FIELD BOOK

No. 355

371

A

B

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X-SECTION NOTES
ON

A County Rock Road Beginning At The NW Corner Section 31, T87N, R12W At Station 320+02.5 And Continuing East Along The North Lines of Sections 31, 32, 33, 34 & 35, T87N, R12W To A Point On The West Corporate Limits Of La Porte City, Iowa In Section 35, T87N, R12W At Station 571+10.2, All In Black Hawk County.

Date Began 12-11-67
Date Ended 12-15-67

PC & Notes	Springer
Level	Underwood
Rod	Claassen
Rod	Majewski

320+02.5		E Co. Rd "X"	
319+91.5		Edge slab	
319+86		Top Shoulder	
319+76.5		Toe Foreslope	
319+63.5		Toe Backslope	
319+51.0		W. R/W Fence	
TBM #2	9.82	962.88	953.06

953.06						
982	943	910	885	860	816	
0	50	100	150	200	250	
	240	365	507	636	735	
	500	450	400	350	300	
952.57						
999	969	931	910	890	845	
0	50	100	150	200	250	
	271	397	542	673	766	
	500	450	400	350	300	
953.18						
97	100	96	93	93	89	
0	50	100	150	200	250	
	32	43	59	72	83	
	500	450	400	350	300	
953.32						
95	132	139	147	150	136	
0	50	100	150	200	250	
	69	80	94	107	124	
	500	450	400	350	300	
953.75						
91	132	142	147	152	143	
0	50	100	150	200	250	
	74	86	97	111	132	
	500	450	400	350	300	
952.18						
107	110	125	130	130	126	
0	50	100	150	200	250	
	16	35	62	92	117	
	500	450	400	350	300	

320+53 E. R/w Fence

320+33 Toe Backslope

320+285 Toe Foreslope

320+19 Top Shoulder

320+13.5 Edge Slab
962.88

51.88

114	146	165	178	175	155	
0	50	100	150	200	250	
		44	49	68	99	128
		500	450	400	350	300

51.68

112	135	164	178	174	155	
0	50	100	150	200	250	
		69	81	98	117	137
		500	450	400	350	300

52.38

106	147	154	162	160	150	
0	50	100	150	200	250	
		67	82	93	114	130
		500	450	400	350	300

52.58

103	103	101	100	99	94	
0	50	100	150	200	250	
		32	45	58	71	84
		500	450	400	350	300

52.88

1006	916	944	917	894	850	
0	50	100	150	200	250	
		266	383	533	658	762
		500	450	400	350	300

953.06

320+02.5		E. Co. Rd. "X"		533	388	260	164	075	0.12
				250	200	150	100	50	0
				666	783	880	948	994
				300	350	400	450	500
319+91.5				365	422	294	192	101
				250	200	150	100	50	0
				692	811	904	972	1022
				300	350	400	450	500
319+86				60	27	34	23	12
				250	200	150	100	50	0
				72	86	93	103	107
				300	350	400	450	500
319+76.5				96	80	67	53	34
				250	200	150	100	50	0
				114	125	134	141	139
				300	350	400	450	500
319+68.5				98	84	70	53	36
				250	200	150	100	50	0
				113	124	134	135	139
				300	350	400	450	500
319+51		W. R/W Fence		70	49	31	12	+06
				250	200	150	100	50	0
TBM #2	0.12	953.18	953.06						
				92	105	115	125	113
				300	350	400	450	500

		15.27	W. ℄ 30" RCP 450' No.							
		12.78.	E. ℄ 30" RCP 450' No.							
320+53	E. R/w Fence		97	72	53	36	33			
			250	200	150	100	50	0		
			118	140	160	175	169			
			300	350	400	450	500			
320+33			104	90	76	62	51			
			250	200	150	100	50	0		
			120	141	159	170	168			
			300	350	400	450	500			
320+28.5			99	87	72	60	45			
			250	200	150	100	50	0		
			117	137	155	162	152			
			300	350	400	450	500			
320+19			62	46	35	24	17			
			250	200	150	100	50	0		
			75	91	97	104	108			
			300	350	400	450	500			
320+13.5			566	410	289	186	103			
			250	200	150	100	50	0		
			698	818	910	979	1019			
			300	350	400	450	500			
	953.18									

	+	HI	−		
			12.29		E. ℄ 36" RCP 186' So. of Beg.
			9.71		W. ℄ 36" RCP 186' So. of Beg.
TBM #2	1.98	955.04		953.06	
			0.0		500' W. of beginning
			2.0		400 " " "
			4.9		300 " " "
			7.8		200 " " "
			10.7		100 " " "
TBM #2	13.16	966.22		953.06	

						43.38						
326+00	147 60	142 39	154 28	158 21	115 13	107 0	113 13	151 23	147 33	124 42	128 60	
						42.08						
325+00	190 60	182 39	182 28	182 21	130 13	120 0	126 13	165 24	162 33	151 42	156 60	
					34.78		35.43					
+76	TE 36"x 34" RCBC		205 60	195 40	19.80 19 TE		18.65 15 TE	193 40 & wash	163 60			
						41.78						
324+00	182 60	182 39	183 28	180 21	131 13	123 0	128 13	163 24	163 33	150 43	155 60	
						43.18						
323+00	146 60	146 39	160 28	160 21	119 13	109 0	117 13	153 24	155 33	143 43	143 60	
						46.18						
322+00	105 60	103 39	127 28	128 21	87 13	79 0	86 13	130 24	130 33	115 43	123 60	
						48.78						
321+00	62 60	57 39	88 28	91 21	50 13	43 0	48 13	98 24	100 33	71 43	86 60	

TBM #2	1.02	954.08	953.06

TP	7.12	960.80	0.40	953.68
333+00				
332+00				
331+00				
330+00				
329+00				
328+00				
327+00				
		954.08		

53.98

20	15	32	42	08	01	05	40	37	08	08
60	40	29	22	14	0	12	20	26	40	60

52.58

48	46	56	56	23	15	21	56	54	35	35
60	40	29	22	14	0	12	20	26	40	60

51.38

76	74	75	70	35	27	32	67	59	41	82
60	40	29	22	14	0	12	20	26	40	60

50.38

83	75	80	79	45	37	43	76	73	37	42
60	40	29	22	14	0	12	20	26	40	60

49.18

70	65	86	95	57	52	55	89	87	35	40
60	40	29	22	14	0	12	20	26	40	60

47.28

78	72	106	112	77	68	76	107	102	52	60
60	40	29	22	14	0	12	20	26	40	60

45.78

104	98	126	133	97	88	94	128	126	80	84
60	39	28	21	13	0	13	23	33	42	60

338+00				
TBM #3		2.18	958.62	
337+00				
+78	Drive Lt. (No Pipe)			
336+00				
335+00				
+22	Drive Rt. (No Pipe)			
334+00				
		960.80		

						55.40					
	54	59	88	95	63	54	62	94	97	81	87
	60	40	30	21	14	0	13	20	30	40	60
Spk. in 40" Tree 160' Lt. of Sta. 337+00											
						56.70					
	42	47	76	75	43	41	47	92	91	75	84
	60	40	30	21	14	0	13	20	30	40	60
		58.3	56.3	56.0	56.6	57.00					
		45	45	44	42	38					
		60	40	27	14	0					
						56.90					
	44	49	67	75	48	39	45	85	86	69	75
	60	40	30	21	14	0.	13	20	30	40	60
						56.40					
	57	51	78	87	50	44	50	82	86	56	69
	60	40	30	21	14	0	13	20	30	40	60
						55.90	55.0	55.3	54.8		
						49	54	55	60		
						0	13	25	40		
						55.60					
	58	58	86	94	58	52	58	90	87	61	62
	60	40	30	21	14	0	13	20	30	40	60

345+00				
TP	5.44	954.78	11.46	949.34
344+00				
343+00				
342+00				
341+00				
340+00				
339+00				
		960.80		

50.08

43	40	74	80	54	47	53	84	88	77	77
60	40	33	22	15	0	12	21	31	40	60

49.80

114	114	138	145	120	110	115	152	153	136	136
60	40	33	22	15	0	12	21	31	40	60

49.60

130	130	148	148	121	112	117	155	160	162	162
60	40	33	22	15	0	12	21	31	40	60

50.00

136	136	151	150	116	108	114	153	154	145	147
60	40	33	22	15	0	12	21	31	40	60

50.90

113	110	129	137	106	99	104	135	135	114	114
60	40	33	22	15	0	12	21	31	40	60

52.50

82	78	106	120	90	83	88	122	119	88	96
60	40	30	21	14	0	13	20	30	40	60

53.90

62	62	96	108	76	69	74	106	110	82	84
60	40	30	21	14	0	13	20	30	40	60

TP	1.39	943.77	12.40	942.38
351+00				
350+00				
349+00				
348+00				
+08	Drive Rt. (No Pipe)			
347+00				
346+00				
		954.78		

					43.28					
96	95	142	153	123	115	122	155	158	125	125
60	40	33	22	15	0	12	21	31	40	60
					46.08					
66	66	107	123	94	87	93	125	125	93	98
60	40	33	22	15	0	12	21	31	40	60
					48.88					
44	45	82	102	74	65	72	106	100	85	90
60	40	33	22	15	0	12	21	31	40	60
					49.88					
28	29	67	82	57	49	57	90	88	75	80
60	40	33	22	15	0	12	21	31	40	60
					50.78					
						42.2	48.6	47.9		47.5
					40	46	52	69		70
					0	12	25	40		60
					50.78					
23	27	62	72	48	40	45	71	72	63	65
60	40	33	22	15	0	12	21	31	40	60
					50.58					
31	31	70	77	50	42	48	80	78	65	65
60	40	33	22	15	0	12	21	31	40	60

358+00				
357+00				
356+00				
355+00				
TP	0.10	931.97	11.90	931.87
354+00				
353+00				
352+00				
		943.77		

22.47

120	112	135	133	103	95	103	150	150	140	145
60	40	31	17	14	0	13	20	26	40	60

23.77

93	87	118	121	88	82	88	134	131	123	
60	40	31	17	14	0	13	20	26	40	60

25.67

77	77	101	109	72	63	79	111	112	97	103
60	40	31	17	14	0	13	20	26	40	60

28.17

49	49	69	77	47	38	45	84	81	52	56
60	40	31	17	14	0	13	20	26	40	60

31.57

127	117	150	155	132	122	130	167	167	127	130
60	40	31	17	14	0	13	20	26	40	60

35.47

	65	60	121	91	83	90	133		85	92
	60	40	23	15	0	12	25		40	60
			"V"				"V"			

37.47

23	18	94	49	43	50	91		50	55
60	40	23	15	0	12	25		40	60
		"V" Ditch				"V" Ditch			

Bank No.

136	129	121	117	107	144
540	440	340	240	140	40

Bank So. (East)

99	96	87	78	83	67
45	140	240	340	440	540

E Creek So. (Random)

139	125	114	109	97	93
40	140	240	340	440	540

Creek Bank So. (West)

96	97	94	96	85	77
40	140	240	340	440	540

+94 ℄ E. End 17'x6'x44' RCBC (No. Side)

					22.08
		12.75			
92	103	13.73	52		44
60	40	22	14		0
		℄			

+64 ℄ W. End 17'x6'x44' RCBC (So. Side)

					22.08					
							12.88			
					44	49	13.60	97		92
					0	12	22	40		60
							℄			
					22.08					
86	86	95	100	53	44	50	110	105	105	102
60	40	31	17	14	0	13	20	26	40	60

359+00

TP	4.41	926.48	9.90	922.07
		931.97		

						23.27						
364+00					73	68	88	88	50	43	49	75	76	29	25
					60	40	35	21	14	0	15	23	31	40	60
										22.67					
363+00					94	91	100	95	55	49	56	91	90	47	42
					60	40	35	21	14	0	15	23	31	40	60
										22.27					
362+00					105	103	111	105	62	53	59	98	99	71	66
					60	40	35	21	14	0	15	23	31	40	60
										21.97					
361+00					112	110	119	111	64	56	62	103	106	89	89
					60	40	35	21	14	0	15	23	31	40	60
TBM #3	12.39	927.57		915.18											
TBM #3			11.30	915.18	Spk. in 30" Lone Tree 410' No. of Sta. 365+40										
	Bank No.				140	134	125	118	115	108					
					540	440	340	240	140	40					
	E Creek No.				178	173	170	157	154	146					
					540	440	340	240	140	40					
		926.48													

370+00

+80 4'x4.5'x35' RCBC

369+00

368+00

+60 Drive Rt. (No Pipe)

367+00

366+00

365+00

927.57

22.47

113	111	115	116	60	51	57	104	104	99	100
60	40	30	23	14	0	13	20	31	40	60

1347 22.37 1487

161	114	1410	58	52	57	1270	105	94		
100	40	20	14	0	13	15	40	100		
		ft				ft				

22.67

103	97	108	96	56	49	55	98	95	74	74
60	40	30	23	14	0	13	20	31	40	60

24.07

55	50	92	90	42	35	41	68	70	27	27
60	40	30	23	14	0	13	20	31	40	60

24.57 24.6 25.0 25.6 26.0

30	30	26	20	16
0	15	23	40	60

24.37

75	70	86	81	40	32	39	62	61	35	33
60	40	35	21	14	0	15	23	31	40	60

24.07

85	76	85	82	45	35	43	65	64	33	30
60	40	35	21	14	0	15	23	31	40	60

23.77

70	61	83	81	47	38	44	64	60	19	16
60	40	35	21	14	0	15	23	31	40	60

1A	+49	Top Shoulder				242 500	195 400	148 300	104 200	60 100		42 100	38 200	23 300	10 400	14 500		
2C	+43	Toe Foreslope				270 500	220 400	170 300	124 200	73 100		82 100	80 200	58 300	43 400	52 500		
2D	+31	Toe Backslope				272 500	222 400	180 300	130 200	76 100		86 100	86 200	64 300	48 400	63 500		
3B	+26	W. R/W Fence				238 500	190 400	146 300	101 200	64 100	33.47 52 48	51 0	73 100	75 200	48 300	30 400	50 500	
											Field Cnt 32.07							
373+00						71 60	71 40	104 30	108 23	76 14		65 0	73 13	111 20	106 31	74 40	78 60	
TP	12.12	938.57	1.12	926.45														
372+00						12 60	17 40	36 30	44 23	12 14	27.27 03 0		09 13	50 20	45 31	18 40	60	
371+00						70 60	73 40	85 30	85 23	42 14	24.07 35 0		42 13	86 20	83 31	74 40	74 60	
		927.57																

376+00						33.27						
	93	83	93	98	61	53	59	84	79	39	35
	60	40	31	22	14	0	13	19	30	41	60
375+00						34.57					
	54	46	73	81	49	40	47	71	62	14	14
	60	40	31	22	14	0	13	19	30	41	60
TBM #4			11.38	927.19							

Spk. in Power Pole Approx. 275' No. of Sta. 373+87 in W. R/W Fence (1.5' above ground)

33 +93	E. R/W Fence					35.07						
	243	195	148	100	62	35	27	28	07	00	09
	500	400	300	200	100	0	100	200	300	400	500
25 +85	Toe Backslope										
	270	226	180	132	88		57	54	39	24	35
	500	400	300	200	100	0	100	200	300	400	500
18 +78	Toe Foreslope										
	277	225	176	127	83		55	52	40	27	31
	500	400	300	200	100	0	100	200	300	400	500
12 +72	Top Shoulder										
	247	198	149	103	61		43	35	20	09	11
	500	400	300	200	100	0	100	200	300	400	500
0 +59.5	E Co. Rock Rd. (N-S)					34.77					
	14.9	15.5	24.2	28.8	33.1		34.8	35.4	36.9	38.1	37.7
	238	191	144	98	55	38	38	32	17	05	09
	500	400	300	200	100	0	100	200	300	400	500
	938.57										

