

374

PLATE

FIELD BOOK

No 374

If found please return to

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

EAST 5.2 374 2.8
WEST 3.2 2.1

12.8

5.2

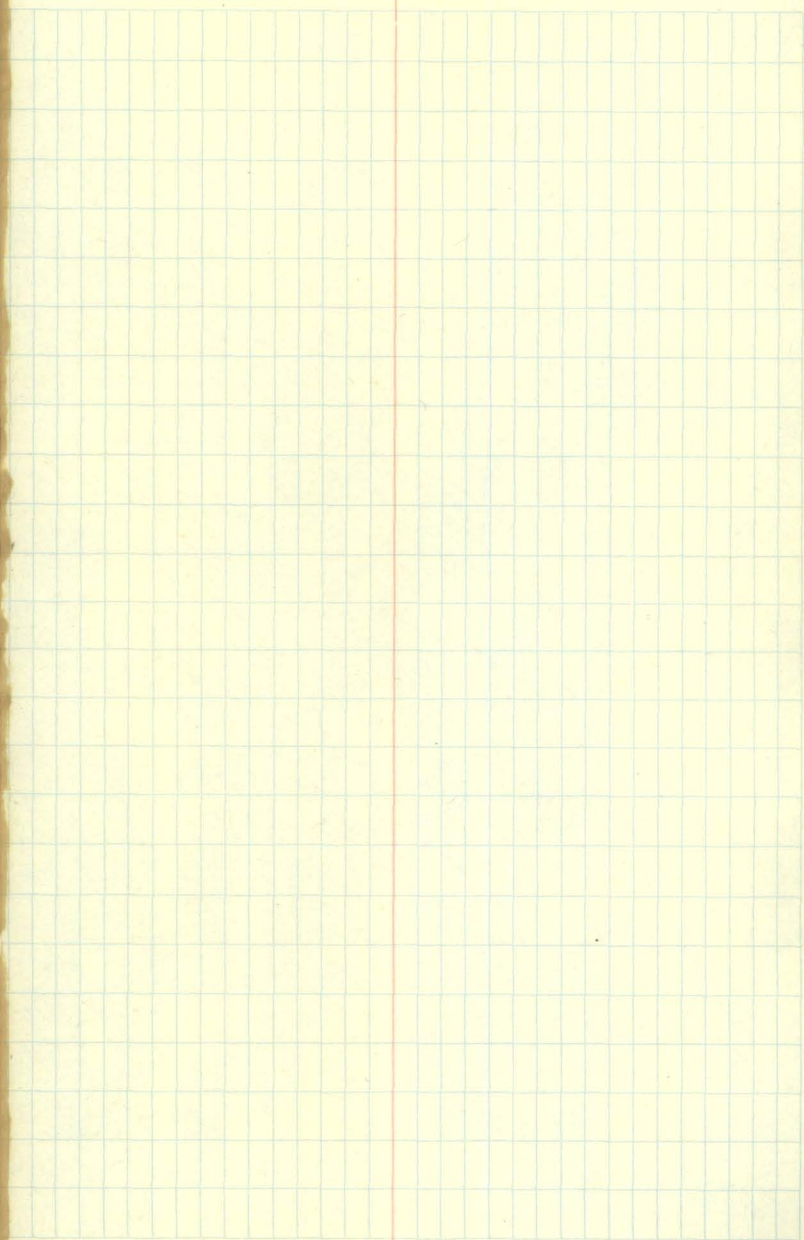
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Page Description

2-24 Grade Stakes Proj. L-436(68) La Porte City Wd. 5 mi.

37-42 CULVERT AND SIDE ROAD GRADE STAKES
PROJECT L-436(68) LA PORTE CITY Wd. 5 mi.

46-47 Co. Rd "N" CLEARING & GRABBING

49-51 Road Profile E 33-88-13
Project - 436(68) La Porte City Wd. 5 mi.

