27	4.5
57				828.40	3.3
+25				829.57	2.1
TP	0.67	821.23	1.17	820.56	
+50				830.75	-9.5
+75				831.92	-10.7
58				833.10	-11.9
TP	11.38	831.94	0.67	820.56	
+30				834.51	-2.6
TP	11.23	843.00	0.17	831.77	
+60				835.91	7.1
TP	12.73	855.58	0.15	842.85	

Inst. Nielsen
Rod. Nelson
Chain Gilberg-Don

9/17/24

	Left	C L	Right	
	Spike Oak 10' R-54-75			
1.1	-28.5 / 60.7 (1.4 SHK)	(1.0 SHK) -24.7	-12.9 / 36.5 (0.6 SHK)	+0.9
1.1	-19.4 / 46.8 (0.9 SHK)	(0.5 SHK) +0.6	+8.6 / 23.8 (0.8 SHK)	+0.9
1.1	-7.1 / 25.8 (0.6 SHK)	(0.3 SHK) -3.3	+19.4 / 34.4	+0.9
	56+88.00 / 25			
-0.8	+2.3 / 27.3			+0.8
-0.8	+3.3 / 28.8			
-0.8	00 / 25			
-0.8	-19.3 / 32.9 (0.9 SHK)			
-0.8	-25.1 / 55.9 (1.7 SHK)			
-0.8	-23.4 / 52.5 (1.1 SHK)			
-0.5	-11.0 / 54.0 (1.0 SHK)			
	144+00 / 25			
-0.3	+5.2 / 30.2			

VOID

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
		855.58			
58+85				837.10	18.5
59				37.80	
59+05				838.03	17.6
59+25				838.92	16.7
59+50				839.97	15.6
+75				840.84	14.8
FP	2.81	845.85	12.54	843.04	
60				841.77	4.1
+50				843.20	2.7
61				844.26	1.6
+50				845.14	0.7
62				846.02	-0.1
B.M.			8.14	837.71	
FP	12.01	856.44	1.42	844.43	
60+00				841.77	14.6

Inst.
Rod.
Chain.

	Left	C L	Right	
-0.2	+11.7 / 36.7			
0.4	+13.6 / 38.6			
-0.4	+12.0 / 41.5 (Old brick chimney Bad house Some dist.)			
-0.4	+8.9 / 38.3 "			
-0.6	+4.8 / 34.2 "			
0.7	+0.4 / 29.8 -1.4 / 18.0 "			
-0.7	+7.5 / 28.1 (0.8 Shot) 30' top		(0.8 Shot) -8.8 / 27.0	+0.7
-0.7	-3.9 / 21.0		-4.9 / 16.5	+0.7
-0.7	-2.5 / 17.0		-3.7 / 19	+0.7
	-1.0 / 16		-1.3 / 18.0	
Nail 10" Butternut 60' R - 66+60				
			+5.5 / 30.5	+0.7

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
		856.44			
59+75				840.84	15.6
PI	11.06	866.84	0.66	855.78	
59+50				839.97	26.9
59+25				838.92	27.9
59+05				838.03	28.8
58+85				837.10	29.7
58+60				835.91	30.9
58+30				834.51	32.3
58+00				833.10	33.7
57+75				831.92	34.9
TP	4.10	860.54	10.40	856.44	
57+50				830.75	29.7
57+25				829.57	31.0
57+00				828.40	32.1

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right	
		+10.7 / 38.7	+0.6
		+18.1 / 43.1	+0.4
		+22.9 / 47.9	+0.2
		+25.0 / 50.0	0.0
		+26.1 / 50.0	+0.2
		+26.5 / 50.0	+0.3
		+25.1 / 50.1	+0.5
		+24.7 / 49.7	+0.8
		+20.7 / 45.7	+0.8
		+23.8 / 48.8	+0.8
		+26.2 / 50.0	+0.8
		+23.2 / 48.2	+0.8

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Cr.
		860.54			
56+75				827.22	3.3.3
56+50				826.05	

Inst. ....

Rod. ....

Chain. ....

Left	C L	Right	
		+23.2 +18.2	+0.8

Levels for Classification

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM.	1274	82846		81572	
P	4.22	83203	0.65	827.81	
53+75					
53+50					
53+25					
53					
52+85					
52+75					
52+60					
52+50	Begin Solid Rock Ledge				
P	2.34	82657	784	82419	
52+15	Loose Rock				
52					
~~51+75~~					
51+75					
51+50	total loose				
51+25	total solid				

Nesbitt
Rod: Nelson
Chain: [illegible]

9/18/24

Left	C L	Right	
Parallel.	Hold Ground to Shldr.	7.7 / 31.0	17.6
✓	"	10.3 / 25.5	18.6
✓	"	6.8 / 34	19.5
✓	"	5.4 / 35	20.4
✓	"	6.0 / 37	
✓	"	9.8 / 34.5	21.3
		12.6 / 32	21.8
		10.0 / 35	
		10.0 / 34	
		9.4 / 36	

Levels for Est of Sub-Grade Excav.

Cross Sections

Sta. Sta.	B. S.	H. I.	F. S.	Grade	Gr. P
BM.	6.21	783.28		777.07	
45				777.3	6.0
44+50				774.9	8.4
44				772.5	10.8
43+50				770.1	13.2
TP	2.0	779.68	12.60	770.68	
43				767.9	4.8
42+50				765.7	7.0
42				763.6	9.1
41+50				761.5	11.2
BM.	6.21	783.28		777.07	
TP	10.80	792.38	1.70	781.58	
45+50				779.7	12.7
46				782.1	10.3
+50				784.5	7.9
47				786.9	5.5
+50				789.3	3.1
48				791.7	0.7

Inst.

Rod.

Chain.