						34.15					
382+00	123 60	123 40	132 30	131 21	102 14	94 0	100 13	125 20	124 31	102 40	102 60
						32.75					
381+00	155 40	146 40	152 30	147 21	116 14	108 0	114 13	134 20	136 31	112 40	112 60
						32.15					
380+00	165 60	156 40	161 30	154 21	123 14	114 0	120 13	145 20	146 31	123 41	124 60
TP	11.90	943.55	6.92	931.65							
						31.77					
379+00	130 60	124 40	126 31	112 22	76 14	68 0	73 13	107 19	95 30	85 41	81 60
				24.57		31.77		25.69			
+87	30" X 43' RCP		160 100	124 40	14.00 22 π	78 14	68 0	74 13	12.88 21 π	102 40	75 100
						31.77					
378+00	137 60	125 40	128 31	127 22	76 14	68 0	75 13	102 19	101 30	72 41	72 60
						32.37					
377+00	117 60	109 40	115 31	109 22	71 14	62 0	69 13	101 19	90 30	61 41	57 60
		938.57									

386+08	Farm Dr. Lt. (No Pipe)			
TBM #5	4.10	947.54		943.44
385+00				
TBM #5			0.11	943.44
384+00				
+83	Drive Lt. (15"x20' RCP)			
383+00				
+33	Drive Lt. (18"x25' CMP)			
		943.55		

42.8 43.0 43.2 42.7 43.04

47 45 43 48 45
60 40 25 13 0

08 16 55 54 34 40.85 27 32 60 58 17 15
60 40 22 18 13 0 13 19 28 40 60

Spk. in twin pine 135' Lt. of Sta. 384+90
(0.3' Ft. above ground)

38 49 72 77 53 36.55 50 54 83 80 55 55
60 40 22 18 13 0 13 19 28 40 60

38.4 38.3 Ft 8.87 37.9 37.15

52 53 57 54
60 40 14 0

9.69
26
Ft

88 88 110 113 82 35.95 76 82 105 108 91 87
60 40 30 21 14 0 13 20 31 40 60

33.5 33.6 Ft 12.25 34.3 34.65

101 100 92 89
60 40 14 0

12.75
29
Ft

						38.54					
391+00	145 60	143 40	146 30	143 24	98 15	90 0	94 12	128 19	129 29	106 40	103 60
						38.44					
+68 2'x2'x33' RCBC	174 100	152 40	33.24 1430 18 $\bar{\bar{E}}$	100 13	91 0	96 13	33.89 1365 15 $\bar{\bar{E}}$	107 40	96 100		
						38.34					
390+00	164 60	154 40	149 31	141 24	99 16	92 0	99 12	130 18	126 29	104 40	106 60
						39.14					
389+00	135 60	125 40	132 31	131 24	92 16	84 0	89 12	120 18	112 29	95 40	95 60
						40.94					
388+00	94 60	94 40	108 31	112 24	75 16	66 0	71 12	103 18	99 29	68 40	68 60
						42.64					
387+00	68 60	65 40	86 31	91 24	56 16	49 0	53 12	79 18	74 29	41 40	41 60
						42.84	42.4	43.4	43.7	44.2	
+73 Field Ent. Rt. (No Pipe)						47 0	51 12	41 25	38 40	33 60	
	41.6	42.0	42.2	42.8		43.14					
386+40 Field Ent. Lt. (No Pipe)	59 60	55 40	53 25	47 13		44 0					

947.54

						42.77						
397+00					94	94	95	90	57	49	53	81	82	62	62
					60	40	35	23	16	0	13	20	34	40	60
						43.07									
396+00					90	90	93	90	54	46	52	77	81	61	57
					60	40	35	23	16	0	13	20	34	40	60
						43.87	43.9	44.2	44.2	44.5					
+11	Farm Dr. Rt. (No Pipe)					38	38	35	35	32					
						0	13	25	40	60					
						43.27									
395+00					57	57	81	80	46	38	38	37	55	39	35
					60	40	30	22	15	0	13	20	29	40	60
						43.07									
394+00					37	37	76	80	54	46	51	75	75	44	38
					60	40	30	23	15	0	13	20	29	40	60
TP	2.30	947.67	2.17	945.37											
						41.54									
393+00					53	53	87	92	67	60	63	92	92	67	67
					60	40	30	23	15	0	13	20	29	40	60
						39.84									
392+00					110	105	121	122	85	77	82	115	117	93	93
					60	40	30	22	15	0	13	20	29	40	60
		947.54													

TBM #6			2.11	952.15
470	Farm Dr. (No Pipe)			
402+00				
401+00				
TP	8.05	954.26	1.46	946.21
400+00				
399+00				
398+00				
		947.67		

NW Cor. Porch (conc.) 94' Rt. of Sta. 401+80

					50.86	30.2	30.0	45.2	48.9	
					34 0	34 15	43 25	51 40	54 60	
					57.56					
28 60	28 40	69 31	74 20	43 13	37 0	43 15	65 19	64 30	36 40	40 60
					49.16					
51 60	48 40	80 31	90 20	59 13	51 0	58 15	80 19	79 30	46 40	50 60
					46.67					
19 60	19 40	45 35	48 23	19 16	10 0	18 13	44 20	43 34	13 40	13 60
					44.47					
66 60	66 40	75 35	73 23	38 16	32 0	38 13	65 20	59 34	38 40	38 60
					43.27					
82 60	82 40	85 35	82 23	52 16	44 0	50 13	76 20	72 34	50 40	47 60

TP	11.82	956.01	10.07	944.19
409+00				
408+00				
+97	Field Ent. Ct. (No Pipe)			
406+00				
405+00				
404+00				
403+00				
		954.26		

44.56

100	106	128	128	103	97	104	146	152	152	152
60	40	31	22	15	0	12	23	27	40	60

45.16

102	102	122	124	97	91	98	141	141	145	145
60	40	31	22	15	0	12	23	27	40	60

46.36

	86	86	82	86	79	87	119	120	105	105
	60	40	25	15	0	12	20	27	40	60

47.16

70	69	88	101	78	71	77	105	105	78	78
60	40	31	22	15	0	12	20	27	40	60

48.26

48	51	82	89	65	60	64	88	94	78	78
60	40	31	22	15	0	12	20	27	40	60

49.36

39	39	69	82	54	49	52	84	84	71	76
60	40	31	22	15	0	12	20	27	40	60

50.66

31	31	63	70	42	36	39	64	67	51	56
60	40	31	22	15	0	12	20	27	40	60

						52.61					
416+00	42 60	46 40	74 31	82 21	60 14	54 0	60 12	87 20	85 28	60 40	68 60
						42.71					
415+00	63 60	68 40	105 31	103 21	79 14	72 0	80 14	111 21	111 30	104 40	109 60
						46.71					
414+00	88 60	93 40	119 32	123 22	97 14	91 0	99 14	132 21	130 30	121 40	126 60
						45.71					
413+00	100 60	105 40	130 32	136 22	108 14	103 0	116 14	149 21	150 30	147 40	152 60
						45.11					
412+00	117 60	122 40	140 32	147 22	115 14	109 0	118 14	164 21	163 30	161 40	161 60
					8.76	44.81		9.26			
+71 2'x 2'x 29' RCBC		116 100	125 40	16.25 15 E		112 0	119 14	16.75 15 E	166 40	196 100	
						44.61					
411+00	116 60	116 40	140 33	147 22	121 15	114 0	120 14	161 20	157 30	151 40	151 60
						44.51					
410+00	115 60	115 40	140 33	144 22	121 15	115 0	120 14	159 20	158 30	148 40	60

956.01

+26	Farm Dr. Lt. (No Pipe)			
422+00				
421+00				
420+00				
419+00				
TP	7.65	962.16	1.50	954.51
418+00				
417+00				
		956.01		

	590	591	586	581	58.16					
	32	31	35	41	40					
	60	40	25	14	0					
					57.96					
26	30	61	72	47	42	45	80	79	65	75
60	41	33	22	15	0	12	20	28	40	60
					56.66					
55	55	81	84	61	55	60	92	96	88	96
60	41	33	22	15	0	12	20	28	40	60
					56.46					
70	75	96	98	70	61	67	102	114	115	125
60	41	33	22	15	0	12	20	28	40	60
					55.56					
77	77	102	104	72	66	71	103	120	113	118
60	41	33	22	15	0	12	20	28	40	60
					54.51					
00	00	35	45	22	15	21	51	42	29	32
60	41	33	22	15	0	12	20	28	40	60
					54.71					
12	16	56	66	40	33	39	64	57	32	32
60	41	33	22	15	0	12	20	28	40	60

10 +17	Top Shoulder										0	96 100	50 200	40 300	68 400	117 500
18 +09	Toe Foreslope										0	119 100	72 200	58 300	83 400	140 500
26 426+00	Toe Backslope										0	119 100	73 200	56 300	86 400	146 500
											50.56					
33 +92	W. R/W Fence										116 0	80 100	37 200	34 300	69 400	107 500
											52.06					
425+00						129 60	123 40	135 30	135 20	110 14	101 0	105 13	130 20	122 29	86 40	86 60
											55.16					
424+00						82 60	76 40	96 30	100 20	78 14	70 0	74 13	97 20	90 28	52 40	52 60
											57.16					
423+00						48 60	45 40	74 30	78 20	58 15	50 0	55 12	78 20	72 28	46 40	56 60
TBM #7			4.20	957.96		Spk. in Twin 16" Tree 95' Lt. of Sta. 422+80										
		962.16														

426+00	Toe Backslope			
425+92	W. R/W Fence			
TP	0.60	952.11	10.65	951.51
33 +62	E. R/W Fence			
26 +54	Toe Backslope			
18 +45	Toe Foreslope			
10 +38	Top shoulder			
0 +26.1	℄ Co. Rock Rd. (N-S)			
		962.16		

173	164	150	131	111
500	400	300	200	100

173	135	123	116	84
500	400	300	200	100

Top
Cor. Post in NW Cor. Inter.

48.96	52.3	52.1	58.2	56.3	52.6
132	99	51	30	59	116
0	100	200	300	400	500

	126	73	50	64	132
0	100	200	300	400	500

	121	71	53	85	134
0	100	200	300	400	500

	96	50	38	69	119
0	100	200	300	400	500

49.86	52.0	57.5	58.7	55.7	50.8
123	93	47	35	65	114
0	100	200	300	400	500

TP	0.02	951.53		951.51					
426+62		E. R/W Fence			192 500	153 400	147 300	140 200	104 100
426+54		Toe Backslope			198 500	177 400	160 300	145 200	115 100
426+45		Toe Foreslope			196 500	182 400	158 300	141 200	116 100
426+38		Top Shoulder			155 500	143 400	125 300	106 200	77 100
426+26.1		E Co. Rock Rd (N-S)			37.2 149 500	38.6 137 400	40.2 119 300	42.1 100 200	44.9 72 100
426+17		Top Shoulder			152 500	142 400	125 300	104 200	76 100
426+09		Toe Foreslope ↑ 952.11			180 500	167 400	150 300	134 200	113 100

TP	4.64	949.13	7.04	944.49
433+00				
432+00				
431+00				
430+00				
429+00				
428+00				
427+00				
		951.53		

					42.53					
130	124	140	140	97	90	94	122	122	95	92
60	40	33	25	17	0	13	21	29	40	60
					43.13					
110	104	123	129	93	84	87	113	112	74	70
60	40	38	25	17	0	13	21	29	40	60
					43.73					
89	84	110	120	87	76	81	107	103	64	60
60	40	33	25	17	0	13	21	29	40	60
					44.43					
103	98	112	112	80	71	74	99	97	69	65
60	40	34	25	17	0	12	20	28	40	60
					45.13					
112	108	110	105	75	64	68	96	98	65	60
60	40	34	25	17	0	12	20	28	40	60
					46.33					
96	92	101	92	60	52	56	87	87	53	53
60	40	34	25	17	0	10	20	28	40	60
					47.93					
73	68	80	79	44	36	41	73	70	30	25
60	40	34	25	17	0	10	20	28	40	60

						44.23					
438+00	51	51	77	83	57	49	51	78	74	33	29
	60	40	33	24	15	0	12	19	27	40	60
TBM #8					0.06	949.07					
							SW Corner bottom step 70' Rt. of Sta. 438+20				
						44.33					
							44.3	44.9	45.0	45.1	
+67	Drive Rt. (No Pipe)					48	48	42	41	40	
						0	13	25	40	60	
						44.03					
437+00	72	72	93	96	58	51	55	81	78	50	
	60	40	32	24	15	0	13	22	30	40	60
											Bldg.
						43.03					
436+00	106	106	112	103	69	61	64	96	97	78	78
	60	40	32	24	15	0	13	22	30	40	60
						42.33					
435+00	130	130	134	119	77	68	71	106	106	92	92
	60	40	32	24	15	0	13	22	30	40	60
				34.40		42.13		36.55			
+24	24" x 43 RCP			14.73	80	70	73	12.58	87	80	
				24	15	0	13	19	40	100	
				℄				℄			
						42.13					
434+00	129	139	136	121	79	70	74	103	107	85	85
	60	40	31	24	16	0	13	22	30	40	60
		949.13									

TP	1.10	941.85	8.38	940.75
443+00				
442+00				
441+00				
+47	24"x43' RCP			
440+00				
439+00				
438+32	Drive Lt (No Pipe)			
		949.13		

42.53

84	84	97	107	72	66	70	101	97	69	67
60	40	33	24	15	0	12	21	27	40	60

42.43

101	98	109	110	74	67	72	101	99	68	62
60	40	33	24	15	0	13	22	26	40	60

42.43

114	114	124	120	75	67	71	106	103	78	73
60	40	32	24	15	0	13	21	27	40	60

42.63

			36.23				37.53			
146		128	12.90	72	65	70	11.60	91		79
100		40	22	15	0	12	21	40		100
			E				E			

42.83

125	125	129	119	70	63	67	108	103	92	92
60	40	32	24	15	0	12	19	27	40	60

43.03

74	71	95	99	65	59	62	91	92	56	51
60	40	33	24	15	0	12	19	27	40	60

44.03

63	58	55	56	51	
60	40	25	15	0	

TBM #9			4.02	937.83
+80	Drive Lt. (15"x20' RCP)			
449+00				
448+00				
447+00				
446+00				
445+00				
444+00				
		941.85		

SE Cor. Conc. Step (lower) 90' Lt. of Sta. 449+25

34.2	34.0	E 11.12	33.5	33.25						
77	79		84	86						
60	40		13	0						
		11.98 E 26		34.45						
65	65	92	101	78	74	79	109	118	96	101
60	40	31	22	15	0	13	21	30	40	60
				35.85						
51	54	83	88	63	60	67	102	100	87	92
60	40	31	22	15	0	13	21	30	40	60
				37.55						
45	45	70	73	48	43	50	83	85	72	77
60	40	33	24	15	0	12	21	27	40	60
				39.15						
26	30	52	61	33	27	34	64	67	48	48
60	40	33	24	15	0	13	21	26	40	60
				40.65						
00	00	35	43	17	12	19	48	47	21	26
60	40	32	24	14	0	13	20	27	40	60
				41.85						
41.0	41.0	25	34	05	00	05	34	30	00	00
60	40	33	24	15	0	12	21	27	40	60

455+00				
454+00				
453+00				
+47	36" x 42' CMP & RCP			
452+00				
451+00				
TP	3.53	935.34	10.04	931.81
450+00				
		941.85		