52 Stream bed & bridge profile E 33-88-13

53-56 Stadia survey E 33-88-13

57-58 X-Sections on bridge E 33-88-13

Stakes for Grading

Proj. L-436(68) NW Cor. 31-87-12 = 320+02.5

			Ditch Grade Lt	Top Stake Lt			El. Top Stake Rt	Ditch Grade Rt 2
T.P.				Top Stake Rt	Sta 332+00			
332			953.4		94 9.4	¢ F 4.0	¢ F 2.7	C-1.2 949.5
T.P.								
331			952.2		94 6.5	¢ F 5.7	¢ F 1.9	C-2.1 948.2
330			950.7		94 6.2 94 7.6	¢ F 4.5 F 3.1	¢ F 0.2	C-3.8 946.7
T.P.								
329			948.9	C-2.1 945.0	94 7.1	¢ F 1.8	¢ C 1.3	C-5.2 945.0
T.P.	951.10							
328			947.2	C-3.1 943.2	94 6.3	¢ F 0.9	¢ C-1.1	C-5.1 943.2
327			945.4	C-2.4 941.3	94 3.7	¢ F 1.7	¢ E 0.2	C-4.1 941.5
T.P.	943.72			Top stake C-1.9 938.0	Lt. Sta 327+00 93 9.7	¢ F 4.0	¢ F 2.6	C-2.6 938.5
326			943.7					
325			942.9	C-0.4 935.0	93 5.4	¢ F 7.5	¢ F 4.6	C-2.3 936.0
B.M.		940.02		Center C-1.2 935.0	South Head Wall Sta 324+			
324			943.2		93 6.2	¢ F 7.0	¢ F 4.1	C-2.8 936.3
323			944.4	C-1.9 937.0	93 7.3	¢ F 5.7	¢ F 4.5	C-1.9 938.0
322			946.7	C-2.9 940.5	94 3.4	¢ F 3.3	¢ F 4.8	C-1.2 940.7
Ø	944.52							
321+00			949.9 949.9	C-3.8 944.2	94 8.0	¢ F 1.9	¢ F 4.2	C-1.5 944.2
		953.06	953.06	Valve	¢ Co. Rd. "X"			

				℄ Grade	Ditch Grade Lt	El. Top Stake				℄ Top Stake Rt	Ditch Grade Rt	3
345				951.5	C-4.9 946.3	951.2	℄ F0.3		℄ F5.2	946.3	C-0.3 946.0	
344				952.4	C-3.5 946.0	949.5	℄ F2.9		℄ F4.8	947.6	C-2.2 945.4	
343				952.9	C-2.5 945.5	948.0	℄ F4.9		℄ F9.8	943.1	941.8	
342				953.3	C-1.4 946.0	947.4	℄ F5.9		℄ F7.2	946.1	C-0.6 945.5	
T.P.		950.80			℄ Sta	341+00						
341				953.8	C-2.3 947.3	949.6	℄ F4.2		℄ F4.8	949.0	C-2.1 946.9	
340				954.2	C-4.4 948.5	952.9	℄ F1.3		℄ F2.6	951.6	C-3.3 948.3	
339				954.6	C-5.4 949.8	955.2	℄ C-0.6		℄ F2.3	952.3	C-2.5 949.8	
B.M. 3		958.68	<u>958.62</u>		Root Spl in 40' Tree	160' Lt of Sta 337+00						
338				955.1	C-4.7 951.0	955.7	℄ C-0.6		℄ F3.2	951.9	C-1.7 950.2	
T.P.		955.81	955.81									
337				955.5	C-4.4 952.2	956.9	℄ C-1.4		℄ F2.7	952.8	C-1.9 950.9	
336				955.6	C-4.8 952.0	956.3	℄ C-0.7		℄ F2.1	953.5	C-2.2 951.3	
T.P.		956.78										
335				955.5	C-4.9 951.3	955.6	℄ C-0.1		℄ F1.0	954.5	C-2.6 951.9	
334				955.3	C-5.1 950.9	954.8	℄ F0.5		℄ F0.6	954.2	C-2.9 951.9	
333+00				954.9	C-1.8 950.5	952.3	℄ F2.1		℄ F1.6	952.8	C-2.3 950.5	