Left	C L	Right	
		6.8 / Shldr.	(0.8 low)
		9.3 / Shldr.	(0.9 low)
		11.4 / Shldr	(0.6 low)
		13.2 / Shldr	(Grade)
		4.8 / Shldr	(Grade)
		6.6 / Shldr	(0.4 high)
		10.1 / Shldr	(1.0 low)
		11.9 / Shldr	(0.7 low)
		13.7 / Shldr	(1.0 low)
		11.6 / Shldr	(1.3 low)
		9.4 / Shldr	(1.5 low)
		6.6 / Shldr.	(1.1 low)
		3.9 / Shldr	(0.8 low)
		2.0 / Shldr	(1.3 low)

X-Levels For Sept. Est. on Under Pass 27+

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM.	3.43	741.48		738.04	
PI	2.28	730.88	12.88	728.60	
0+60-S			2.4	28.5	
0+50-S			2.5	28.4	
0+30-S			2.8	28.1	
0+20-S			11.5	19.4	
0+38-N	- Some				
			3.9	27.0	
0+30-N					
			11.7	19.2	
0+20-N					
0+09-N			#1		
PI	2.03	720.60	12.31	718.57	
0+10-S			71	13.5	
			~~86~~		
0+05-S			86	12.0	
0+00			10.7	09.9	

Inst. .....
Rod. .....
Chain. .....

J-1

9/31

Left				C L	Right			
0.6.7			0.6.7					
6.8 / 20	5.1 / 11.5	2.5 / 7.0		2.4	2.9 / 8.0	8.8 / 10.5	8.8 / 18.5	
6.7 / 20.0	7.2 / 19.0	5.8 / 12.5	4.3 / 10.0	3.6 / 7.5	2.4 / 4.0	2.9 / 9.0	6.3 / 10.0	10.6 / 13.0
8.4 / 21	11.6 / 18.0	12.6 / 9.5	8.5 / 8.0	6.2 / 5.5	2.6 / 5.0	2.8	2.9 / 2.0	11.7 / 6.0
11.7 / 12.0								
10.5 / 26	12.7 / 24	12.7 / 19	11.7 / 5.0	11.5	11.9 / 5.0	12.0 / 13.0		
				~~3.9~~				
	9.0 / 12	5.7 / 7		3.9	10.5 / 3	10.5 / 12		
	7.7 / 7.5	10.1 / 5		11.7	13.5 / 13			
		7.3 / 8						
9.3 / 26	8.0 / 14	R7 4.4 / 7.0	5.2 / 1.0	7.1	6.5 / 13	9.0 / 18	(R7 / 44)	
11.2 / 3.10	9.9 / 18	8.7 / 6		8.6	10.1 / 5.0	10.1 / 10.0	8.7 / 12	7.3 / 13	9.2 / 20
11.5 / 35	9.8 / 19	10.3 / 14		10.7	10.6 / 8	8.8 / 9	7.5 / 15	9.0 / 20

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		72060			
0+09-N			7.5	13.1	
0+20+N					

Inst.
Rod.
Chain.

V-2

Left	C L	Right
9.1 / 24	6.0 / 13	7.5 (RB 3.5)
		11.9 / 36
9.4 / 20		11.3 / 26

Levels Sept Est.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
59+75					
59+50					
59+05					
58+85					
58+60					
58+30					
58					
57+75					
57+50					
57+25					
57					
56+75				Grade 1½:1 on R.	
56+50					
56+25					
56					

Inst.
Rod.
Chain.

53

9/3/24

Left	C L	Right
+3.7 / 29		+3.2 / 5 (1:1)
+6.0 / 30	+6.0 / 5 (1:1)	
+7.0 / 29	+6.5 / 13	+6.0 / 5 (1:1)
+4.5 / 30	+4.5 / 20 (1:1)	
+0.0 / 30	-2.0 / 27	-3.0 (1:1)
	Level (1:1)	+12.0 / 20
	Level (1:1)	+12.0 / 23
	Level (1:1)	+12.0 / 20

Finals ..... Cross Sections

Levels to Est. Excav. Farm X-ing

Lt 10 ± 1

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM.	2.69	876.90		874.21	
TP.	8.38	874.94	10.31	866.59	
0+00	00 of Excav.				
0+07					
0+25					
0+50					
0+75					
1+00					
1+15	00 of Excav.				

Inst. Yoshith
Rod. Galvin
Chain. Fibberg

9-30-24

54

Left	C L	Right
Spk. 12" Oak 33' Lt. 99+15		
0.6 Z 12.5/8	12.1	12.4/6 3.1/19 0.6 ←
0.6 Z 10.4/6	10.8	10.9/6 2.9/18 0.6 ←
0.6 Z 7.7/8	7.7	7.7/6 8.8/8 1.6/15 0.6 ←
0.6 Z 4.7	4.7/6	5.6/8 1.0/14 0.6 ←
0.6 Z 3.4		3.5/8 1.0/10 0.6 →

X Levels for Borrow Pit Sta 58+50-60+00

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	10.70	848.41		837.71	
T.P.	6.03	845.69	8.75	839.66	
58+60	834.3			13	13.4
+85	833.7				12.5
59+05	834.0				11.7
+25	834.7				11.0
+50	835.6				10.1
+75	836.5				9.2
60+00	837.5				8.2
T.P.	4.83	844.52	6.00	839.69	
BM			6.80	837.72	O.K.

old grades used for plotting on X sect.

Inst. Cooper
Rod. Stangeland
Chain. Ahlborg - Galvin

10/6/34

Left				C L		Right
Nail in Tree 60 + 60 50' Rt.						
14.2 / 100.0	12.7 / 91.	11.4 / 70.	11.4 / 57.0	10.5 / 47.4	✓	
	7.5 / 100.0	5.3 / 91.0	3.7 / 65.0	1.2 / 50.0	✓	
		6.8 / 100.0	2.7 / 70.0	0.6 / 59.0	✓	
	7.3 / 100.0		2.9 / 71.0	0.0 / 56.0	✓	
13.0 / 100.0	9.6 / 79.0	6.1 / 64.0	1.5 / 50.0		✓	
	13.00 / 73.7	4.6 / 50.0	0.5 / 34.2		✓	
			12.7 / 51.0			

Y Levels for Weekly Est. 10-1-24

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM	9.35	842.06		837.71	
60+00				837.5	9.6
59+50				835.6	11.5
+25				834.7	12.4
+05				834.0	13.0
59+85				833.2	13.9
+60				832.3	14.8
58+00	appears to be Zero Rock.				