31.64

30	33	59	69	40	37	45	85	84	70	80
60	40	34	20	12	0	16	23	32	40	60

32.44

50	53	71	74	50	49	57	93	92	76	86
60	40	35	20	12	0	16	23	32	40	60

32.94

60	60	87	87	56	54	62	112	114	103	103
60	40	31	22	12	0	15	22	31	40	60

30.64

74	72	10.77	55	53	58	12.25	126	146		
100	40	22	12	0	13	20	40	100		
		FE				FE				

30.14

76	76	90	89	55	52	59	112	114	109	110
60	40	31	22	12	0	13	21	30	40	60

31.34

56	53	75	79	47	40	47	93	89	71	76
60	40	31	22	15	0	13	21	30	40	60

32.95

81	82	111	110	89	89	95	130	128	103	108
60	40	31	22	15	0	13	21	30	40	60

	02.1		02.1	01.9	01.3	41.67	41.4	41.4	40.8	40.8	
+83 Drive Lt. & Rt. (No Pipe)	38		38	40	46	42	45	46	51	51	
	60		40	25	14	0	15	25	40	60	
						41.67					
461+00	35	40	66	75	47	42	48	84	85	75	85
	60	40	33	20	14	0	15	22	31	40	60
						41.17					
460+00	41	44	68	80	51	47	53	94	90	82	97
	60	40	33	20	14	0	15	22	31	40	60
						39.67					
459+00	57	57	82	95	67	62	67	99	93	68	78
	60	40	33	20	14	0	15	22	31	40	60
						37.47					
458+00	97	97	115	128	91	84	91	120	116	93	98
	60	40	33	20	12	0	15	23	32	40	60
TP 11.34 945.87 0.81 934.53											
						34.84					
457+00	05	05	35	45	09	05	13	52	49	30	30
	60	40	34	20	12	0	16	23	32	40	60
						34.74					
456+00	21	21	54	59	28	26	32	82	82	76	76
	60	40	34	20	12	0	16	23	32	40	60
935.34											

467+00				
466+00				
TP	0.11	931.63	12.23	931.52
465+00				
464+00				
463+00				
462+00				
TP	2.29	943.75	4.41	941.46
		945.87		

26.53

91	81	94	96	59	51	55	86	82	50	45
60	40	33	21	15	0	14	20	28	40	60

27.23

49	39	56	65	31	24	28	59	53	22	17
60	40	33	21	15	0	14	20	28	40	60

32.45

125	120	141	150	120	113	119	144	141	99	94
60	40	33	21	15	0	14	20	28	40	60

35.45

84	80	103	114	86	78	85	108	106	56	61
60	40	33	21	15	0	14	20	28	40	60

39.15 34.55 35.85

39	39	65	80	52	46	51	79	71	24	24
60	40	33	20	14	0	15	22	31	40	60

41.45

12	12	38	48	26	23	26	58	60	22	32
60	40	33	20	14	0	15	25	31	40	60

474+00				
473+00				
TP	0.52	920.08	12.07	919.56
472+00				
471+00				
470+00				
469+00				
468+00				
		931.63		

17.38

52	48	68	73	33	27	32	77	10	05	
60	40	34	21	15	0	14	25	40	60	
							"V" 0.46			

19.18

61	56	60	58	14	09	13	48	44	13	08
60	40	36	21	15	0	14	20	28	40	60

20.23

180	170	178	170	122	116	122	153	149	127	127
60	40	36	21	15	0	14	20	28	40	60

20.43

169	163	166	159	118	112	116	146	139	110	110
60	40	36	21	15	0	14	20	28	40	60

21.23

162	156	161	156	109	104	107	140	133	109	109
60	40	36	21	15	0	14	20	28	40	60

22.73

140	135	140	140	95	89	92	127	125	98	98
60	40	33	21	15	0	14	20	28	40	60

24.33

116	111	120	120	80	73	76	110	105	75	75
60	40	33	21	15	0	14	20	28	40	60

BM			5.37	905.15	~~904.08~~ "X" in hdwl. So. in 2'x2'x34' RCBC @ Sta. 477+78
478	2'x2'x34' RCBC				
33 471	W. R/W Fence				
462	Drive Ct. (15"x21' RCP)				
TP	2.64	910.52	12.20	907.88	
477+00					
476+00					
475+00					
		920.08			

				00.41		4.72			01.07	
				1011	64	58	59		945	
				16	15	0	14		18	
				E					E	
						4.82				
128	154	144	141	116		57				
500	400	300	200	100		0				
00.3	01.7		E	00.3		5.22				
102	88		10.84	62		53				
60	40			15		0				
			9.96							
			E							
			28							
						7.48				
164	158	170	170	134		126	130	160	157	133	133
60	40	34	21	15		0	14	20	28	40	60
						11.08					
20	116	130	135	96		90	94	127	124	77	77
0	40	34	21	15		0	14	20	28	40	60
						14.41					
80	76	96	100	63		56	58	107	41	41	
60	40	34	21	15		0	14	25	40	60	
								"V" Ditch			

33	+38	E. R/W Fence	128 500	165 400	166 300	158 200	133 100	87 0
22	+28	Toe Backslope	144 500	162 400	168 300	174 200	157 100	
17	+21	Toe Foreslope	147 500	160 400	168 300	165 200	157 100	
11	+14	Top Shoulder	107 500	119 400	128 300	122 200	105 100	
	478+03.2	E Co. Rock Rd. (N-5)	100.4 101 500	98.8 1170 400 (Top Bridge)	98.2 123 300	98.7 118 200	100.4 101 100	03.52 70 0
11	+94	Top Shoulder	106 500	120 400	127 300	123 200	105 100	
17	+87	Toe Foreslope	134 500	155 400	159 300	154 200	140 100	0
22	+79	Toe Backslope	138 500	161 400	155 300	153 200	141 100	0

910.52

17	+24	Toe Foreslope				152	93	50	75	112
						100	200	300	400	500
"	+18	Top shoulder				132	73	33	53	80
						100	200	300	400	500
℄	478+03	E Co. Rock Rd. (N-S)				16.8	12.7	16.7	14.7	12.0
						129	70	30	50	77
						100	200	300	400	500
"	+95	Top Shoulder				128	73	34	53	77
						100	200	300	400	500
17	+87	Toe Foreslope				148	90	44	70	106
						100	200	300	400	500
22	+83	Toe Backslope				148	87	42	70	105
						100	200	300	400	500
33	477+71	W. R/W line (No Fence)				95	39	02	52	91
						0 100	200	300	400	500
TP	11.14	919.74	1.92	908.60						
		910.52								

482+00				
TP	0.66	893.73	12.11	893.07
481+00				
480+00				
479+00				
BM	0.03	905.18		905.15
23 +40	E. R/W Fence			
22 +29	Toe Backslope			
		919.74		

91.73

65	65	75	74	28	20	25	69	68	46	44
60	40	33	23	15	0	14	21	30	40	60

93.38

164	159	170	170	125	118	121	163	164	130	130
60	40	33	23	15	0	14	21	30	40	60

95.88

130	125	146	143	102	93	96	130	127	90	92
60	40	33	23	15	0	14	21	30	41	60

99.08

96	81	105	104	70	61	66	94	88	43	43
60	40	33	23	15	0	14	21	30	41	60

"X" in hdwl. So. in 2'x2'x 34' RCBC @ Sta. 477+78

124	66	23	55	105
100	200	300	400	500

150	89	49	83	121
100	200	300	400	500

							94.63						
489+00	129	126	170	138	136	99	91	95	122	117	76	74
	60	40	26	24	20	14	0	14	21	32	40	60
					(Berm)							
							85.83					
488+00	125	118		159		88	79	84	112	108	82	82
	60	40		27		14	0	14	21	32	40	60
				"V" Ditch								
							86.93					
				80.03					80.97			
486+06	120		110	13.70		75	68	70	12.76		77	70
	100		40	17		14	0	14	22		40	100
				℄					℄			
							86.93					
				80.63					81.08			
487+00	110	110	127	13.10		75	68	71	12.65	108	77	77
	60	40	33	17		15	0	14	20	32	40	60
				℄					℄			
							87.73					
486+00	101	101	118	111		66	60	63	95	96	78	75
	60	40	33	23		15	0	15	21	32	40	60
							88.63					
485+00	90	90	110	105		59	51	55	94	93	68	68
	60	40	33	23		15	0	14	21	30	40	60
							89.33					
484+00	78	78	98	90		51	44	48	88	88	75	75
	60	40	33	23		15	0	14	21	30	40	60
							90.23					
483+00	67	67	83	84		43	35	39	81	80	65	65
	60	40	33	23		15	0	14	21	30	40	60

489+00		
488+00		
+06	36" x 39 RCP	
487+00	36" x 37' RCP	
486+00		
485+00		
484+00		
483+00		
		893.73

+87	30"x 32' RCP			
494+00				
493+00				
492+00				
491+00				
490+00				
TP	0.14	883.31	10.56	883.17
		893.73		

			73.48			78.41		74.81			
	100 100	86 40	9.83 16		55 13	49 0	52 12	8.50 16	53 40	24 100	
			FL					FL			
						79.31					
94 60	84 40	127 26	98 24	90 20	46 14	40 0	44 14	64 21	60 32	28 40	28 60
						80.71					
88 60	74 40	121 26	87 24	84 20	33 14	26 0	31 14	52 21	48 32	22 40	17 60
						82.01					
76 60	58 40	107 26	75 24	67 20	20 14	13 0	17 14	47 21	47 32	19 40	09 60
						82.81					
46 60	46 40	96 26	59 24	57 20	11 14	05 0	08 14	33 21	33 32	+1.0 40	+0.5 60
						83.31					
37 60	37 40	84 26	48 24	45 20	03 14	00 0	01 14	26 21	20 32	+1.0 40	+0.5 60
			(Berm)								

						72.96						
499+00	151 60	146 40	152 35	148 20	109 14	105 0	110 15	138 20	140 31	100 40	95 60	
						74.36						
498+00	145 60	140 40	150 35	148 20	97 14	91 0	96 15	117 20	124 31	73 40	67 60	
				(Berm Runout)								
						75.66						
497+00	123 60	109 40	149 26	129 24	122 20	84 14	78 0	82 14	102 21	99 32	56 40	46 60
						76.96						
496+00	95 60	86 40	147 26	127 24	124 20	71 14	65 0	69 14	86 18	89 32	62 40	52 60
				(Berm)								

TBM #10 0.29 883.46 883.17

TBM #10 0.14 883.17

Spk. in lone 14" Pine 130' Rt. of sta. 496+50 (0.2' above ground)

						72.21	10.2	FE 10.19		79.0	78.8
						51 0	51 14			43 40	35 60
								9.87 FE 24			
	73.5		74.5	76.0	77.5	72.11					
	98 60		88 40	73 25 Top Bridge	58 14	52 0					

+19 Drive Rt. (24"x31' RCP)

+14 Drive Lt. (Wood Bridge)

883.31

+25	Drive Lt. (42"x27' RCP)			
504+00				
503+14	E. End bridge (Top Conc.)			
+84	W. End bridge (Top Conc.)			
502+00				
501+00				
500+00				
TP	2.96	874.37	12.05	871.41
		883.46		

	67.7	68.2		69.6	69.77						
	67	62	FL 9.95	48	46						
	60	40		14	0						
			9.60 FL 29		69.87						
70	71	83	73	49	45	50	90	93	83	83	
60	40	35	20	14	0	15	20	31	40	60	
					70.69						
					3.68						
					0						
67.9	67.9	67.4	65.8	65.7		65.2	64.3	63.2	63.1	62.7	
68	68	70	76	77	70.75	92	101	112	113	117	
500	400	300	200	100		100	200	300	400	500	
					3.62						
					0						
					70.27						
70	64	78	82	45	41	46	76	74	52	47	
60	40	35	20	14	0	15	20	31	40	60	
					70.87						
66	62	76	72	40	35	40	68	68	38	33	
60	40	35	20	14	0	15	20	31	40	60	
					71.87						
63	59	71	67	32	25	30	57	57	26	21	
60	40	35	20	14	0	15	20	31	40	60	

						78.19						
511+00	93 60	93 40	108 31	111 20	80 15	14 0	82 15	113 20	116 31	71 40	71 60	
						74.89						
510+00	132 60	132 40	142 31	144 21	112 14	107 0	114 15	157 20	158 31	132 40	137 60	
TP	11.60	885.59	0.38	873.99								
						72.47						
509+00	36 60	36 40	54 35	49 21	23 14	19 0	26 15	78 20	78 31	76 40	76 60	
						70.87						
508+00	40 60	40 40	64 35	59 20	38 14	35 0	42 15	94 20	100 31	101 40	101 60	
						70.07						
507+00	46 60	46 40	65 35	66 20	45 14	43 0	48 15	95 20	107 31	108 40	108 60	
						69.77						
506+00	53 60	53 40	70 35	70 20	50 14	46 0	53 15	98 20	104 31	105 40	105 60	
						69.77						
505+00	66 60	66 40	73 35	83 20	50 14	46 0	53 15	100 20	103 31	90 40	90 60	
		874.37										

						96.80	96.2	E	94.7	94.0	
744	Field Rt. (15"x24" RCP)					04	10	4.10	25	32	
						0	16		40	60	
								502			
						95.10		E			
								31			
517+00	10	10	45	45	18	14	20	53	55	47	50
	60	40	29	19	14	0	16	20	31	40	60
						93.70					
516+00	25	23	58	60	40	35	40	72	72	69	73
	60	40	30	19	14	0	16	20	31	40	60
						91.80					
515+00	37	37	78	83	60	54	59	89	92	77	82
	60	40	30	19	14	0	16	20	31	40	60
						89.40					
514+00	54	54	107	112	84	78	83	114	114	98	98
	60	40	29	19	14	0	16	20	31	40	60
						86.30					
513+00	91	91	141	140	117	110	115	142	137	116	120
	60	40	29	19	14	0	16	20	31	40	60
TP	12.45	897.20	0.84	884.75							
						82.19					
512+00	25	25	55	60	38	34	40	70	75	31	31
	60	40	31	20	15	0	15	20	31	40	60
		885.59									

522+00				
TP	0.25	891.73	11.38	891.48
521+00				
TBM #11			1.10	901.76
520+02	Drive Rt. (15"x28' RCP)			
519+08	Farm Dr. Rt. (No Pipe)			
518+00				
TP	8.30	902.86	2.64	894.56
		897.20		

86.73

66	66	85	89	54	50	55	98	97	68	68
60	40	28	20	15	0	14	21	29	40	60

90.36

141	136	168	164	131	125	131	161	160	133	133
60	40	28	20	15	0	14	21	29	40	60

NE Cor. bottom step 120' Rt. of Sta. 519+38

94.46 94.3 E 96.2 97.3

81	71	115	113	90	84	86	11.59	67	56
60	40	29	19	14	0	16		40	60

9.90 E

97.46 97.5 98.2 99.3 99.3

20	20	76	80	60	54	54	21 47	36	26
60	40	29	19	14	0	16	25	40	60

92.56

40	40	67	75	58	53	61	81	78	49	49
60	40	29	19	14	0	16	20	31	40	60

						86.63					
530+00	54 60	54 40	85 28	86 20	54 15	51 0	58 14	97 21	96 29	60 40	55 60
						83.13					
529+00	92 60	90 40	116 28	117 20	90 15	86 0	93 14	141 21	141 29	118 40	118 60
						81.13					
528+00	116 60	116 40	141 28	141 20	109 15	106 0	115 14	170 21	170 29	160 40	160 60
						80.03					
527+00	134 60	134 40	155 28	155 20	120 15	117 0	124 14	175 21	175 29	165 40	165 60
						79.73					
526+03 48" x 41' RCP	136 100		170 40	71.85 19.88 19 FE	125 15	120 0	127 14	70.28 21.45 22 FE	195 40	220 100	
						80.23					
525+00	126 60	131 40	160 28	156 20	120 15	115 0	122 14	173 21	172 29	168 40	168 60
						81.43					
524+00	123 60	123 40	139 28	138 20	108 15	103 0	111 14	160 21	160 29	148 40	149 60
						83.73					
523+00	106 60	106 40	116 28	115 20	84 15	80 0	86 14	132 21	134 29	106 40	106 60