			℄ Grade	Ditch Grade Lt	El. of Stake Lt			El. of Stake Rt	Ditch Grade Rt	4
358			922.5	C-3.4 916.8	920.2	℄ F2.3	℄ F5.0	919.5	C-0.5 917.0	
357			923.9	C-3.7 918.9	922.6	℄ F1.3	℄ F-4.5	919.4	C-0.5 918.9	
356			925.5	C-3.2 921.5	924.7	℄ F-0.8	℄ F3.1	922.4	C-0.9 921.5	
T.P.	92 8.04			℄ Sta. 355+00						
355			928.1	C-2.7 924.1	926.8	F1.3	℄ F2.0	926.1	C-2.0 924.1	
354			931.9	C-3.1 927.4	930.5	℄ F0.9	℄ F1.0	930.4	C-3.0 927.4	
T.P.	936.82			Top of Stake Lt of Sta 353+00						
353			934.7	C-6.1 930.7	936.8	℄ C-2.1	℄ F0.2	934.5	C-3.8 930.7	
352			937.9	C-7.6 933.8	941.4	℄ C-3.6	93 C-0.4	938.2	C-4.4 933.8	
T.P.	945.02			Top of Stake Lt. Sta. 351+00						
351			940.6	C-8.4 936.6	945.0	℄ C-4.4	℄ C-1.0	941.6	C-5.0 936.6	
350			943.2	C-8.4 939.2	947.6	℄ C-4.4	℄ C-1.5	944.7	C-5.5 939.2	
349			945.4	C-8.7 941.4	950.1	℄ C-4.7	℄ F0.1	945.3	C-3.9 941.4	
348			947.4	C-7.2 944.4	951.6	℄ C-4.2	℄ F1.1	946.3	C-1.9 944.4	
T.P.	947.88			Top stake Rt Sta 347+00						
347			949.0	C-5.6 947.0	952.6	℄ C-3.6	℄ F1.1	947.9	C-0.9 947.0	
346+00			950.4	C-5.3 946.5	951.8	℄ C-1.4	℄ F2.5	947.9	C-1.4 946.5	

			± Grade	Ditch Grade Lt	El. of Stake Lt			El. of Stake Rt	Ditch Grade Rt	5
371			928.7	C-2.2 918.7	920.9	± F 7.5	± F 8.2	920.2	C-0.8 919.4	
T.P.		928.32								
370			925.8	—	916.4	F 9.4	F 7.0	918.8	C-2.8 916.0	
369			924.4	C-1.1 916.0	917.1	F-7.3	F 3.9	920.5	C-3.7 916.8	
368			923.5	C-3.1 919.0	922.1	F 1.4	± C-2.0	925.5	C-6.5 919.0	
367			922.9	C-0.4 919.6	920.0	± F 2.9	± C-1.1	924.6	C-4.6 920.0	
366			922.7	± 919.2	919.0	± F 3.3	± C-2.1	925.4	C-6.0 919.4	
365			922.6	C-1.4 919.0	920.4	± F-2.2	± F-4.2	926.8	C-7.8 919.0	
		920.39								
364			922.5	C-1.4 918.5	919.9	F 2.6	F-3.3	925.8	C-7.3 918.5	
363			922.4	C-0.2 917.5	917.7	± F 4.7	C-1.4	923.6	C-5.8 918.0	
362			922.3	F-4.4 916.8	916.1 916.4	± F 5.6	± F 1.0	921.3 922.3	C-4.3 917.0	
361			922.2	C-1.4 916.3	916.1	± F 6.1	± F 3.0	919.2	C-2.5 916.4	
360			922.1		916.8	± F 5.3	± F 4.0	918.1		
B.M.		920.68								
359+00			922.1	C-3.4 914.7	COR. NORTH HEAD WALL BOX ONLY. 918.1	± F 4.0	± F 6.0	916.1	C-1.1 915.0	