Inst. Skoog
Rod. Galvin
Chain. Fritz

Left ~~Left~~ Rt.		C L		Right ~~Right~~ Lt.			
+1.0 / 15.0	6.7 / 4.5	6.4 / 0.0	6.0 / 12.0	6.0 / 16.0	8.2 / 24.0	9.1 / 41.0	11.5 / 46.0 ← O.G.
	O.G. / 23.0	7.7 / 5.0	7.7 / 00	7.7 / 18.0	9.0 / 29.0	9.2 / 57.0	7.8 / 65.0 ← OG
OG / 27.0	R. +6.2 / 20.0	8.4 / 3.0	8.4 / 00	8.4 / 30.0	8.3 / 55.0	3.0 / 64.0 ← OG	
OG / 30.0	+4.0 / 20.0 R	9.0 / 10.0	9.0 / 00	8.5 / 27.0	10.5 / 32.0	10.5 / 45.0	1.7 / 60.0 ← OG
O.G / 23	2.0 / 10.0 R		8.2 / 00	9.0 / 21.0	11.0 / 24.0	11.0 / 57.0	5.3 / 65.0 ← OG
OG / 25	2.0 / 13.0 R		9.4 / 00	9.4 / 16.0	11.0 / 19.0	12.0 / 47.0	12.7 / 57.0

cut aprox exc. to here

(R indicates top of Rock)

X Levels for Weekly Est.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
Base	1.68	739.72		738.04	
T.P.	5.83	732.91	12.64	727.08	
0+00 = 27+68.3				726.7	
0+05 S				726.7	
0+10				725.9	
0+20				728.1	
0+30				728.2	4.7
0+50				728.3	4.6
0+60 S				728.4	4.5
0+09 N.				726.9	6.9
0+20				727.9	5.1
0+30				727.9	5.1
0+38				727.7	5.5
0+45				727.8	5.1
0+60 N				727.9	5.0

Original X sect for Holmes & Johnson Page 38

Inst.
Rod.
Chain.

10/11/24 57

Left				C L				Right
				6.6 / 0.0	8.4 / 5.3	14.9 / 13.6	12.5 / 20.0	
	12.5 / 15.4	6.5 / 6.9		4.6 / 0.0	6.1 / 7.0	8.4 / 12.8	9.0 / 21.6	
	10.8 / 10.4	5.0 / 7.8		4.4 / 0.0	4.6 / 9.0	7.2 / 12.0		8.4 / 20.0
8.7 / 30.2	11.4 / 23.4	11.3 / 12.0	7.1 / 4.2	6.2 / 0.0	✓			
0 G → 8.0 / 18.0	9.3 / 14.3	7.3 / 5.0	5.5 / 4.1	5.2 / 0.0	5.2 / 5.9	✓		
0 E → 7.2 / 11.4	5.4 / 11.3	5.3 / 5.3		5.2 / 0.0	5.0 / 5.6	✓		
Same				5.0 / 0.0	4.7 / 5.3	5.4 / 8.6	✓	

W E

X Levels for Weekly Est

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		732.91			
	1.39	726.67	7.63	720.28	
0+00				726.7	-5.0
+09 N				726.0	-4.3
+20				727.8	-6.1
+30				727.8	-6.1
+38				727.7	-6.0
+45				727.8	-6.1
+60				727.9	-6.2
+70	Zero Exc.				

Inst. .....
Rod. .....
Chain. .....

10/11/24 J-8

Left			C L			Right	
E	11.8	11.7	11.5	11.9	11.9	11.5	19.5 W
	33.2	19.4	10.8	00	8.2	14.2	21.0
	12.8	11.6	12.2	11.7	11.6	9.4	
	38.4	21.2	13.2	00	12.4	22.6	
13.1	12.4	12.7	13.2	10.9	9.6	3.5 SR	3.2 3.7
49.8	25.2	14.2	6.2	00	6.0	6.4	15.0 27.6
13.5	12.6	12.8					
33.3	23.0	13.0					
	13.9	12.9	4.3				
	41.8	19.4	13.0				
	13.4	11.4	4.6				
	42.4	18.0	13.0				
14.0	14.0	7.3	1.4 SR				
41.0	28.8	18.0	13.0				

X Levels for Weekly Est.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		721.67			
0+05 S				726.4	-4.7
0+10				725.9	-4.2
+20				728.1	-6.4
T.P	13.05	724.82	9.90	711.77	
+20				728.1	-3.3
+30				728.2	-3.4
+50				728.3	-3.5
+60				728.4	-3.6

Inst.
Rod.
Chain.

10/11/24

59

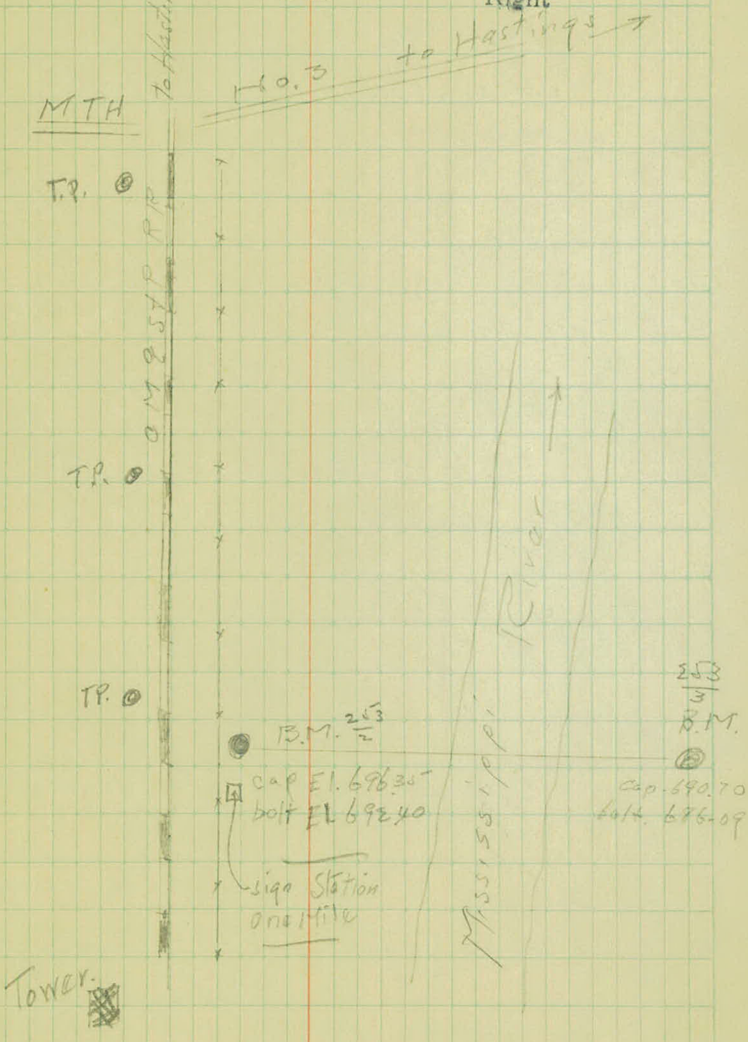
Left			C L		Right	
4.4	12.5	11.6	12.0	11.8	11.4	10.5
37.6	27.6	10.6	0.0	10.4	18.2	26.4
4.0	10.3	11.1	11.9	11.5	10.4	
34.4	27.6	23.4	0.0	18.6	21.2	
2.8	6.3	6.2	11.5	11.9		
27.2	34.2	4.2	4.8	0.0		
				15.1	13.9	
				20.2	24.0	
				14.2	13.6	
				13.0	22.0	
				13.4		
				24.0		
				13.2		
				26.2		