891.73

14 +68.4	E. Co. Rock Rd. (N-S)				
13 +55	Top Shoulder				
20 +48	Toe Foreslope				
21 +39	Toe Backslope				
33 +31	W. R/W Fence				
		↑			
(Hub)	15.84	905.31		889.47	
BM (Hub)			2.37	894.21	894.2
TP	7.11	896.58	2.26	889.47	
531+00					
		891.73			

0+8	0+6	98.6	95.5	92.01	
05	37	67	98	133	
400	300	200	100	0	
12	44	73	103		
400	300	200	100		
36	68	96	125		
400	300	200	100		
38	72	97	125		
400	300	200	100		
				91.31	
17	52	78	105	140	
400	300	200	100	0	

Found
Spk. in Power pole (NW Quad.) @ NE Cor. 34-87-12
÷ Geodetic Bench ÷

					90.33					
00	00	33	41	17	14	21	45	44	10	25
60	40	28	30	15	0	14	21	29	40	60

+50	Toe Foreslope			
+46	Toe Backslope			
531+31	W. R/W Fence			
(Hub)	3.34	892.81	889.47	
33 532+02	E. R/W Fence			
27 +97	Toe Backslope			
28 +91	Toe Foreslope			
29 +83	Top Shoulder			
		905.31		

91	160	226	270
100	200	300	400
92	165	231	272
100	200	300	400
51	131	210	240
100	200	300	400

				91.81
+2.0	22	54	89	135
400	300	200	100	0
31	60	95	129	
400	300	200	100	
33	60	94	129	
400	300	200	100	
10	41	72	105	
400	300	200	100	

						892.85					
	03	09	47	62	41	38	44	75	83	60	75
	60	40	30	19	14	0	15	20	31	40	60

533+00											
(Hub)	4.18	893.65	889.47								
532+02	E. R/w Fence						53	133	210	220	
							100	200	300	400	
+98	Toe Backslope						98	170	230	266	
							100	200	300	400	
+90	Toe Foreslope						96	170	227	264	
							100	200	300	400	
+84	Top Shoulder						70	138	191	232	
							100	200	300	400	
+68.4	E Co. Rock Rd. (N-S)						61	93	141	190	
							67	135	187	228	
							100	200	300	400	
+56	Top Shoulder						70	138	191	230	
							100	200	300	400	
		892.81									

TP	11.56	904.82	0.39	893.26
539+00				
538+00				
537+00				
536+00				
+73	42" x 36' RCP			
535+00				
534+00				
		893.65		

93.25

00	105	27	34	07	04	10	45	53	20	25
60	40	30	19	14	0	15	21	31	40	60

90.05

45	39	68	68	40	36	41	78	88	59	65
60	40	30	19	14	0	15	21	31	40	60

87.45

91	91	104	104	66	62	70	112	120	108	113
60	40	30	19	14	0	15	21	31	40	60

85.95

105	105	124	119	83	77	83	143	146	144	144
60	40	30	19	14	0	15	21	31	40	60

85.85

	102	117	18.11 154	81	78	84	16.58 17.06	149	170	
	100	40	18	14	0	15	18	40	100	
			E				E			

86.15

89	89	115	117	78	75	81	138	143	139	152
60	40	30	19	14	0	15	21	31	40	60

87.85

8	48	88	90	63	58	65	106	108	89	100
	40	30	19	14	0	15	21	31	40	60

546+00				
545+00				
544+00				
TBM #12			0.52	909.73
+98	(15" x 28' RCP) Drive Lt.			
TP	8.66	910.25	3.23	901.59
542+00				
541+00				
540+00				
		904.82		

0.65

96	96	125	122	101	96	104	127	129	101	109
60	40	30	19	14	0	14	20	30	40	60

4.15

32	28	70	77	66	61	68	90	99	83	88
60	40	19	16	14	0	15	21	31	40	60

5.25

61	06	54	66	52	50	54	81	86	63	68
60	40	19	16	14	0	15	21	31	40	60

Spk. in 20" Tree 80' Lt. of Sta. 543+35 (0.5' above grd.)

4.35

	46	50	8.33	58	59	63	97	103	80	80
	60	40		14	0	15	21	31	40	60

45.7 45.3 FE 45

9.40 FE 25

1.72

23	26	66	58	33	31	36	73	78	56	61
60	40	30	19	14	0	15	21	31	40	60

99.02

50	50	80	83	59	58	64	99	105	86	91
60	40	30	19	14	0	15	21	31	40	60

16.22

72	72	110	115	87	86	92	124	134	100	110
60	40	30	19	14	0	15	21	31	40	60

550+00				
TP	0.72	889.46	11.25	888.74
549+00				
548+00				
+25	Drive Rt. (15" x 28' RCP)			
TP	1.54	899.99	11.80	898.45
547+00				
		910.25		

83.76

82 82 99 96 63 57 62 95 107 75 70
60 40 32 20 14 0 14 19 31 40 60

86.79

165 150 183 168 140 132 138 170 177 137 139
60 40 32 20 15 0 14 19 31 40 60

90.99

112 107 131 126 95 90 96 120 122 92 92
60 40 32 20 15 0 14 19 31 40 60

94.99

94.3 Rt 9.25 94.9 94.7
50 57 51 53
0 14 4.0 6.0
7.80
Rt
25

96.05

180 160 182 170 149 142 144 158 162 131 131
60 40 30 19 14 0 14 20 30 40 60

												99.58											
557+00							93	93	131	131	100	95	102	145	155	150	155
							60	40	32	20	14	0	14	19	31	40	60
TP	10.08	899.08	0.46	889.00													
												88.16					
556+00							00	00	49	55	20	13	21	56	60	37	32
							60	40	32	20	14	0	14	19	31	40	60
												86.26					
555+00							16	16	69	65	38	32	42	72	72	31	30
							60	40	32	20	14	0	14	19	31	40	60
												83.76					
554+00							60	59	88	84	60	57	63	95	100	68	63
							60	40	32	20	14	0	14	19	31	40	60
												81.86					
553+00							87	88	108	105	80	76	82	122	126	116	116
							60	40	32	20	14	0	14	19	31	40	60
												81.26					
								94	116	74.03 15.43		82	87	73.56 15.90	143		152
+89	3'x 3'x 30 RCBC							100	40	15	13	0	13	15	40		100
										TC				TC			
												82.06					
551+00							92	92	109	107	81	74	82	127	129	119	119
							60	40	32	20	14	0	14	19	31	40	60
		889.46															

						900.00						
563+00					30	30	75	90	77	71	77	98	94	60	72
					60	40	33	20	14	0	14	19	31	40	60
										1.50					
						0.1	0.35	0.0	0.5						
562+00	Drive Ct. (No Pipe)					30	36	41	56	56	61	91	94	81	86
						60	40	25	14	0	14	19	31	40	60
										12.70					
561+00					57	57	95	100	78	74	80	108	110	92	92
					60	40	35	20	14	0	14	19	31	40	60
TP	9.18	907.10	1.16	897.92											
										97.08					
560+00					11	11	47	55	26	20	30	54	58	14	19
					60	40	33	20	14	0	14	19	31	40	60
										93.98					
559+00					60	59	87	89	55	51	58	90	90	54	64
					60	40	33	20	14	0	14	19	31	40	60
								886.91		91.58					
						10.6	10.5	E	9.4						
558+13	Drive Ct. (18"x24' RCP)					87	86	12.17	77	75	82	124	125	117	119
						60	40	62	14	0	14	19	31	40	60
								886.46							
								12.46							
								E							
								31							
		899.08													

569+00				
568+00				
567+08	30" x 37' RCP			
566+00				
TP	0.39	895.64	11.85	895.25
565+00				
564+00				
TBM #13			0.71	906.39
		907.10		

89.24

20	20	75	85	70	64	69	90	61	62	
60	42	30	20	15	0	15	20	40	60	

88.44

63	68	107	110	79	72	78	125	130	116	121
60	40	33	20	15	0	13	20	31	40	60

88.84

	104	114	80.69 14.95		68	77	79.11 16.53		148	185
	100	40	18	15	0	13	19		40	100
			E				E			

90.34

94	94	103	100	60	53	60	122	122	97	97
60	40	33	20	15	0	13	20	31	40	60

93.10

144	144	175	170	144	140	144	182	180	147	152
60	40	33	20	14	0	14	19	31	40	60

96.70

82	82	117	128	108	104	108	134	134	94	97
60	40	33	20	14	0	14	19	31	40	60

Spk. in Lane 16" Pine 95' Lt. of Sta. 562+90

			16.5	75.9	200' NE'ly of end on ℄
			11.0	81.4	100' NE'ly of end on ℄
TBM #14			6.03	886.36	Spk. in 16" Lone Pine 120' Rt. of Sta. 569+87 @ SW Cor. Garage. (1.0' above ground)
(Hub) TP	3.11	892.39	6.36	889.28	

571+00

					96.24				
05	103	102	94	94	94	115	96	96	
53	33	25	12	0	5	14	33	60	
		"V" Ditch	℄ Road						

570+00

				88.94					
10	10	66	84	76	67	69	87	71	79
60	41	30	23	16	0	14	23	40	60
							"V" Ditch		
					89.34	88.6	88.4	88.7	88.0
					63	60	62	69	76
					0	14	25	40	60

569+65 Drive Rt. (No Pipe)

895.64

BM			1.56	894.24	894.2	Spk. in Power Pole (NW Quad.) @ NE Cor. 34-57-12 ÷ Geodetic Bench ÷
TP	0.01	895.80	11.73	895.79		
TP	8.84	907.52	0.35	898.68		
TP	11.74	899.03	1.01	887.29		
TP	1.73	888.30	11.61	886.57		
TP	1.18	898.18	5.25	897.00		
TP	10.69	902.25	0.83	891.56		
			38.0	54.4		500' NE'ly of end on ℄
			33.0	59.4		400' NE'ly of end on ℄
			24.9	67.5		300' NE'ly of end on ℄
		↑ 892.39				

Extra "X"-Sections

(Road No. 1)

320+53		E. R/W fence	69 40	90 29	93 17	69 12	54 0	58 12	102 20	100 35	83 40
320+36		Toe backslope	82 40	83 29	85 17	56 12	52 0	56 12	98 20	94 35	93 40
320+28.5		Toe foreslope	78 40	78 29	74 25	50 16	47 0	51 16	84 25	85 35	86 40
319+76.5		Toe foreslope	67 40	64 30	60 25	40 16	37 0	36 16	59 25	64 35	67 40
319+63.5		Toe backslope	63 40	64 30	59 17	35 12	30 0	31 12	58 20	58 35	68 40
319+51		W. R/W Fence	28 40	60 29	58 20	31 12	27 0	29 12	59 20	58 35	43 40
TBM #2	3.87	956.93		953.06							

Day Lighting
(Road No. 1)
956.93

4.9	90' Rt.	of	Sta.	319+02	(Use for sight dist.)
5.9	140' "	"	"	"	"
29	90' "	"	"	318+52	"
4.7	140' "	"	"	"	"
3.4	90' Lt.	"	"	319+02	"
4.9	140' "	"	"	"	"
2.1	90' "	"	"	318+52	"
4.0	140 "	"	"	"	"
12.7	90' Rt.	of	Sta.	321+02	"
13.8	140' "	"	"	"	"
13.0	90' "	"	"	321+52	"
14.9	140' "	"	"	"	"
9.8	90' Lt.	"	"	321+02	"
10.5	140' "	"	"	"	"
11.7	90' "	"	"	321+52	"
12.6	140' "	"	"	"	"

MISC. Info.

TP	0.73	950.81	950.08
342+61	24"x43' RCP (26' Rt. & 17' Lt. of ℄)		
TP	4.42	947.19	942.77
396+65	24"x37' RCP (19' Rt. & 18' Lt. of ℄)		
TP	4.40	947.44	943.04
385+80	Sta. falls in dr. use this for quantities		
TP	4.54	875.29	870.75
502+78 (84)	W. End bridge		
503+20 (14)	E. End bridge		

Top ℄ rail Sta. 345+00

			44.73				43.71			
25	33	33	608	19	11	14	710	62	62	70
00	60	40	17	13	0	14	27	40	60	100
			℄				℄			

Top ℄ rail Sta. 397+00

			38.09				38.97			
115	107	103	910	50	44	47	820	65	60	55
100	60	40	18	15	0	13	19	40	60	100
			℄				℄			

Intersection ℄ Drive & ℄ Road @ Sta. 386+08

42	46	70	79	58	51	54	85	75	34	35
60	40	24	19	14	0	14	20	30	40	60

Top conc. W. end bridge

					78.8					
85	86	95	91	47	45	45	87	87	87	87
60	40	35	20	14	0	15	20	31	40	60
					78.4					
81	79	89	95	50	49	49	87	91	91	91
60	40	35	20	14	0	15	20	31	40	60

Misc. Info. (cont.)

TP	4.95	902.41	897.46
518+85	sta. falls in drive		
520+27	sta. falls in drive		
TP	7.25	908.97	901.72
542+70	sta. falls in drive		
TP	3.98	895.56	891.58
558+00	missed this one!!		
TP	4.56	906.06	901.50
561+73	sta. falls in drive		

Inter. E Road & E Drive Rt. @ Sta. 519+08

04	04	57	71	52	47	49	65	58	20	20
60	40	28	20	14	0	15	20	30	40	60

97.7

94	91	119	123	99	92	94	115	106	72	67
60	40	29	19	14	0	14	21	29	40	60

93.2

Top nail E Rd. @ Sta. 542+00

40	42	76	78	55	53	58	91	94	74	74
60	40	30	19	14	0	15	21	32	40	60

360

Inter. E Road & E Drive Lt. @ Sta. 558+13

59	59	78	74	45	42	51	86	96	97	97
60	40	33	20	14	0	14	19	31	40	60

94

Top E nail @ sta. 562+00

33	33	63	74	53	48	56	83	87	77	82
60	40	35	20	14	0	14	19	31	40	60

126

Level Circuit running from East end of job to "X" in R.C.B.C. @ South end of La Porte High School

TBM #14	5.74	892.10		886.36	Spk. in 16" Lone pine 120' Rt. of Sta. 569+87 @ SW Cor. garage (1.0' above ground)
TP	0.65	880.31	12.44	879.66	
TP	0.94	869.15	12.10	868.21	
TP	1.59	858.43	12.31	856.84	
TP	0.98	847.54	11.87	846.56	
TP	0.24	836.76	11.02	836.52	
TP	4.19	828.98	11.97	824.79	
BM #15			3.77	825.21	"X" Chiseled in W. hdwl of RCBC on curve @ South end high school prop. in La Porte
BM #15	3.51	828.72		825.21	
TP	10.51	835.59	3.64	825.08	

		835.59			
TP	11.43	846.55	0.47	835.12	
TP	12.42	858.38	0.59	845.96	
TP	12.30	870.47	0.21	858.17	
TP	12.44	882.56	0.35	870.12	
TP	10.08	892.39	0.25	882.31	
TBM #14			6.02	886.37	886.36

Extra "X" Sections
(Road No. 2)

						35.15						
373+93	E. R/W fence	51	42	79	75	50	46	48	68	65	32	33
		70	40	29	21	14	0	13	25	31	40	70
							35.05					
+85	Toe backslope	86	77	76		50	47	48		68	66	67
		70	40	29		14	0	13		31	40	70
							35.05					
+78	Toe foreslope	89	79	67		50	47	48			61	68	66
		70	40	29		14	0	13			30	40	70
							34.15					
+43	Toe foreslope	71	60	70	74	58	56	60	71	85	85	95
		70	40	29	23	14	0	18	28	31	40	70
			T/drive									
							33.75					
+31	Toe backslope	77	64	86	86	65	60	64	97	94	91	93
		70	40	29	21	14	0	13	25	31	40	70
			T/drive									
							33.05					
373+26	W. R/W fence	68	65	90	98	71	62	68	100	105	69	76
		70	40	29	21	14	0	13	25	31	40	70