384			938.7	C-3.9 935.0	940.1	♀ C-1.4	♀ F0.7	939.0	C-3.0 935.0
T.B.M #5	943.47	943.44		Spk in TWIN PINE 135' Lt. of Sta. 384+70					
383			938.1	C-2.9 932.5	935.35	♀ F 2.7	♀ F-3.1	935.0	C-2.0 933.0
T.P.	935.35			Top of Stake Lt. of Sta. 383+00					
382			937.6	C-1.4 930.0	931.4	♀ F6-2	♀ F3.8	933.9	C-1.8 932.0
T.P.	934.10								
381			937.1	C-0.5 928.0	928.5	♀ F8.6	♀ F4.5	932.6	C-2.6 930.0
380			936.6	C-0.2 927.0	927.2	♀ F9.4	♀ F-5.0	931.6	C-3.3 928.3
379			936.1	C-0.3 925.0	925.3	♀ F10.8	♀ F6.1	931.0	C-4.5 926.5
378			935.6	C 925.0	924.8	♀ F10.8	♀ F4.2	931.4	C-5.0 926.4
377			935.1	C-0.6 926.0	926.6	♀ F-8.5	♀ F-2.2	932.9	C-5.5 927.4
T.P.	932.27			♀ Sta 377+00					
376			934.4	C-1.0 928.1	929.1	♀ F5.3	♀ C-0.8	935.2	C-6.7 928.5
375			933.5	C-4.0 929.5	933.0	♀ F0.5	♀ C-4.2	937.7	C-8.2 927.5
T.P.	935.14								
374			932.4	C-3.8 928.4	934.6 934.6	♀ C-2.2	♀ C-5.0	C-6.9 937.4	930.5 928.4
T.B.M #4	927.11	927.19		Spk in Power Pole 275± North of Sta. 374+27					
373			931.0	C-5.1 927.0	932.1	♀ C-1.1	♀ F0.1	930.9	C-3.9 927.0
372+00			929.4	C-3.5 922.9	926.4	♀ F3.0	♀ F3.2	925.5	C-2.2 923.3

	Prop Elv.	Prop Lt ditch Elv.	Stace Elv. 58 1/2' L1	Grade to L	Grade to R	Stace Elv. 58 1/2' R1	Prop Rt ditch Elv.
397+00	945.7	938.0	938.1	F-7.8	F-4.3	941.6	939.8
396	945.4	938.2	938.0	F-7.4	F-3.0	942.4	940.0
395	944.9	939.4	941.0	F-3.8	F-0.3	944.5	941.0
394	944.3	939.0	943.3	F-1.0	C-0.0	944.3	939.2
393	943.3	937.8	942.2	F-1.1	F-3.0	941.3	937.8
T.P.		941.54	± Nail Sta. 383+00				
392	942.8	935.5	937.0	F-5.8	F-4.2	939.6	935.5
391	942.3	—	937.0	F-9.3	F-4.7	937.6	939.5
390	941.7	—	931.4	F-10.3	F-3.9	937.8	934.5
T.P.		939.08	± Nail Sta. 389+00				
389	941.2	933.8	934.1	F-7.1	F-2.5	938.7	935.5
388	940.7	936.5	937.5	F-3.2	C-0.5	941.2	936.6
387	940.2	937.2	940.5	C-0.3	C-3.9	944.1	937.2
386	939.7	937.7	943.3	C-3.6	C-4.6	944.3	936.8
385+00	939.2	936.2	943.0	C-3.8	C-2.7	941.9	937.0