..... Cross Sections

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

Inst. ....
Rod. ....
Chain. ....

Left | C L | Right



X sect for borrow pit Ramsey Co property

Original .... Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
BM	1.74	739.78		738.04	
T.P.	6.22	734.06	11.94	727.84	
29+00					
29+50					
30				(R.R. Row) → 10.9/101.5	9.4/90.6
30+30±	on prop. line.			(R.R. Row) → 9.4/110.5 7.9/107.1	8.5/90.0
T.P.	11.17	739.83	5.40	728.66	
BM			1.77	738.06	

Inst. Galvin Conner
Rod. Staaglon
Chain. Fritz

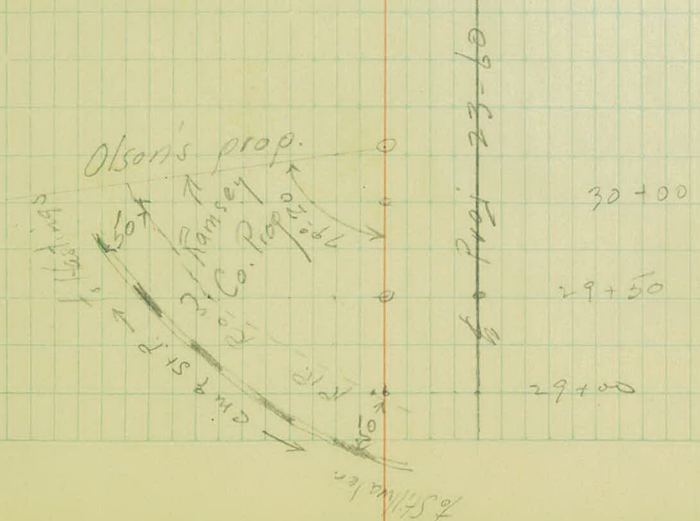
10-17-24 P.M.

Left					C L	Right

Stump Br. Sta 30

RR Row

		8.2		8.0	
		43.0		40.0	
RR Row 8.1	7.0	6.2	5.2	4.9	(17.6)
74.4	68.0	60.3	48.0	40.0	
7.9	6.6	5.5	4.5	4.4	(15.1)
76.5	60.7	47.5	40.0	38.0	
6.9	6.9	6.4	5.6	5.2	
80.7	67.0	52.7	40.0	35.0	



Original Xsect. for borrow pit

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
Bm	11.0	871.48		860.46	
66+30	P.I.			859.48	12.0
66				858.68	12.8
65+50				856.98	14.5
T.P.	4.45	870.93	5.00	866.48	
65				855.28	15.6
64+50				853.58	17.3
64				852.72	18.1
T.P.	0.78	859.74	11.97	858.96	
63+50				850.18	9.5
63				848.20	11.5
T.P.			6.78	852.96	

Inst. Galvin Conner
Rod. Sturgeon
Chain. Fritz

10-18-24 A.M.

Left	C L	Right				
		6.9 / 30.6	6.2 / 37.7	3.4 / 43.2	3.5 / 50.0	+25
		6.4 / 31.0	6.0 / 36.8	4.8 / 50.0	✓	+90
		5.1 / 33.2	4.1 / 44.1	3.5 / 50.0	✓	
		5.0 / 35.3	4.5 / 39.2	3.5 / 50.0	✓	
		4.3 / 36.6	3.6 / 44.4	3.5 / 50.0	✓	
		7.2 / 34.3	6.1 / 40.8	5.6 / 50.0	✓	+10
		6.1 / 27.1	2.6 / 40.7	0.4 / 50.0	✓	
		13.5 / 28.8	10.8 / 41.1	8.8 / 50.0	✓	

Copy Stake Sta 64+00

Original Xsections for Borrow Pit.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. F
T.P.	6.61	859.57		852.96	
64+00				851.88	7.7
+25					
+50				853.58	6.0
+85					
T.P.	6.44	863.26	2.75	856.82	
65				855.28	8.0
+25					
+50				856.98	6.3
+90				858.00	5.3
66				859.68	4.6
+30.7 PT				859.48	3.8
B.M.			2.80	860.26	

Inst. ....
Rod. Stoughton
Chain. ....