TP 4.98 939.75 934.77

Inter. N-S & E-W. Roads @ Sta. 373+59.5

Day Lighting
(Road No. 2)

939.75
↓

373+93	1.4	90° Rt
✓	0.4	140° ✓
373+43	2.4	90° Rt.
✓	2.8	140° ✓
373+93	8.3	90° Lt.
✓	10.2	140° ✓
373+43	7.2	90° ✓
✓	9.0	140° ✓
372+76	11.4	90° Rt.
✓	12.1	140° ✓
372+26	13.7	90° Rt.
✓	14.7	140° ✓
372+76	9.6	90° Lt.
✓	10.3	140° ✓
372+26	11.8	90° Lt.
✓	12.5	140° ✓

Extra "X" Sections
(Road No. 3)

						48.9						
+62	E. R/W fence	136	100	110	110	73	67	69	101	99	66	43
		70	40	29	21	13	0	14	21	28	40	70
							48.2					
+54	Toe backslope	146	115	108	103	71	64	68	91	98	92	71
		70	40	29	21	13	0	14	21	28	40	70
							49.4					
+45	Toe foreslope	148	116	107	81	67	62	64	77	93	92	71
		70	40	29	21	13	0	14	21	28	40	70
							49.2					
+09	Toe foreslope	144	117	107	72	62	54	54	54	72	79	60
		70	40	29	21	13	0	14	21	28	40	70
							50.4					
426+00	Toe backslope	144	114	116	96	61	52	56	72	77	70	65
		70	40	29	21	13	0	14	21	28	40	70
							50.6					
425+92	W. R/W fence	116	89	103	99	59	51	57	78	74	42	26
		70	40	29	21	13	0	14	21	28	40	70

TP 5.73 950.59 949.86
935.59

Inter. N-S & E-W Road @ Sta. 426+26.1

Day Lighting
(Road No. 3)

950.59

427+62	7.1	90'	Rt.
✓	4.0	140'	✓
427+12	5.6	90'	✓
✓	4.0	140'	✓
427+62	15.1	90'	Lt.
✓	17.8	140'	✓
427+12	14.6	90'	✓
✓	17.2	140'	✓
425+42	1.9	90'	Rt
✓	0.1	140'	✓
424+92	0.9	90'	✓
✓	0.0	140	✓
425+42	10.0	90'	Lt.
✓	11.4	140'	✓
424+92	7.6	90'	✓
✓	9.7	140'	✓

Extra "X" Sections
(Road No. 4)

						01.9					
140	E. R/w fence	113	101	106	110	87	82	85	99	107	80	46
		70	40	32	22	12	0	14	21	31	40	70
							02.4					
129	Toe backslope	132	103	100	97	85	77	79	84	98	95	79
		70	40	32	22	12	0	14	21	31	40	70
			T/drive									
							02.8					
478+24	Toe foreslope	137	95	90	81	77	73	73	74	88	90	81
		70	40	32	22	12	0	14	21	31	40	70
			T/drive									
							04.4					
187	Toe foreslope	124	115	106	73	63	57	58	60	77	81	67
		70	40	32	22	12	0	14	21	31	40	70
							04.8					
183	Toe backslope	126	111	109	101	60	53	56	85	84	70	65
		70	40	32	22	12	0	14	21	31	40	70
							05.0					
477+71	W. R/w fence	97	85	78	68	57	51	55	83	79	44	25
		70	40	32	22	12	0	14	21	31	40	70
				T/drive	T/drive							

TP 6.56 910.08 903.52

Inter. N-S & E-W Road @ Sta. 478+03

Day Lighting
(Road No. 4)

	910.08 ↓		
479+40		8.6	90' Rt.
✓		5.9	140' ✓
478+90		5.7	90' ✓
✓		2.7	140' ✓
479+40		17.0	90' Lt.
✓		18.0	140' ✓
478+90		15.1	90' ✓
✓		16.3	140' ✓
477+21		1.1	90' Rt.
✓		+1.3	140' ✓
476+71		0.2	90' ✓
✓		+1.6	140' ✓
477+21		9.7	90' Lt.
✓		11.7	140' ✓
476+71		7.6	90' ✓
✓		9.4	140' ✓

Extra "X" Sections
(Road No. 5)

						91.9					
532+02	E. R/w fence	20	25	63	59	54	54	59	72	81	66	78
		70	40	28	19	12	0	16	23	31	40	70
							92.1					
+97	Toe backslope	52	56	62	50	50	52	59	61	80	87	121
		70	40	28	19	12	0	16	23	31	40	70
							92.1					
+91	Toe foreslope	53	56	47	47	47	52	56	65	73	92	119
		70	40	28	19	12	0	16	23	31	40	70
							91.9					
+48	Toe foreslope	48	59	50	49	54	54	58	64	70	89	114
		70	40	28	19	12	0	16	23	31	40	70
							91.7					
+39	Toe backslope	52	62	63	50	58	56	60	72	83	91	110
		70	40	28	19	12	0	16	23	31	40	70
							91.3					
531+31	W. R/w fence	31	32	74	70	61	58	62	83	85	55	77
		70	40	28	19	12	0	16	23	31	40	70
	↑											

BM 3.10 897.31 894.21

RR Spk. in pow. pole NW Quad. NE Cor. 34-87-12

Day Lighting
(Road No. 5)

897.31

533+02	13.0	84.3	90'	Rt.
✓	17.2	80.1	140	✓
532+52	12.3	85.0	90	✓
✓	15.4	81.9	140	✓
533+02	2.6	94.7	90	Lt.
✓	0.6	96.7	140	✓
532+52	2.0	95.3	90	✓
✓	0.1	97.2	140	✓
530+81	10.9	86.4	90'	Rt.
✓	14.0	83.3	140'	✓
530+31	12.9	84.4	90'	✓
✓	16.0	81.3	140	✓
530+81	5.7	91.6	90	Lt.
✓	4.4	92.9	140	✓
530+31	8.3	89.0	90	✓
✓	7.4	89.9	140	✓

Elev's. to tie in datum of Northern 2/20/68
Nat. Gas. Co. where 6" main crosses
Co. Rd. S26-87-12

		9.91	886.67	℄ W. end Ealr Culv. Sta 558+13 Lt.
		9.54	887.04	℄ E " " " " "
		5.12	891.46	Spk. in Perm. Pole 40' N Sta 558+50?
7.00	896.58		889.58	℄ nail Sta 557+00

Smith
Shoff

Cold, Clear 25°
Mar 22, 1968

Clearing & Grubbing Count for Estimate

Size Diameter	Div I	Div II
3"-6"	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII	III 𝍸 𝍸 𝍸 𝍸 𝍸
6"-9"	𝍸 𝍸 𝍸 IIII	𝍸 𝍸 𝍸 I
9"-12"	𝍸 𝍸 𝍸 𝍸 II	𝍸 IIII
12"-15"	𝍸 𝍸 𝍸 𝍸 I	
15"-18"	𝍸 𝍸 I	II
18"-24"	𝍸 𝍸 𝍸 𝍸 𝍸 I	𝍸
24"-30"	𝍸 𝍸 IIII	III
30"-36"	𝍸 𝍸 IIII	I
36"-42"	IIII	
42"-48"	III	
48"-60"	I	
60"-72"		
Over 72"		
Brush (Sq.)	𝍸 I 𝍸 IIII	𝍸

Div I. Grub Only	Div. I Cl. & Gr.	Div. I Gr. Only	Div II Cl. & Gr.	Div II Grub Only.
𝍸 𝍸 𝍸 III	43	18	24	
IIII	19	4	16	
IIII	22	4	8	
𝍸 III	21	8		
𝍸	11	5	2	
III	26	3	5	
I	14	1	3	
I	14	1	1	
	4			
	3			
	1			
	14		5	

IMPROVED TABLES AND INFORMATION

HORIZONTAL STADIA CORRECTIONS								
2°—00′	—	0.1	21°—00′	—	12.8	33°—00′	—	29.7
3°—00′	—	0.3	21°—30′	—	13.4	33°—15′	—	30.1
4°—00′	—	0.5	22°—00′	—	14.0	33°—30′	—	30.5
5°—00′	—	0.8	22°—30′	—	14.7	33°—45′	—	30.9
6°—00′	—	1.1	23°—00′	—	15.3	34°—00′	—	31.3
7°—00′	—	1.5	23°—30′	—	15.9	34°—15′	—	31.7
8°—00′	—	1.9	24°—00′	—	16.5	34°—30′	—	32.1
9°—00′	—	2.5	24°—30′	—	17.2	34°—45′	—	32.5
10°—00′	—	3.0	25°—00′	—	17.9	35°—00′	—	32.9
10°—30′	—	3.3	25°—30′	—	18.6	35°—15′	—	33.3
11°—00′	—	3.6	26°—00′	—	19.2	35°—30′	—	33.7
11°—30′	—	4.0	26°—30′	—	19.9	35°—45′	—	34.1
12°—00′	—	4.3	27°—00′	—	20.6	36°—00′	—	34.6
12°—30′	—	4.7	27°—30′	—	21.3	36°—15′	—	35.0
13°—00′	—	5.1	28°—00′	—	22.0	36°—30′	—	35.4
13°—30′	—	5.5	28°—30′	—	22.8	36°—45′	—	35.8
14°—00′	—	5.9	29°—00′	—	23.5	37°—00′	—	36.2
14°—30′	—	6.3	29°—30′	—	24.3	37°—15′	—	36.6
15°—00′	—	6.7	30°—00′	—	25.0	37°—30′	—	37.1
15°—30′	—	7.2	30°—15′	—	25.4	37°—45′	—	37.5
16°—00′	—	7.6	30°—30′	—	25.8	38°—00′	—	37.9
16°—30′	—	8.1	30°—45′	—	26.2	38°—15′	—	38.3
17°—00′	—	8.5	31°—00′	—	26.5	38°—30′	—	38.7
17°—30′	—	9.0	31°—15′	—	26.9	38°—45′	—	39.1
18°—00′	—	9.5	31°—30′	—	27.3	39°—00′	—	39.6
18°—30′	—	10.1	31°—45′	—	27.7	39°—15′	—	40.0
19°—00′	—	10.6	32°—00′	—	28.1	39°—30′	—	40.5
19°—30′	—	11.2	32°—15′	—	28.5			
20°—00′	—	11.7	32°—30′	—	28.9			
20°—30′	—	12.3	32°—45′	—	29.3			

Chains to Feet	
1	66
2	132
3	198
4	264
5	330
6	396
7	462
8	528
9	594
10	660

Feet to Chains	
100	1.515
200	3.030
300	4.545
400	6.060
500	7.575
600	9.090
700	10.606
800	12.121
900	13.636
1,000	15.151

DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope 1½ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

TABLE No. 9.

To find Tangent and External for curve of any other degree, divide by degree of curve and add correction found in column of corrections.

Degree of curve with a given I may be found by dividing tangent, (or external), opposite I by given tangent, (or external).

The distance from a point on the tangent to the curve is very nearly the square of the tangent length divided by twice the radius.

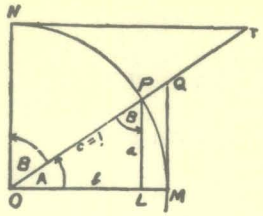


TABLE II

TRIGONOMETRIC FORMULÆ.

$\angle A = \angle MOP \qquad \angle B = \angle PON = \angle OPL$

$R = OP = c = 1$

$\sin A = \frac{a}{c} = \frac{a}{1} = a = \cos B = LP$

$\cos A = \frac{b}{c} = \frac{b}{1} = b = \sin B = OL$

$\tan A = \frac{a}{b} = \frac{MQ}{OM} = \frac{MQ}{1} = MQ = \cot B = MQ$

$\cot A = \frac{NT}{ON} = \frac{NT}{1} = NT = \tan B = NT$

$\sec A = \frac{OQ}{OM} = \frac{OQ}{1} = OQ = \csc B = OQ$

$\csc A = \frac{OT}{ON} = \frac{OT}{1} = OT = \sec B = OT$

$\text{vers } A = \frac{LM}{OP} = LM = \text{covers } B$ #

$\text{covers } A = \frac{OP - LP}{OP} = OP - LP = \text{vers } B$

$\text{exsec } A = PQ = \text{coexsec } B$

$\text{coexsec } A = PT = \text{exsec } B$

$\sin \tfrac{1}{2} A = \sqrt{\frac{1 - \cos A}{2}} \qquad \cos \tfrac{1}{2} A = \sqrt{\frac{1 + \cos A}{2}}$

$\sin 2A = 2 \sin A \cos A \qquad \cos 2A = \cos^2 A - \sin^2 A$

Law of Sines $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Law of Cosines $c^2 = a^2 + b^2 - 2\,ab \cos C$

Law of Tangents $\frac{a+b}{a-b} = \frac{\tan \tfrac{1}{2}(A+B)}{\tan \tfrac{1}{2}(A-B)}$

Table II—Continued

TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Sines.

Given A, B, c; to find a, b, C.

Use Law of Sines.

Given a, b, c; to find A, B, C.

$$\text{Let } \frac{a+b+c}{2} = s, \sqrt{\frac{(s-a)\ (s-b)\ (s-c)}{s}} = r$$

$$\cos \tfrac{1}{2} A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\tan \tfrac{1}{2} A = \frac{r}{s-a}$$

$$\tan \tfrac{1}{2} B = \frac{r}{s-b}$$

$$\tan \tfrac{1}{2} C = \frac{r}{s-c}$$

Area of a triangle:

$$\text{Area} = \tfrac{1}{2}\, ab \sin C$$

$$\text{Area} = \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$$

PRISMOIDAL FORMULA.

$$\text{Vol.} = \frac{h}{6}\,(B+b+4M)$$

h = altitude; b, B = bases; M = midsection

Table III

INCHES AND FRACTIONS OF AN INCH IN DECIMALS OF A FOOT

	0	1	2	3	4	5	6	7	8	9	10	11	
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219	1/16
1/8	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271	1/8
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323	3/16
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375	1/4
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427	5/16
3/8	.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479	3/8
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531	7/16
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583	1/2
9/16	.0469	.1302	.2135	.2969	.3803	.4635	.5469	.6302	.7135	.7969	.8802	.9635	9/16
5/8	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688	5/8
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740	11/16
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792	3/4
13/16	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844	13/16
7/8	.0729	.1563	.2396	.3229	.4063	.4896	.5729	.6563	.7396	.8229	.9063	.9896	7/8
15/16	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948	15/16
1	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	1.000	1
	0	1	2	3	4	5	6	7	8	9	10	11	

Table IV

USEFUL RELATIONS.