10-18-24

Left				C L	Right
Top of stake Sta 64+00					
13.2	12.2 40.5	9.3 32.6	7.9 23.8	(7.4)	
	11.8 50.0	6.5 36.6	3.8 28.3		
	10.1 50.0	6.2 38.0	3.2 28.1		
	12.0 45.0	8.6 36.0	4.5 27.1		
13.3 50.0	11.9 43.0	10.0 38.8	7.2 24.5		
9.4 50.0	7.7 42.2	5.9 33.6	5.0 27.0		
	9.1 50.0	6.9 36.5	4.4 26.9		
12.6 50.0	10.3 39.1	8.3 30.5	6.1 25.3		
8.4 50.0	7.0 44.5	5.7 33.4	5.1 25.3	(2.9)	
11.2 50.0	7.5 41.4	5.1 33.9	2.9 25.2	(+25)	

Grade Change 31+50 to 37+50

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
BM	1.68	739.72		738.04	
31+50				726.50	13.2
32	(See page 71)			728.10 ~~728.90~~	10.8
+50				731.10	8.6
33				733.20	6.5
+50				735.10	4.6
T.P.	12.78	750.03	2.47		
34				736.90	13.1
+50 / +74	(lower End CM Lt. 11.3 Rd. / upper end of pipe 10.5 ✓)			738.70	11.3
35	(34+93 lower end 10.0 / 35+33 upper end 8.9) Burnt Cor.			740.50	9.5
+50	(+50 lower end Cor Lt. 8.65 / +75 upper " " " 8.3)			742.20	7.8
36	(see page 71)			744.00 ~~743.10~~	6.9 x
+50				745.60 ~~745.50~~	4.5 x
37				747.10 ~~746.80~~	3.2 x
BM	Cont. on P. 71		6.19	743.84	(743.79)
+50				~~748.0~~ 748.50	2.0

Vertical notes along Grade column: +5.00% ; 200' V.C. ; +3.575% ; 200' V.C.

Cont. on P. 71

Inst. ....
Rod. ....
Chain. ....

Left						C L						Right
4 30+00 Rt.												
0.0 / 15.0												0.0 / 15.0
X 0.0 / 15.0												0.0 / 15.0 X
0.0 / 15.0												C 0.4 / 15.0
0.0 / 15.0						-0.2 / 0.0						C 0.2 / 15.0
(+0.9 / 23.6)	3.7 / 23.6	4.8 / 18.8	3.7 / 16.2			+0.8 / 0.0	3.2 / 16.6	+1.4	4.4 / 20	4.2 / 25.4		(+4.6 / 29.7)
(+0.5 / 12.6 / 24.0)		12.6 / 21.2	11.4 / 15.2			+1.4 / 11.7 / 0.0	+1.8 / 11.3 / 14.4	13.5 / 20.6	12.8 / 25.0			(+0.5 / 12.6 / 25.3) back slope
(+2.5 / 8.8 / 27.5)	8.8 / 25.8	10.9 / 23.0	11.1 / 19.6	9.2 / 15.8		+2.0 / 9.3 / 0.0	9.0 / 16.8	11.3 / 21.2	11.3 / 23.4	8.0 / 26.2		(+3.6 / 7.7 / 28.6)
(+1.6 / 7.9 / 26.6)	8.9 / 24.4	9.7 / 21.8	9.8 / 19.0	7.5 / 14.6		7.4 / 0.0	7.5 / 15.5	(+1.7 / 7.8 / 24.7)	Burris St. Connect.			
(+0.7 / 7.1 / 25.1)	7.1 / 24.2	8.3 / 22.0	8.3 / 20.2	6.5 / 16.0		6.4 / 0.0	6.2 / 11.6	7.9 / 17.8	(0.0 / 7.8 / 22.8) back slope	Garage yard		
(+0.5 / 6.4 / 25.5)	6.3 / 24.0	7.7 / 22.0	7.2 / 19.0	5.4 / 14.8		5.3 / 0.0	5.6 / 12.0	7.2 / 16.6	7.4 / 19.0	(+2.4 / 4.7 / 22.8)		X
X	0.0 / 15.0					+0.4 / 0.0		0.0 / 15.0				X
X	0.0 / 15.0					+0.5		C 0.7 / 15.0				X
Lt 35+50	X	0.0 / 15.0				+0.2		0.0 / 15.0	X			

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
		733.16			
27+79					
27+90	Top Elev. Percentage/base Rim				
28					
Balance to 28+67 = 1st Dirt on Surface				28+62	28+67 Total Rock
27+68					
27+50	00 Excav.				

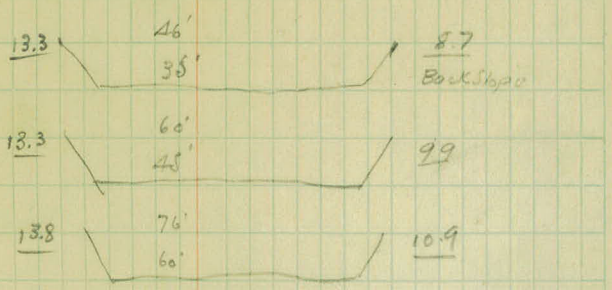
East side of Track.

27	Full Sec to Grade Ex. Ditch				
+25					
+50					
+68					
+79	= 00 Excav.				

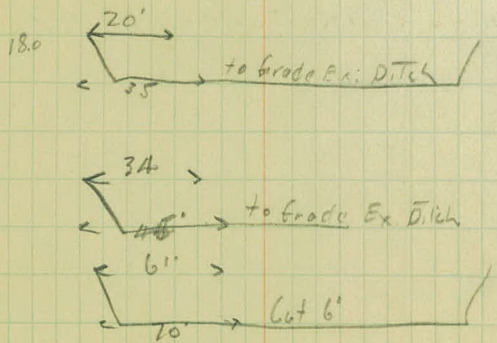
Inst. .....
Rod. .....
Chain. .....

65

Left | C L | Right



7.3 / 28 | 12.1 / 20 | 16.2 / 6 | 8.8 | Distances to Extra Slope



..... Cross Sections

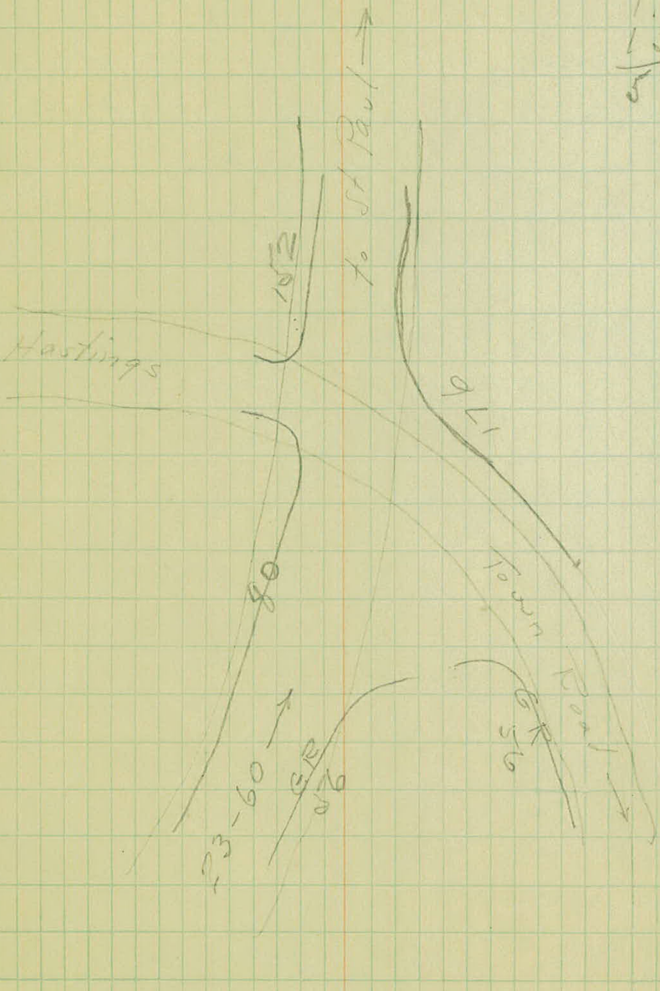
Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.

Inst. ....
Rod. ....
Chain. ....

Left	C L	Right

Grade Xing Town Road
Sta 142 + 50

56
56
80
176
152
520



Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R
Guard Rail.					
123+39	to	127+15	Rt	304'	8/22
122+64	to	126+64	Lt	344	8/22
91+82	to	93+50	Lt	168'	8/23
92+22	to	93+50	Rt	128'	8/23
113+00	to	117+45	Rt		8/23-28
113+00	to	117+45	Lt		8/23-28
0+84	to	18+50	Rt+Lt		
118+00	to	120+24	Lt		8/28
133+20	to	136+24	Lt		8/28
87+00	to	88+76	Lt		8/29
83+25	to	85+41	Lt		8/29
83+75	to	84+39	Rt		8/29
77+75	to	79+75	Rt		8/30
77+75	to	79+75	Lt		8/30

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr.
105+50	to 110+50		R+		9/3/24
105+50	to 116+50		L+		9/3/24
93+50	to 94+50		L+		9/3/24
91+00	to 92+22		R+		9/3/24
95+28	to 96+88		L+		9/20/24
97+69	to 99+45		Lt		"
95+88	to 96+20		Rt		"

Inst.
Rod.
Chain.

Left	C L	Right

Orig X Sect. for Side Borrow Tct.

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
B.M.	9.52	847.23		837.71	
60+50				839.40	2.8
T.P.	11.84	858.79	0.28	846.95	
60+00				837.50	21.3
59+75				836.60	V.V. V
59+50				835.70	V3.1
T.P.	9.37	867.45	0.71	858.08	
59+25				834.70	3V.7
59+05				834.00	33.4
58+85				833.20	34.V

Inst. Galvin Conner
Rod. Skoaglun
Chain. Fritz

10-30-34

Left | C L | Right

10.0/24.1 9.3/31.5 7.8/50.0

✓10.6/29.0 ✓10.4/40.0 ✓10.6/50.0

✓6.5/35.7 ✓6.1/50

✓0.3/39.0 ✓0.0/50.0

✓5.4/42.0 ✓5.3/50.0

✓4.3/44.0 ✓4.3/50.0

✓4.2/45.0 ✓4.0/50.0

Classified Material 11-3-24
for Mo. Est. Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. F
BM	10.65	721.53		710.88	
27+25				709.10	11.4
+50				709.30	11.2
+79				709.80	11.7
+90				710.00	11.5
28				710.25	11.2

Inst. Galvin Conner.
Rod. Skooglum
Chain. Fritz

Left		C L	Right		
Nail W. end bottom sill center pier Sta 27+10					
top of R → 0.3 ✓ / 24.0	12.9 / 19.0	(12.7 / 25.0)	1.3 / 35.0 ← top of Rock		
top of R → 5.8 ✓ / 31.0	11.8 / 25.0		12.2 / 15.0	(+0.5) / 33.0 ←	top of R
top of R → 4.8 / 29.0	11.2 / 25.0		10.6 / 27.0	(+2.0) ✓ / 42.0 ←	top of R
top of R → 2.2 / 31.0	11.2 / 25.0		9.8 / 26.0	1.7 / 38.0 ←	Top of R
top of R → 2.2 / 28.0	11.0 / 25.0		9.6 / 26.0	0.0 / 39.0 ←	top of R

Grade Chg & Corrections from P. 64

Cross Sections

Sta.	B. S.	H. I.	F. S.	Grade	Gr. R.
32 T.P.	1.06 4.40	744.85	12.65	743.79 732.20 728.10	8.5
	6.30	750.09		743.79	
36				744.00	6.1
+50				745.60	4.5
37				747.10	3.0
+50				748.50	1.6
38	8			749.90	0.2
	8.42	758.3	0.19	749.19	
+50				751.30	1.0
39				752.70	1.6
+50				754.00	4.3
40				755.60	2.7
+50				757.45	0.8

Inst.

Rod.

Chain.

Spike Left in 36" line C [illegible]

Right

Left		Right
00 15.0		00 19
00 25.0	00	00 14.2
00 15.0		00 10.0
00 15.0		00 15.0
00 15.0		00 15.0

Cross Sections

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

Inst. .....
Rod. .....
Chain. .....

72

Left	C L	Right

..... 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

..... Cross Sections

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

Inst.
Rod.
Chain.

75

Left	C L	Right

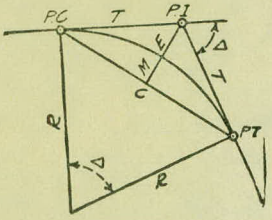
..... Cross Sections

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

Inst. .....
Rod. .....
Chain. .....