Lineal feet	×.00019	= miles
Lineal yards	×.0006	= miles
Square inches	×.007	= square feet
Square feet	×.111	= square yards
Square yards	×.0002067	= acres
Acres	×4840	= square yards
Cubic inches	×.00058	= cubic feet
Cubic feet	×.03704	= cubic yards
Links	×.22	= yards
Links	×.66	= feet
Feet	×1.5	= links

$360° = 21600' = 1296000''$

Radius = arc of 57.2957790°

Arc of 1° (radius = 1) = .017453292

Arc of 1′ (radius = 1) = .000290888

Arc of 1″ (radius = 1) = .000004848

$\pi = 3.141592654$	$\sqrt{\frac{1}{\pi}} = 0.564190$
$\frac{\pi}{4} = 0.785398163$	$\sqrt[3]{\frac{6}{\pi}} = 1.240700982$
$\frac{\pi}{6} = 0.523598776$	$\pi^2 = 9.869604401$
$\sqrt{\frac{4}{\pi}} = 1.128379167$	$\frac{1}{\pi^2} = 0.101321184$
$\frac{\pi}{6} = 0.523598776$	$\sqrt{\pi} = 1.772453851$
$\frac{4.\pi}{3} = 4.188790205$	$\frac{1}{\pi} = 0.3183099$

Curvature of Earth's surface = about 0.7 feet in 1 mile

Curvature in feet = 0.667 (Dist. in miles)^2

Difference between arc and chord length, 0.05 feet in 11½ miles

$$\text{Probable error of a single observation} = 0.6754\sqrt{\frac{Mv^2}{n-1}}$$

Error in chaining of 0.01 feet in 100 feet:

Due to—

1. Length of tape error of 0.01 feet
2. Alignment. One end 1.4 feet out of line
3. Sag of tape at centre of 0.61 feet.
4. Temperature difference of 15°
5. Difference of pull of 15 lbs.

STADIA REDUCTION FORMULÆ.

Horizontal Distance = R — R sin² a+C cos a

Vertical Distance = R ½ sin 2 a+C sin a

$$R = \text{Reading} \times \frac{\text{distance from Object glass to cross hairs}}{\text{distance between cross hairs}}$$

C = distance from Object glass to cross hairs + distance from Object glass to center of instrument.

a = angle of elevation for mid Reading

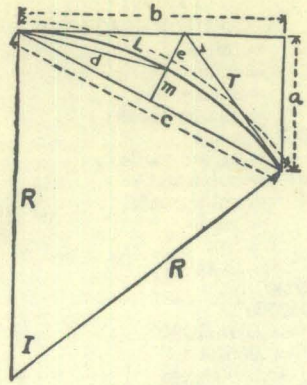


Table V

CURVE FORMULAE FOR SIMPLE CURVES

Compiled by J. Calvin Locke, C.E.

(1) $c = \sqrt{2Ra}$ (2) $c = \sqrt{a^2+b^2}$

(3) $c = \sqrt{2R\,(R-\sqrt{(R+b)\,(R-b)}} = \sqrt{2R(R-\sqrt{R^2-b^2})}$

(4) $c = 2\sqrt{m\,(2R-m)}$

(5) $c = 2R \sin \frac{1}{2} I$ (6) $c = 2T \cos \frac{1}{2} I$

(7) $e = R \operatorname{exsec} \frac{1}{2} I$

(8) $e = R \tan \frac{1}{2} I \tan \frac{1}{4} I$ (9) $e = T \tan \frac{1}{4} I$

(10) $b = \sqrt{a\,(2R-a)}$

(11) $b = \sqrt{\left(c+\frac{c^2}{2R}\right)\left(c-\frac{c^2}{2R}\right)} = \sqrt{c^2-\frac{c^4}{4R^2}}$

(12) $b = R \sin I$ (13) $b = a \cot \frac{1}{2} I$

(14) $R = \frac{a^2+b^2}{2a} = \frac{c^2}{2a}$ (15) $R = \frac{d^2}{2m} = \frac{c^2+4m^2}{8m}$

(16) $d = \sqrt{R\,(2R-\sqrt{(2R+c)\,(2R-c)}} = \sqrt{R(2R-\sqrt{4R^2-c^2})}$

(17) $d = \sqrt{2Rm}$ (18) $d = 2R \sin \frac{1}{4} I$ (19) $m = \frac{d^2}{2R}$

(20) $m = R \mp \sqrt{\left(R+\frac{c}{2}\right)\left(R-\frac{c}{2}\right)} = R \mp \sqrt{R^2-\frac{c^2}{4}}$

(21) $m = R \operatorname{vers} \frac{1}{2} I$ (22) $m = R \sin \frac{1}{2} I \tan \frac{1}{4} I$ (23) $m = \frac{1}{2} c \tan \frac{1}{4} I$

(24) $a = \frac{c^2}{2R}$ (25) $a = R - \sqrt{(R+b)\,(R-b)} = R - \sqrt{R^2-b^2}$

(26) $a = 2\,R\,(\sin^2 \frac{1}{2} I)^2$ (27) $a = R \operatorname{vers} I$ (28) $a = R \sin I \tan \frac{1}{2}$

(29) $a = b \tan \frac{1}{2} I$ (30) $a = T \sin I$ (31) $T = R \tan \frac{1}{2} I$

(32) $I = \frac{L}{R} \times 57.295780$ (33) $R = \frac{L}{I} \times 57.295780$

(34) $L = IR \times 0.01745329$ (35) $L = \frac{8d-c}{3}$

(36) Area Seg. $= \frac{I.R - R^2 \operatorname{Sin} I}{2} = \frac{LR - Rb}{2}$

Table VI

SINES, COSINES, TANGENTS, COTANGENTS

deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	deg.
0	0000	0000	0029	0029	0058	0058	0087	0087	0116	0116	0145	0145	89
1	175	0175	0204	0204	0233	0233	0262	262	291	291	320	320	88
2	349	349	378	378	407	407	436	437	465	466	494	495	87
3	523	524	552	553	581	582	610	612	640	641	669	670	86
4	698	699	727	729	756	758	785	787	814	816	843	846	85
5	872	875	901	904	929	934	958	963	987	992	1016	1022	84
6	1045	1051	1074	1080	1103	1110	1132	1139	1161	1169	190	198	83
7	219	228	248	257	279	287	305	317	334	346	363	376	82
8	392	405	421	435	449	465	478	495	507	524	536	554	81
9	564	584	593	614	622	644	650	673	679	703	708	733	80
10	736	763	765	793	794	823	822	853	851	883	880	914	79
11	908	944	937	974	965	2004	994	2035	2022	2065	2051	2095	78
12	2079	2126	2108	2156	2136	186	2164	217	193	247	221	278	77
13	250	309	278	339	306	370	334	401	363	432	391	462	76
14	419	493	447	524	476	555	504	586	532	617	560	648	75
15	588	679	616	711	644	742	672	773	700	805	728	836	74
16	756	867	784	899	812	931	840	962	868	994	896	3026	73
17	924	3057	952	3089	939	3121	3007	3153	3035	3185	3062	217	72
18	3090	249	3118	281	3145	314	173	346	201	378	228	411	71
19	256	443	283	476	311	508	338	541	365	574	393	607	70
20	420	640	448	673	475	706	502	739	529	772	557	805	69
21	584	839	611	872	638	906	665	939	692	973	719	4006	68
22	746	4040	773	4074	800	4108	827	4142	854	4176	881	210	67
23	907	245	934	279	961	314	987	348	4014	383	4041	417	66
24	4067	452	4094	487	4120	522	4147	557	173	592	200	628	65
25	226	663	253	699	279	734	305	770	331	806	358	841	64
26	384	877	410	913	436	950	4462	986	488	5022	514	5059	63
27	540	5095	566	5132	592	5169	617	5206	643	243	669	280	62
28	695	317	720	354	746	392	772	430	797	467	823	505	61
29	848	543	874	581	899	619	924	658	950	696	975	735	60
30	5000	774	5025	5812	5050	851	5075	890	5100	930	5125	969	59
31	150	6009	175	6048	200	6088	225	6128	250	6168	275	6208	58
32	299	249	324	289	348	330	5373	371	398	412	422	453	57
33	446	494	471	536	495	577	519	619	544	661	568	703	56
34	592	745	616	787	640	830	664	873	688	916	712	959	55
35	736	7002	760	7046	783	7089	807	7133	831	7177	854	7221	54
36	878	265	901	310	925	355	948	400	972	445	995	490	53
37	6018	536	6041	581	6065	627	6088	673	6111	720	6134	766	52
38	157	813	180	860	202	907	225	954	248	8002	271	8050	51
39	293	8098	316	8146	338	8195	361	8243	383	292	406	342	50
40	428	391	450	441	472	491	494	541	517	591	539	642	49
41	561	693	583	744	604	796	626	847	648	899	670	952	48
42	691	9004	713	9057	734	9110	756	9163	777	9217	799	9271	47
43	820	325	841	380	862	435	884	490	905	545	926	601	46
44	947	657	967	713	988	770	7009	827	7030	884	7050	942	45
45	7071	1.0000	7092	1.0058	7112	1.0117	133	1.0176	153	1.0235	173	1.0295	44
deg.	60′ cos	60′ cot	50′ cos	50′ cot	40′ cos	40′ cot	30′ cos	30′ cot	20′ cos	20 cot	10′ cos	10′ cot	deg.

Table VI (continued)
SINES, COSINES, TANGENTS, COTANGENTS (continued)

deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	deg.
46	7193	1.0355	7214	1.0416	7234	1.0477	7254	1.0533	7274	1.0599	7294	1.0661	43
47	314	.0724	333	.0786	353	.0850	373	.0913	392	.0977	412	.1041	42
48	431	.1106	451	.1171	470	.1237	490	.1303	509	.1369	528	.1436	41
49	547	.1504	566	.1571	585	.1640	604	.1708	623	.1778	642	.1847	40
50	660	1.1918	7679	1.1988	7698	1.2059	7716	1.2131	7735	1.2203	7753	1.2276	39
51	771	.2349	790	.2423	808	.2497	826	.2572	844	.2647	862	.2723	38
52	880	.2799	898	.2876	916	.2954	934	.3032	951	.3111	969	.3190	37
53	986	.3270	8004	.3351	8021	.3452	8039	.3514	8056	.3597	8073	.3680	36
54	8090	.3764	107	.3848	124	.3934	141	.4019	158	.4106	175	.4193	35
55	192	.4281	208	.4370	225	.4460	241	.4550	258	.4641	274	.4733	34
56	290	.4826	307	.4919	323	.5013	339	.5108	355	.5204	371	.5301	33
57	387	.5399	403	.5497	418	.5597	434	.5697	450	.5798	465	.5900	32
58	480	.6003	496	.6107	511	.6212	526	.6319	542	.6426	557	.6534	31
59	572	.6643	587	.6753	601	.6864	616	.6977	631	.7090	646	.7205	30
60	660	1.7321	8675	1.7437	8689	1.7556	8704	1.7675	8718	1.7797	8732	1.7917	29
61	746	.8040	760	.8165	774	.8291	788	.8418	802	.8546	816	.8676	28
62	829	.8807	843	.8940	857	.9074	870	.9210	884	.9347	897	.9486	27
63	910	.9626	923	.9768	936	.9912	949	2.0057	962	2.0204	975	2.0353	26
64	988	2.0503	9001	2.0655	9013	2.0809	9026	.0965	9038	.1123	9051	.1283	25
65	9063	.1445	075	.1609	088	.1775	100	.1943	112	.2113	124	.2286	24
66	135	.2460	147	.2637	159	.2817	171	.2998	182	.3183	194	.3369	23
67	205	.3559	216	.3750	228	.3945	239	.4142	250	.4342	261	.4545	22
68	272	.4751	283	.4960	293	.5172	304	.5386	315	.5605	325	.5826	21
69	336	.6051	346	.6279	356	.6511	367	.6746	377	.6985	387	.7228	20
70	397	2.7475	9407	2.7725	9417	2.7980	9426	2.8239	9436	2.8502	9446	2.8770	19
71	455	.9042	465	.9319	474	.9600	483	.9887	492	3.0178	502	3.0475	18
72	511	3.0777	520	3.1084	528	3.1397	537	3.1716	546	.2041	555	.2371	17
73	563	.2709	572	.3052	580	.3402	588	.3759	596	.4124	605	.4495	16
74	613	.4874	621	.5261	628	.5656	636	.6059	644	.6470	652	.6891	15
75	659	.7321	667	.7760	674	.8208	681	.8657	689	.9136	696	.9617	14
76	703	4.0108	710	4.0611	717	4.1126	724	4.1653	730	4.2193	737	4.2747	13
77	744	.3315	750	.3897	757	.4494	763	.5107	769	.5736	775	.6382	12
78	781	.7046	787	.7729	793	.8430	799	.9152	805	.9894	811	5.0658	11
79	816	.1446	822	5.2257	827	5.3093	833	5.3955	838	5.4845	843	.5764	10
80	9848	5.6713	9853	5.7694	9858	5.8708	9863	5.9758	9868	6.0844	9872	6.1970	9
81	877	6.3138	881	6 4348	886	6.5606	890	6.6912	894	.8269	899	.9682	8
82	903	7.1154	907	7.2687	911	7.4287	914	7.5958	918	7.7704	922	7.9530	7
83	925	8.1443	929	8.3450	932	8.5555	936	8.7769	939	9.0098	942	9.2553	6
84	945	9.5144	948	9.7882	951	10.078	954	10.385	957	10.711	959	11.059	5
85	962	11.430	964	11.826	967	12.250	969	12.706	971	13.197	974	13.727	4
86	976	14.300	978	14.924	980	15.605	981	16.350	983	17.169	985	18.075	3
87	986	19.081	988	20.206	989	21.470	990	22.903	992	24.542	993	26.432	2
88	994	28.636	9995	31.242	9996	34.368	997	38.189	997	42 964	9998	49.104	1
89	9998	57.290	9999	68.750	9999	85.940	9999	114.58	1.000	171.88	1.000	343.77	0
deg.	60′ cos	60′ cot	50′ cos	50′ cot	40′ cos	40′ cot	30′ cos	30′ cot	20′ cos	20′ cot	10′ cos	10′ cot	deg.