Left	C L	Right

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES



CURVE FORMULAS

Radius=R=$\frac{50}{\text{sin. } D/2}$ (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 vers $\frac{\Delta}{2}$ (6)

External=E=T tan $\frac{\Delta}{4}$ (7) =R÷cos. $\frac{\Delta}{2}$—R (8)=R 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. Δ=62° 10′ D=8° 20′. From Table IV for 1° curve T=3454.1 and÷8⅓=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—Sta. P. C.=54.50, hence offset=7.27 (54.50÷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÷(2 x 688.26)=2.16 ft.

Deflections.—Deflection angle=½ D for 100 ft., ¼ D for 50 ft., etc. For c ft.=(in minutes) .3 x C x D° or=defl. for 1 ft. from Table III x C. For Sta. 158 of above curve=.3 x 54.5 x 8⅓=136.2′ or 2° 16.2′, or=2.50 x 54.5=136.2′ from Table III. For Sta. 159 deflection angle=2° 16.2′+8° 20′÷2=6° 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° 20′=960.6÷8⅓=91.27 and from Table V correction=.10 or E=91.37 ft. Or suppose Δ=32° and E is measured and found to be 42 ft. What is D? From Table IV E=230.9 and÷42=5.5 or D=5° 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	1/8	3–16	1/4	5–16	3/8	1/2	5/8	3/4	7/8
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729

1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

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

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′	58.34	.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	23.38	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	2115.3
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	1293.8	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	4651.3
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	.70	.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	.711	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
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	.985	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°	.360	.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

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	.273	.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=slope distance—slope distance (1—Cos. V. A.). Thus for slope distance of 248.7 ft. and V. A. of 4° 20′ from Table VIII Cos=.99714 and correction=1—.99714=.00286 per foot or total of .286× 2½ (near enough)=.57 and horizontal distance=248.7—.57=248.13 ft.

TRIGONOMETRICAL FORMULAS.

See fig. (a).

sin. $A=\frac{a}{c}$

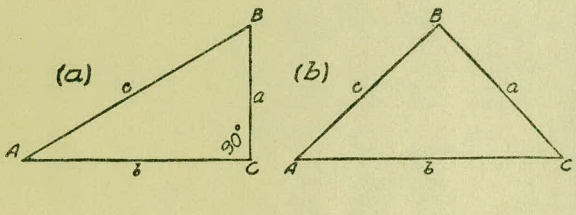
cos. $A=\frac{b}{c}$

tan. $A=\frac{a}{b}$

cot. $A=\frac{b}{a}$

sec. $A=\frac{c}{b}$

cosec. $A=\frac{c}{a}$



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	$B=90°-A$, $b=a \cot. A$, $c=\frac{a}{\sin. A}$.
A, b	B, a, c	$B=90°-A$, $a=b \tan. A$, $c=\frac{b}{\cos. A}$.
A, c	B, a, b	$B=90°-A$, $a=c \sin. A$, $b=c \cos. A$
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	If $s=\frac{1}{2}(a+b+c)$, $\sin. \frac{1}{2}A=\sqrt{\frac{(s-b)(s-c)}{b\,c}}$; $\cos. \frac{1}{2}A=\sqrt{\frac{s(s-a)}{b\,c}}$, $\tan. \frac{1}{2}A=\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$, $\sin. A=\frac{2\sqrt{(s-a)(s-b)(s-c)\,s}}{b\,c}$
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	00	1	90	8	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	I	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	.1733	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.	
°						°					
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	2.669	.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	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30						
40	.5398	.6412	1.560	.84182	20	39	.6293	.8098	1.235	.77715	51
50	.5422	.6453	1.550	.84025	10	10	.6316	.8146	1.228	.77531	50
						20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30						
40	.5544	.6661	1.501	.83228	20	40	.6428	.8391	1.192	.76604	50
50	.5568	.6703	1.492	.83066	10	10	.6450	.8441	1.185	.76417	50
						20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30						
40	.5688	.6916	1.446	.82248	20	41	.6561	.8693	1.150	.75471	49
50	.5712	.6959	1.437	.82082	10	10	.6583	.8744	1.144	.75280	50
						20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30						
40	.5831	.7177	1.393	.81242	20	42	.6691	.9004	1.111	.74314	48
50	.5854	.7221	1.385	.81072	10	10	.6713	.9057	1.104	.74120	50
						20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30						
40	.5972	.7445	1.343	.80212	20	43	.6820	.9325	1.072	.73135	47
50	.5995	.7490	1.335	.80038	10	10	.6841	.9380	1.066	.72937	50
						20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30						
40	.6111	.7720	1.295	.79158	20	44	.6947	.9657	1.036	.71934	46
50	.6134	.7766	1.288	.78980	10	10	.6967	.6713	1.030	.71732	50
						20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
											°
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