TABLE VII
RODS IN FEET, 10THS AND 100THS OF FEET

Rods	Feet	Rods	Feet	Rods	Feet	Rods	Feet	Rods	Feet
1	16.50	21	346.50	41	676.50	61	1006.50	81	1336.50
2	33.00	22	363.00	42	693.00	62	1023.00	82	1353.00
3	49.50	23	379.50	43	709.50	63	1039.50	83	1369.50
4	66.00	24	396.00	44	726.00	64	1056.00	84	1386.00
5	82.50	25	412.50	45	742.50	65	1072.50	85	1402.50
6	99.00	26	429.00	46	759.00	66	1089.00	86	1419.00
7	115.50	27	445.50	47	775.50	67	1105.50	87	1435.50
8	132.00	28	462.00	48	792.00	68	1122.00	88	1452.00
9	148.50	29	478.50	49	808.50	69	1138.50	89	1468.50
10	165.00	30	495.00	50	825.00	70	1155.00	90	1485.00
11	181.50	31	511.50	51	841.50	71	1171.50	91	1501.50
12	198.00	32	528.00	52	858.00	72	1188.00	92	1518.00
13	214.50	33	544.50	53	874.50	73	1204.50	93	1534.50
14	231.00	34	561.00	54	891.00	74	1221.00	94	1551.00
15	247.50	35	577.50	55	907.50	75	1237.50	95	1567.50
16	264.00	36	594.00	56	924.00	76	1254.00	96	1584.00
17	280.50	37	610.50	57	940.50	77	1270.50	97	1600.50
18	297.00	38	627.00	58	957.00	78	1287.00	98	1617.00
19	313.50	39	643.50	59	973.50	79	1303.50	99	1633.50
20	330.00	40	660.00	60	990.00	80	1320.00	100	1650.00

TABLE VIII
LINKS IN FEET, 10THS AND 100THS OF FEET

Links	Feet	Links	Feet	Links	Feet	Links	Feet	Links	Feet	Links	Feet
1	0.66	18	11.88	35	23.10	52	34.32	69	45.54	86	56.76
2	1.32	19	12.54	36	23.76	53	34.98	70	46.20	87	57.42
3	1.98	20	13.20	37	24.42	54	35.64	71	46.86	88	58.08
4	2.64	21	13.86	38	25.08	55	36.30	72	47.52	89	58.74
5	3.30	22	14.52	39	25.74	56	36.96	73	48.18	90	59.40
6	3.96	23	15.18	40	26.40	57	37.62	74	48.84	91	60.06
7	4.62	24	15.84	41	27.06	58	38.28	75	49.50	92	60.72
8	5.28	25	16.50	42	27.72	59	38.94	76	50.16	93	61.38
9	5.94	26	17.16	43	28.38	60	39.60	77	50.82	94	62.04
10	6.60	27	17.82	44	29.04	61	40.26	78	51.48	95	62.70
11	7.26	28	18.48	45	29.70	62	40.92	79	52.14	96	63.36
12	7.92	29	19.14	46	30.36	63	41.58	80	52.80	97	64.02
13	8.58	30	19.80	47	31.02	64	42.24	81	53.46	98	64.68
14	9.24	31	20.46	48	31.68	65	42.90	82	54.12	99	65.34
15	9.90	32	21.12	49	32.34	66	43.56	83	54.78	100	66.00
16	10.56	33	21.78	50	33.00	67	44.22	84	55.44	101	66.66
17	11.22	34	22.44	51	33.66	68	44.88	85	56.10	102	67.32

Table IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=10°	I	T	E	I=20°	I	T	E	I=30°
1°	50.00	.218	+	11°	551.70	26.500	+	21°	1061.9	97.577	+
10′	58.34	.297	5° C.	10′	560.11	27.313	5° C	10′	1070.6	99.155	5° C
20′	66.67	.388	T	20′	568.53	28.137	T	20′	1079.2	100.75	T
30′	75.01	.491	.03	30′	576.95	28.974	.06	30′	1087.8	102.35	.10
40′	83.34	.606	E	40′	585.36	29.824	E	40′	1096.4	103.97	E
50′	91.68	.733	.001	50′	593.79	30.686	.006	50′	1105.1	105.60	.013
2°	100.01	.873		12°	602.21	31.561		22°	1113.7	107.24	
10′	108.35	1.024		10′	610.64	32.447		10′	1122.4	108.90	
20′	116.68	1.188		20′	619.07	33.347		20′	1131.0	110.57	
30′	125.02	1.364		30′	627.50	34.259		30′	1139.7	112.25	
40′	133.36	1.552		40′	635.93	35.183		40′	1148.4	113.95	
50′	141.70	1.752		50′	644.37	36.120		50′	1157.0	115.66	
3°	150.04	1.964	10° C.	13°	652.81	37.070	10° C.	23°	1165.7	117.38	10° C.
10′	158.38	2.188	T	10′	661.25	38.031	T	10′	1174.4	119.12	T
20′	166.72	2.425	.06	20′	669.70	39.006	.13	20′	1183.1	120.87	.19
30′	175.06	2.674	E	30′	678.15	39.993	E	30′	1191.8	122.63	E
40′	183.40	2.934	.003	40′	686.60	40.992	.011	40′	1200.5	124.41	.025
50′	191.74	3.207		50′	695.06	42.004		50′	1209.2	126.20	
4°	200.08	3.492		14°	703.51	43.029		24°	1217.9	128.00	
10′	208.43	3.790		10′	711.97	44.066		10′	1226.6	129.82	
20′	216.77	4.099		20′	720.44	45.116		20′	1235.3	131.65	
30′	225.12	4.421		30′	728.90	46.178		30′	1244.0	133.50	
40′	233.47	4.755		40′	737.37	47.253		40′	1252.8	135.35	
50′	241.81	5.100	15° C.	50′	745.85	48.341	15° C.	50′	1261.5	137.23	15° C.
5°	250.16	5.459	T	15°	754.32	49.441	T	25°	1270.2	139.11	T
10′	258.51	5.829	.09	10′	762.80	50.554	.19	10′	1279.0	141.01	.29
20′	266.86	6.211	E	20′	771.29	51.679	E	20′	1287.7	142.93	E
30′	275.21	6.606	.004	30′	779.77	52.818	.017	30′	1296.5	144.85	.038
40′	283.57	7.013		40′	788.26	53.969		40′	1305.3	146.79	
50′	291.92	7.432		50′	796.75	55.132		50′	1314.0	148.75	
6°	300.28	7.863		16°	805.25	56.309		26°	1322.8	150.71	
10′	308.64	8.307		10′	813.75	57.498		10′	1331.6	152.69	
20′	316.99	8.762		20′	822.25	58.699		20′	1340.4	154.69	
30′	325.35	9.230		30′	830.76	59.914		30′	1349.2	156.70	
40′	333.71	9.710	20° C.	40′	839.27	61.141	20° C.	40′	1358.0	158.72	20° C.
50′	342.08	10.202	T	50′	847.78	62.381	T	50′	1366.8	160.76	T
7°	350.44	10.707	.13	17°	856.30	63.634	.26	27°	1375.6	162.81	.39
10′	358.81	11.224	E	10′	864.82	64.900	E	10′	1384.4	164.86	E
20′	367.17	11.753	.006	20′	873.35	66.178	.022	20′	1393.2	166.95	.051
30′	375.54	12.294		30′	881.88	67.470		30′	1402.0	169.04	
40′	383.91	12.847		40′	890.41	68.774		40′	1410.9	171.15	
50′	392.28	13.413		50′	898.95	70.091		50′	1419.7	173.27	
8°	400.66	13.991		18°	907.49	71.421		28°	1428.6	175.41	
10′	409.03	14.582		10′	916.03	72.764		10′	1437.4	177.55	
20′	417.41	15.184	25° C.	20′	924.58	74.119	25° C.	20′	1446.3	179.72	25° C.
30′	425.79	15.799	T	30′	933.13	75.488	T	30′	1455.1	181.89	T
40′	434.17	16.426	.16	40′	941.69	76.869	.32	40′	1464.0	184.08	.49
50′	442.55	17.065	E	50′	950.25	78.264	E	50′	1472.9	186.29	E
9°	450.93	17.717	.007	19°	958.81	79.671	.028	29°	1481.8	188.51	.065
10′	459.32	18.381		10′	967.38	81.092		10′	1490.7	190.74	
20′	467.71	19.058		20′	975.96	82.525		20′	1499.6	192.99	
30′	476.10	19.746		30′	984.53	83.972		30′	1508.5	195.25	
40′	484.49	20.447		40′	993.12	85.431		40′	1517.4	197.53	
50′	492.88	21.161		50′	1001.7	86.904		50′	1526.3	199.82	
10°	501.28	21.887	30° C.	20°	1010.3	88.389	30° C.	30°	1535.3	202.12	30° C.
10′	509.68	22.624	T	10′	1018.9	89.888	T	10′	1544.2	204.44	T
20′	518.08	23.375	.19	20′	1027.5	91.399	.39	20′	1553.1	206.77	.59
30′	526.48	24.138	E	30′	1036.1	92.924	E	30′	1562.1	209.12	E
40′	534.89	24.913	.008	40′	1044.7	94.462	.034	40′	1571.0	211.48	.078
50′	543.29	25.700		50′	1053.3	96.013		50′	1580.0	213.86	

T = R tan ½ I E = R exsec ½ I

Table IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=40°	I	T	E	I=50°	I	T	E	I=60°
31°	1589.0	216.3	+	41°	2142.2	387.4	+	51°	2732.9	618.4	+
10′	1598.0	218.7	5° C.	10′	2151.7	390.7	5° C.	10′	2743.1	622.8	5° C.
20′	1606.9	221.1	T	20′	2161.2	394.1	T	20′	2753.4	627.2	T
30′	1615.9	223.5	.13	30′	2170.8	397.4	.17	30′	2763.7	631.7	.21
40′	1624.9	226.0	E	40′	2180.3	400.8	E	40′	2773.9	636.2	E
50′	1633.9	228.4	.023	50′	2189.9	404.2	.037	50′	2784.2	640.7	.056
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	10° C.	43°	2257.0	428.5	10° C.	53°	2856.7	672.7	10° C.
10′	1706.3	248.7	T	10′	2266.6	432.0	T	10′	2867.1	677.3	T
20′	1715.3	251.3	.26	20′	2276.2	435.6	.34	20′	2877.5	682.0	.42
30′	1724.4	253.9	E	30′	2285.9	439.2	E	30′	2888.0	686.7	E
40′	1733.5	256.5	.046	40′	2295.6	442.8	.075	40′	2898.4	691.4	.112
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	15° C.	50′	2363.5	468.4	15° C.	50′	2972.1	725.0	15° C.
35°	1806.6	278.1	T	45°	2373.3	472.1	T	55°	2982.7	729.9	T
10′	1815.7	280.8	.40	10′	2383.1	475.8	.51	10′	2993.3	734.8	.63
20′	1824.9	283.6	E	20′	2392.8	479.6	E	20′	3003.9	739.7	E
30′	1834.1	286.4	.070	30′	2402.6	483.4	.116	30′	3014.5	744.6	.168
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	20° C.	40′	2471.5	510.3	20° C.	40′	3089.4	779.8	20° C.
50′	1907.9	309.3	T	50′	2481.4	514.3	T	50′	3100.2	784.9	T
37°	1917.1	312.2	.53	47°	2491.3	518.2	.68	57°	3110.9	790.1	.84
10′	1926.4	315.2	E	10′	2501.2	522.2	E	10′	3121.7	795.2	E
20′	1935.7	318.1	.093	20′	2511.2	526.1	.151	20′	3132.6	800.4	.225
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	25° C.	20′	2571.0	550.4	25° C.	20′	3197.8	832.0	25° C.
30′	2000.9	339.3	T	30′	2581.0	554.5	T	30′	3208.8	837.3	T
40′	2010.2	342.4	.67	40′	2591.0	558.6	.85	40′	3219.7	842.7	1.05
50′	2019.6	345.5	E	50′	2601.1	562.8	E	50′	3230.7	848.1	E
39°	2029.0	348.6	.117	49°	2611.2	566.9	.189	59°	3241.7	853.5	.283
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	30° C.	50°	2671.8	592.3	30° C.	60°	3308.0	886.4	30° C.
10′	2094.9	371.0	T	10′	2681.9	596.6	T	10′	3319.1	892.0	T
20′	2104.3	374.2	.80	20′	2692.1	600.9	1.02	20′	3330.3	897.5	1.27
30′	2113.8	377.5	E	30′	2702.3	605.3	E	30′	3341.4	903.2	E
40′	2123.3	380.8	.141	40′	2712.5	609.6	.227	40′	3352.6	908.8	.340
50′	2132.7	384.1		50′	2722.7	614.0		50′	3363.8	914.5	

T = R tan ½ I E = R exsec ½ I

Table IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=70°	I	T	E	I=80°	I	T	E	I=90°
61°	3375.0	920.2	+	71°	4086.9	1308.2	+	81°	4893.6	1805.3	+
10′	3386.3	925.9	5° C.	10′	4099.5	1315.6	5° C.	10′	4908.0	1814.7	5° C.
20′	3397.5	931.6	T	20′	4112.1	1322.9	T	20′	4922.5	1824.1	T
30′	3408.8	937.3	.25	30′	4124.8	1330.3	.30	30′	4937.0	1833.6	.36
40′	3420.1	943.1	E	40′	4137.4	1337.7	E	40′	4951.5	1843.1	E
50′	3431.4	948.9	.080	50′	4150.1	1345.1	.110	50′	4966.1	1852.6	.149
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	10° C.	73°	4239.7	1398.0	10° C.	83°	5069.2	1920.5	10° C.
10′	3522.6	996.2	T	10′	4252.6	1405.7	T	10′	5084.0	1930.4	T
20′	3534.1	1002.3	.51	20′	4265.6	1413.5	.61	20′	5099.0	1940.3	.72
30′	3545.6	1008.3	E	30′	4278.5	1421.2	E	30′	5113.9	1950.3	E
40′	3557.2	1014.4	.159	40′	4291.5	1429.0	.220	40′	5128.9	1960.2	.299
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	15° C.	50′	4383.3	1484.4	15° C.	50′	5234.9	2031.4	15° C.
65°	3650.2	1063.9	T	75°	4396.5	1492.4	T	85°	5250.3	2041.7	T
10′	3661.9	1070.2	.76	10′	4409.8	1500.5	.91	10′	5265.6	2052.1	1.09
20′	3673.7	1076.6	E	20′	4423.1	1508.6	E	20′	5281.0	2062.5	E
30′	3685.4	1082.9	.240	30′	4436.4	1516.7	.332	30′	5296.4	2073.0	.450
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	20° C.	40′	4530.4	1574.7	20° C.	40′	5405.6	2147.5	20° C.
50′	3780.4	1134.8	T	50′	4544.0	1583.1	T	50′	5421.4	2158.4	T
67°	3792.4	1141.4	1.02	77°	4557.6	1591.6	1.22	87°	5437.2	2169.2	1.45
10′	3804.4	1148.0	E	10′	4571.2	1600.1	E	10′	5453.1	2180.2	E
20′	3816.4	1154.7	.321	20′	4584.8	1608.6	.445	20′	5469.0	2191.1	.603
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	25° C.	20′	4667.4	1660.5	25° C.	20′	5565.4	2258.0	25° C.
30′	3901.2	1202.0	T	30′	4681.3	1669.2	T	30′	5581.6	2269.3	T
40′	3913.4	1208.9	1.28	40′	4695.2	1678.1	1.53	40′	5597.8	2280.6	1.83
50′	3925.6	1215.8	E	50′	4709.2	1686.9	E	50′	5614.2	2292.0	E
69°	3937.9	1222.7	.403	79°	4723.2	1695.8	.558	89°	5630.5	2303.5	.756
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	30° C.	80°	4807.7	1749.9	30° C.	90°	5729.7	2373.3	30° C.
10′	4024.4	1272.1	T	10′	4822.0	1759.0	T	10′	5746.3	2385.1	T
20′	4036.8	1279.3	1.54	20′	4836.2	1768.2	1.84	20′	5763.1	2397.0	2.20
30′	4049.3	1286.5	E	30′	4850.5	1777.4	E	30′	5779.9	2408.9	E
40′	4061.8	1293.6	.485	40′	4864.8	1786.7	.671	40′	5796.7	2420.9	.910
50′	4074.4	1300.9		50′	4879.2	1796.0		50′	5813.6	2432.9	