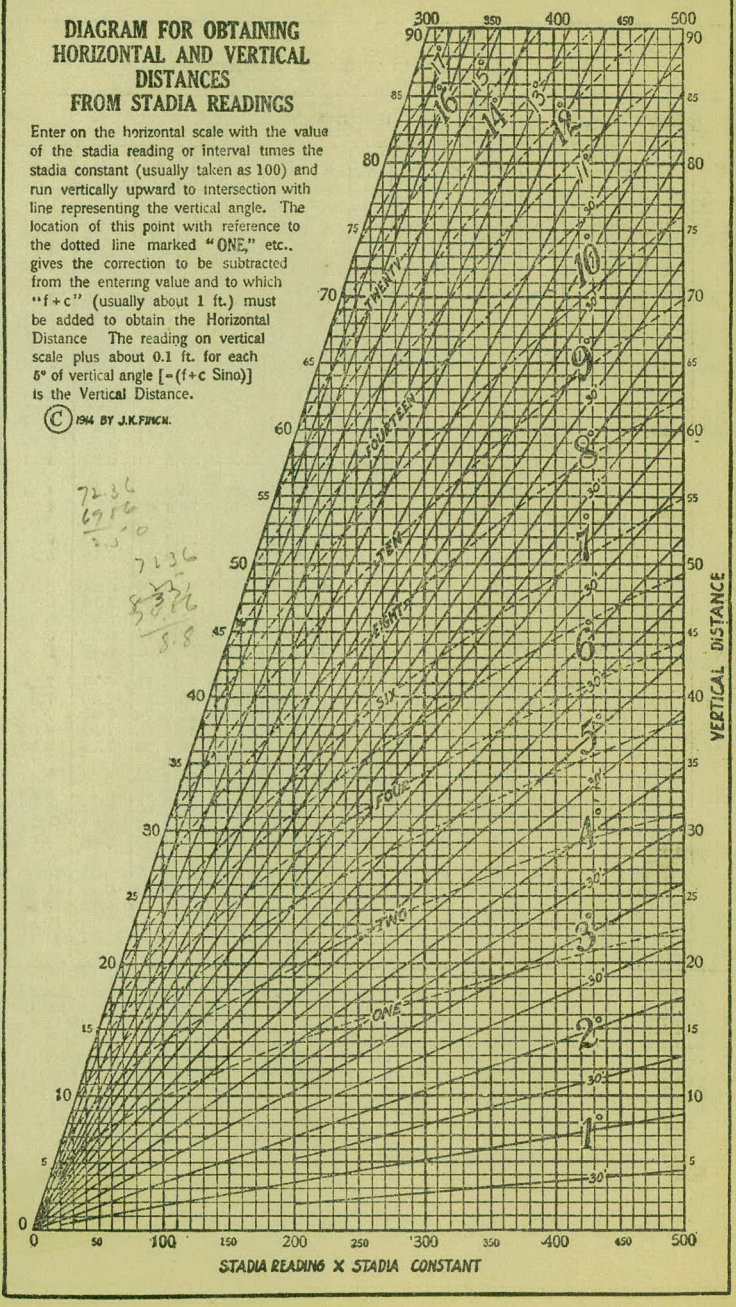
Table IX.—Calculation of Earthwork.

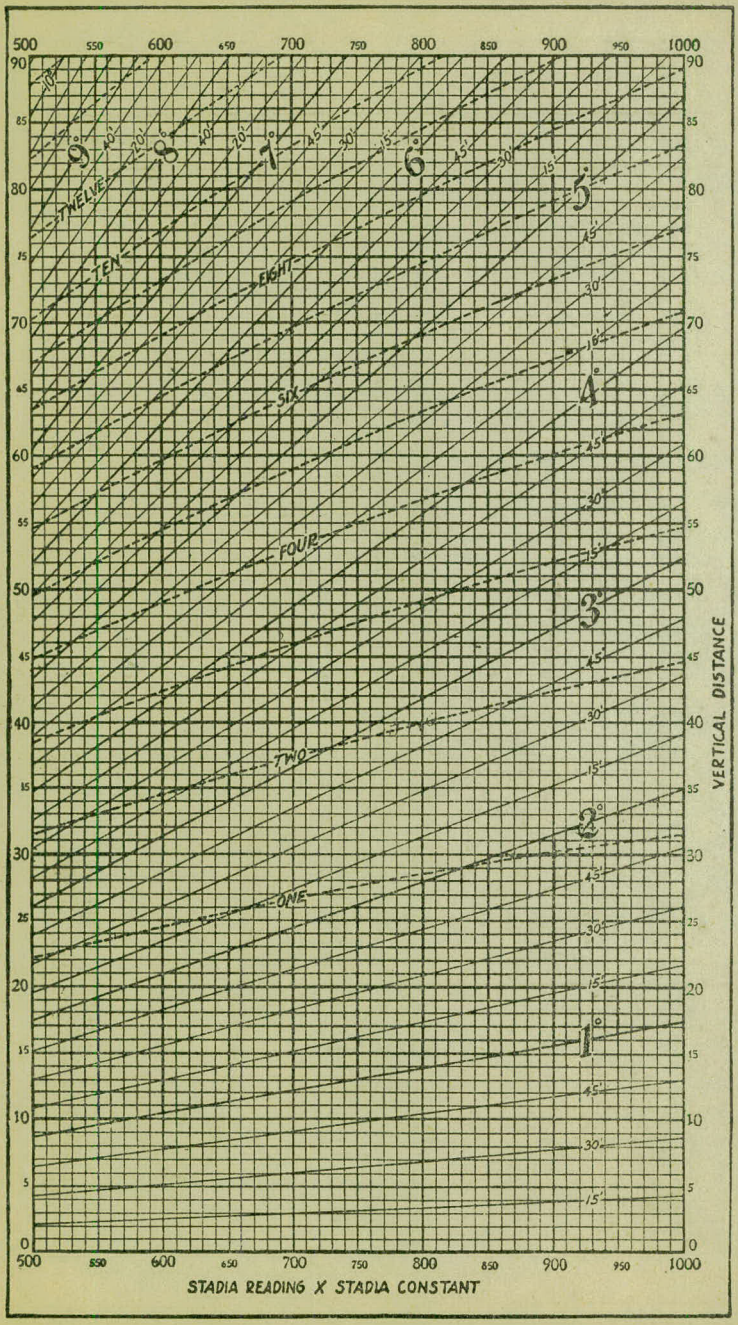
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	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 ½ 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 Sino)] is the Vertical Distance.




500
550
600
650
700
750
800
850
900
950
1000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
9°
8°
7°
6°
5°
4°
3°
2°
1°
TWELVE
TEN
EIGHT
SIX
FOUR
TWO
ONE
VERTICAL DISTANCE
STADIA READING X STADIA CONSTANT

456
49
407

.15
8.2
8V

8.12
6.5
1.5

5.41
4.30
1.11

5.0

.25
8.18
8.43
6.6
1.8

2163.9
117.95
2281.85

4.59
2.15
0.15
10.34
17.23

20.59
13.02
4.65
12.05
.683
51.14
12.23
38.91

20.59
4.59

83.71
54.07
29.64

0.38
2.31
1.90
2.15
0.15
10.34
17.23

11.65
8.94
13.02
4.65
12.05
.683
51.14
17.23
33.91

83.33
43.73
39.60

88.33
843.73
39.60

51.15
4.65
46.49
17.23
29.26

88.333
843.730
39.63
3.1.03
29.26

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)÷2 or 2 ft. added to 41.9 =43.9. For slopes of 1 on 1 see inside of front cover.

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