T = R tan ½ I E = R exsec ½ I

Table IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=100°	I	T	E	I=110°	I	T	E	I=120°
91°	5830.5	2444.9	+	101°	6950.6	3278.1	+	111°	8336.7	4386.1	+
10′	5847.5	2457.1	5° C.	10′	6971.3	3294.1	5° C.	10′	8362.7	4407.6	5° C.
20′	5864.6	2469.3	T	20′	6992.0	3310.1	T	20′	8388.9	4429.2	T
30′	5881.7	2481.5	.43	30′	7012.7	3326.1	.51	30′	8415.1	4450.9	.62
40′	5898.8	2493.8	E	40′	7033.6	3342.3	E	40′	8441.5	4472.7	E
50′	5916.0	2506.1	.200	50′	7054.5	3358.5	.268	50′	8468.0	4494.6	.360
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	10° C.	103°	7203.2	3474.4	10° C.	113°	8656.6	4651.3	10° C.
10′	6055.4	2606.8	T	10′	7224.7	3491.3	T	10′	8684.0	4674.2	T
20′	6073.1	2619.7	.86	20′	7246.3	3508.2	.103	20′	8711.5	4697.2	1.25
30′	6090.8	2632.6	E	30′	7268.0	3525.2	E	30′	8739.2	4720.3	E
40′	6108.6	2645.5	.401	40′	7289.8	3542.4	.536	40′	8767.0	4743.6	.721
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′	6162.2	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	15° C.	50′	7444.6	3664.5	15° C.	50′	8965.0	4909.9	15° C.
95°	6252.8	2751.3	T	105°	7467.0	3682.3	T	115°	8993.8	4934.1	T
10′	6271.1	2764.8	1.30	10′	7489.6	3700.2	1.56	10′	9022.7	4958.6	1.93
20′	6289.4	2778.3	E	20′	7512.2	3718.2	E	20′	9051.7	4983.1	E
30′	6307.9	2792.0	.604	30′	7534.9	3736.2	.806	30′	9080.9	5007.8	1.09
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	20° C.	40′	7696.3	3865.2	20° C.	40′	9289.2	5184.5	20° C.
50′	6457.3	2903.1	T	50′	7719.7	3884.0	T	50′	9319.5	5210.3	T
97°	6476.2	2917.3	1.74	107°	7743.2	3902.9	2.08	117°	9349.9	5236.2	2.52
10′	6495.2	2931.6	E	10′	7766.8	3921.9	E	10′	9380.5	5262.3	E
20′	6514.3	2945.9	.809	20′	7790.5	3940.9	1.08	20′	9411.3	5288.6	1.46
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	25° C.	20′	7934.6	4057.4	25° C.	20′	9598.9	5449.2	25° C.
30′	6649.6	3047.9	T	30′	7959.0	4077.2	T	30′	9630.7	5476.5	T
40′	6669.2	3062.8	2.18	40′	7983.5	4097.1	2.61	40′	9662.6	5504.0	3.16
50′	6688.8	3077.7	E	50′	8008.0	4117.0	E	50′	9694.7	5531.7	E
99°	6708.6	3092.7	1.02	109°	8032.7	4137.1	1.36	119°	9727.0	5559.4	1.83
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′	6808.2	3168.7		50′	8157.5	4239.0		50′	9890.8	5700.9	
100°	6828.3	3184.1	30° C.	110°	8182.8	4259.7	30° C.	120°	9924.0	5729.7	30° C.
10′	6848.5	3199.6	T	10′	8208.2	4280.5	T	10′	9957.5	5758.6	T
20′	6868.8	3215.1	2.62	20′	8233.7	4301.4	3.14	20′	9991.0	5787.7	3.81
30′	6889.2	3230.8	E	30′	8259.3	4322.4	E	30′	10025.0	5817.0	E
40′	6909.6	3246.5	1.22	40′	8285.0	4343.6	1.63	40′	10059.0	5846.5	2.20
50′	6930.1	3262.3		50′	8310.8	4364.8		50′	10093.0	5876.1	

T = R tan ½ I E = R exsec ½ I

Table X.

MIDDLE ORDINATES OF RAILS

Length of Rail (feet)

C ° ′	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch	C °	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch
0–20	17189	.08	.07	.06	.05	.04	.03	8	716.8	1.88	1.64	1.42	1.20	1.01	.84
0–40	8594	.16	.14	.12	.10	.08	.07	9	637.3	2.12	1.84	1.60	1.35	1.14	.94
1–0	5730	.24	.20	.18	.15	.13	.10	10	573.7	2.36	2.05	1.78	1.50	1.27	1.04
1–20	4297	.31	.27	.23	.20	.17	.13	11	521.7	2.59	2.26	1.95	1.65	1.39	1.15
1–40	3438	.39	.34	.29	.25	.21	.17	12	478.3	3.83	2.47	2.15	1.81	1.54	1.26
2–0	2865	.47	.41	.35	.30	.25	.20	13	441.7	3.05	2.66	2.30	1.96	1.66	1.36
2–20	2456	.55	.48	.41	.35	.29	.23	14	410.3	3.30	2.87	2.48	2.10	1.78	1.46
2–40	2149	.63	.55	.47	.40	.33	.27	15	383.1	3.54	3.08	2.68	2.26	1.91	1.57
3–0	1910	.71	.62	.53	.45	.38	.31	16	359.3	3.76	3.28	2.83	2.40	2.04	1.67
3–20	1719	.78	.68	.59	.50	.42	.35	17	338.3	4.00	3.48	3.02	2.57	2.16	1.78
3–40	1563	.86	.75	.65	.55	.46	.38	18	319.6	4.21	3.67	3.18	2.70	2.28	1.87
4–0	1433	.94	.82	.71	.60	.50	.42	19	302.9	4.45	3.89	3.36	2.86	2.41	1.98
4–20	1323	1.02	.89	.77	.65	.55	.45	20	287.9	4.70	4.09	3.55	3.00	2.54	2.09
4–40	1228	1.10	.96	.83	.70	.59	.48	22	262.0	5.16	4.44	3.84	3.30	2.80	2.29
5	1146	1.18	1.03	.89	.75	.63	.52	24	240.5	5.64	4.92	4.20	3.59	3.04	2.50
6	955.3	1.41	1.23	1.06	.90	.76	.62	26	222.3	6.07	5.29	4.58	3.88	3.29	2.70
7	819.0	1.65	1.44	1.24	1.05	.89	.73								

Table XI.

SHORT RADIUS CURVES

Radius Feet	Chord Feet	Central Angle	Deflection Angle	Deflection for 1 Foot
35	10	16-26	8-13	49.3
45	10	12-46	6-23	38.3
50	15	17-16	8-38	34.5
60	15	14-22	7-11	28.8
75	15	11-30	5-45	23.0
100	20	11-30	5-45	17.3
120	20	9-34	4-47	14.3
150	20	7-39	3-49	11.5
190	25	7-32	3-46	9.15
200	25	7-10	3-35	8.6
225	25	6-25	3-12	7.7
240	25	5-58	2-59	7.2
250	25	5-44	2-52	6.9
275	25	5-12	2-36	6.2
288	50	9-58	4-59	6.0
300	50	9-32	4-46	5.7
350	50	8-12	4-06	4.9
376	50	7-40	3-50	4.6
400	50	7-10	3-35	4.3
410	50	7-00	3-30	4.2

To find length of curve divide angle from P. C. to P. T. by central angle of chord and multiply by length of chord.

Table XII.

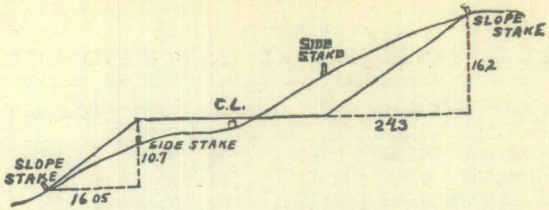
INCLINED DISTANCE OF 100 FT. REDUCED TO HORIZONTAL

Slope	Horizontal Distance	Correction	Rise Per Foot	Slope	Horizontal Distance	Correction	Rise Per Foot
0°00′	100.000	0.000	0.000	8°00′	99.027	0.973	0.139
15′	99.999	0.001	0.004	15′	98.965	1.035	0.143
30′	99.996	0.004	0.009	30′	98.902	1.098	0.148
45′	99.991	0.009	0.013	45′	98.836	1.164	0.152
1 00	99.985	0.015	0.017	9 00	98.769	1.231	0.156
15	99.976	0.024	0.022	15	98.700	1.300	0.161
30	99.966	0.034	0.026	30	98.629	1.371	0.165
45	99.953	0.047	0.031	45	98.556	1.444	0.169
2 00	99.939	0.061	0.035	10 00	98.481	1.519	0.174
15	99.923	0.077	0.039	15	98.404	1.596	0.178
30	99.905	0.095	0.044	30	98.325	1.675	0.182
45	99.885	0.115	0.048	45	98.245	1.755	0.187
3 00	99.863	0.137	0.052	11 00	98.163	1.837	0.191
15	99.839	0.161	0.057	15	98.079	1.921	0.195
30	99.813	0.187	0.061	30	97.992	2.008	0.199
45	99.786	0.214	0.065	45	97.905	2.095	0.204
4 00	99.756	0.244	0.070	12 00	97.815	2.185	0.208
15	99.725	0.275	0.074	15	97.723	2.277	0.212
30	99.692	0.308	0.078	30	97.630	2.370	0.216
45	99.657	0.343	0.083	45	97.534	2.466	0.221
5 00	99.619	0.381	0.087	13 00	97.437	2.563	0.225
15	99.580	0.420	0.092	15	97.338	2.662	0.229
30	99.540	0.460	0.096	30	97.237	2.763	0.233
45	99.497	0.503	0.100	45	97.134	2.866	0.238
6 00	99.452	0.548	0.105	14 00	97.030	2.970	0.242
15	99.406	0.594	0.109	15	96.923	3.077	0.246
30	99.357	0.643	0.113	30	96.815	3.185	0.250
45	99.307	0.693	0.118	45	96.705	3.295	0.255
7 00	99.255	0.745	0.122	15 00	96.593	3.407	0.259
15	99.200	0.800	0.126	15	96.479	3.521	0.263
30	99.144	0.856	0.131	30	96.363	3.637	0.267
45	99.087	0.913	0.135	45	96.246	3.754	0.271

Table XIII.

MINUTES IN DECIMALS OF A DEGREE.

0 30″	.00833	10′ 30″	.17500	20′ 30″	.34167	30′ 30″	.50833	40′ 30″	.67500	50′ 30″	.84167
1 00	.01667	11 00	.18333	21 00	.35000	31 00	.51667	41 00	.68333	51 00	.85000
30	.02500	30	.19167	30	.35833	30	.52500	30	.69167	30	.85833
2 00	.03333	12 00	.20000	22 00	.36667	32 00	.53333	42 00	.70000	52 00	.86667
30	.04167	30	.20833	30	.37500	30	.54167	30	.70833	30	.87500
3 00	.05000	13 00	.21667	23 00	.38333	33 00	.55000	43 00	.71667	53 00	.88333
30	.05833	30	.22500	30	.39167	30	.55833	30	.72500	30	.89167
4 00	.06667	14 00	.23333	24 00	.40000	34 00	.56667	44 00	.73333	54 00	.90000
30	.07500	30	.24167	30	.40833	30	.57500	30	.74167	30	.90833
5 00	.08333	15 00	.25000	25 00	.41667	35 00	.58333	45 00	.75000	55 00	.91667
30	.09167	30	.25833	30	.42500	30	.59167	30	.75833	30	.92500
6 00	.10000	16 00	.26667	26 00	.43333	36 00	.60000	46 00	.76667	56 00	.93333
30	.10833	30	.27500	30	.44167	30	.60833	30	.77500	30	.94167
7 00	.11667	17 00	.28333	27 00	.45000	37 00	.61667	47 00	.78333	57 00	.95000
30	.12500	30	.29167	30	.45833	30	.62500	30	.79167	30	.95833
8 00	.13333	18 00	.30000	28 00	.46667	38 00	.63333	48 00	.80000	58 00	.96667
30	.14167	30	.30833	30	.47500	30	.64167	30	.80833	30	.97500
9 00	.15000	19 00	.31667	29 00	.48333	39 00	.65000	49 00	.81667	59 00	.98333
30	.15833	30	.32500	30	.49167	30	.65833	30	.82500	30	.99167
10 00	.16667	20 00	.33333	30 00	.50000	40 00	.66667	50 00	.83333	60 00	1.00000



DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING.

SLOPE 1½ TO 1. ROADWAY OF ANY WIDTH.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.00	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	0
1	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	1
2	3.00	3.15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	2
3	4.50	4.65	4.80	4.95	5.10	5.25	5.40	5.55	5.70	5.85	3
4	6.00	6.15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	4
5	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	5
6	9.00	9.15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	6
7	10.50	10.65	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	7
8	12.00	12.15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	8
9	13.50	13.65	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85	9
10	15.00	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	10
11	16.50	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	11
12	18.00	18.15	18.30	18.45	18.60	18.75	18.90	19.05	19.20	19.35	12
13	19.50	19.65	19.80	19.95	20.10	20.25	20.40	20.55	20.70	20.85	13
14	21.00	21.15	21.30	21.45	21.60	21.75	21.90	22.05	22.20	22.35	14
15	22.50	22.65	22.80	22.95	23.10	23.25	23.40	23.55	23.70	23.85	15
16	24.00	24.15	24.30	24.45	24.60	24.75	24.90	25.05	25.20	25.35	16
17	25.50	25.65	25.80	25.95	26.10	26.25	26.40	26.55	26.70	26.85	17
18	27.00	27.15	27.30	27.45	27.60	27.75	27.90	28.05	28.20	28.35	18
19	28.50	28.65	28.80	28.95	29.10	29.25	29.40	29.55	29.70	29.85	19
20	30.00	30.15	30.30	30.45	30.60	30.75	30.90	31.05	31.20	31.35	20
21	31.50	31.65	31.80	31.95	32.10	32.25	32.40	32.55	32.70	32.85	21
22	33.00	33.15	33.30	33.45	33.60	33.75	33.90	34.05	34.20	34.35	22
23	34.50	34.65	34.80	34.95	35.10	35.25	35.40	35.55	35.70	35.85	23
24	36.00	36.15	36.30	36.45	36.60	36.75	36.90	37.05	37.20	37.35	24
25	37.50	37.65	37.80	37.95	38.10	38.25	38.40	38.55	38.70	38.85	25
26	39.00	39.15	39.30	39.45	39.60	39.75	39.90	40.05	40.20	40.35	26
27	40.50	40.65	40.80	40.95	41.10	41.25	41.40	41.55	41.70	41.85	27
28	42.00	42.15	42.30	42.45	42.60	42.75	42.90	43.05	43.20	43.35	28
29	43.50	43.65	43.80	43.95	44.10	44.25	44.40	44.55	44.70	44.85	29
30	45.00	45.15	45.30	45.45	45.60	45.75	45.90	46.05	46.20	46.35	30
31	46.50	46.65	46.80	46.95	47.10	47.25	47.40	47.55	47.70	47.85	31
32	48.00	48.15	48.30	48.45	48.60	48.75	48.90	49.05	49.20	49.35	32
33	49.50	49.65	49.80	49.95	50.10	50.25	50.40	50.55	50.70	50.85	33
34	51.00	51.15	51.30	51.45	51.60	51.75	51.90	52.05	52.20	52.35	34
35	52.50	52.65	52.80	52.95	53.10	53.25	53.40	53.55	53.70	53.85	35
36	54.00	54.15	54.30	54.45	54.60	54.75	54.90	55.05	55.20	55.35	36
37	55.50	55.65	55.80	55.95	56.10	56.25	56.40	56.55	56.70	56.85	37
38	57.00	57.15	57.30	57.45	57.60	57.75	57.90	58.05	58.20	58.35	38
39	58.50	58.65	58.80	58.95	59.10	59.25	59.40	59.55	59.70	59.85	39
40	60.00	60.15	60.30	60.45	60.60	60.75	60.90	61.05	61.20	61.35	40
41	61.50	61.65	61.80	61.95	62.10	62.25	62.40	62.55	62.70	62.85	41
42	63.00	63.15	63.30	63.45	63.60	63.75	63.90	64.05	64.20	64.35	42
43	64.50	64.65	64.80	64.95	65.10	65.25	65.40	65.55	65.70	65.85	43
44	66.00	66.15	66.30	66.45	66.60	66.75	66.90	67.05	67.20	67.35	44
45	67.50	67.65	67.80	67.95	68.10	68.25	68.40	68.55	68.70	68.85	45
46	69.00	69.15	69.30	69.45	69.60	69.75	69.90	70.05	70.20	70.35	46
47	70.50	70.65	70.80	70.95	71.10	71.25	71.40	71.55	71.70	71.85	47
48	72.00	72.15	72.30	72.45	72.60	72.75	72.90	73.05	73.20	73.35	48
49	73.50	73.65	73.80	73.95	74.10	74.25	74.40	74.55	74.70	74.85	49
50	75.00	75.15	75.30	75.45	75.60	75.75	75.90	76.05	76.20	76.35	50

Computed by L. Leland Locke.

845.96
12.42
858.38

BLACK HAWK COUNTY
ENGINEER'S OFFICE
COURT HOUSE
WATERLOO, IOWA