			Prop. & Elev.	Drop Lt. ditch Elev.	Lt. Stake Elev.	Grd. to E	Grd. to E	Rt. Stake Elev.	Drop Rt. ditch Elev.
409+0			944.4	C-2.9 941.2	944.1	F-0.3	F-6.3	938.1	938.0
408+0			945.5	C-2.3 941.8	944.1	F-1.4	F-5.9	939.6	939.8
T.P.	946.09								
407+0			946.5	C-3.1 942.5	945.6	F-0.9	F-3.4	943.1	C-0.8 942.3
406+0			947.3	C-4.7 943.1	947.8	C-0.5	F-1.6	945.7	C-1.7 944.0
405+0			947.9	C-5.6 943.8	949.4	C-1.5	F-2.0	945.9	C-1.8 944.1
404+0			948.2	C-5.8 944.6	950.4	C-2.2	F-1.8	946.4	C-1.6 944.8
403+0			948.2	C-6.3 945.0	951.3	C-3.1	C-0.0	948.2	C-3.2 945.0
B.M.	952.17	952.15		Nat. Cor. Conc. Perch 94' 6". Sta	401+80				
402+0			947.9	C-5.8 945.5	951.3	C-3.4	C-2.5	950.4	C-4.9 945.5
401+0			947.4	C-4.1 945.0	949.1	C-2.3	C-1.9	949.3	C-4.5 944.8
400+0			946.89	C-3.0 943.0	946.0	F-0.9	F-0.2	946.7	C-3.7 943.0
399+0			946.38	C-0.9 940.0	940.9	F-5.3	F-2.3	944.1	C-3.1 941.0
T.P.	943.76			E Nail 398+00					
398+0			945.86	C-0.3 938.8	939.1	F-6.8	F-3.2	942.7	C-2.7 940.0

			Prop E Elev.	Prop Lt ditch El.	Lt Stake Elev.	Grade to E	Grade to E	Rt Stake Elev.	Prop Rt ditch El.
421+0			254.8	C-5.4 252.0	257.4	C-2.6	F-2.4	252.4	C-2.2 250.2
420+0			254.6	C-4.1 251.5	255.6	C-1.0	F-5.7	248.9	248.5
419+0			254.0	C-4.3 251.0	255.3	E-1.3	F-4.6	249.4	250.0
418+0			253.3 255.3	C-6.0 250.0	256.0	C-2.7	F-1.0	252.3	C-2.3 250.0
417+0			252.2	C-6.4 248.3	254.7	C-2.5	F-0.1	252.1	C-3.8 248.3
		254.54		E Nail 418+00					
416+0			250.9	C-4.8 246.5	251.7	C-0.8	F-2.2	248.7	C-2.2 246.5
415+0			249.3	C-5.4 244.6	250.0	C-0.7	F-4.3	245.0	C-0.4 244.6
414+0			247.5	C-4.8 243.0	247.8	C-0.3	F-4.7	242.8	243.0
T.P.		247.00		Nail on E 414+00					
413+0			245.9	C-4.6 241.2	245.8	F-0.1	F-5.6	240.3	241.0
412+0			244.8	C-4.5 240.0	244.5	F-0.3	F-6.3	238.5	—
411+0			244.2	C-4.3 240.5	244.8	C-0.6	F-3.8	240.4	240.5
410+0			244.1	C-4.1 240.8	244.9	C-0.8	F-3.9	240.2	C-0.2 240.0

433+0			243.8	C-2.2 236.0	238.2	F-5.6	F-1.4	242.4	C-4.6 237.8
432+0			244.2	C-2.9 237.0	239.9	F-4.3	C-0.2	244.4	C-3.9 238.5
431+0			244.8	C-4.1 238.0	242.1	F-2.7	C-0.8	245.6	C-6.1 239.5
430+0			246.0	C-1.5 239.3	240.8	F-5.2	F-1.1	244.9	C-4.4 240.5
429+0			247.4	C-0.5 240.5	239.6	F-7.8	F-2.0	245.4	C-3.9 241.5
T.P.	245.05			4 Nail 429+00				247.6	
428+0			248.2	C-0.5 242.0	241.0	F-8.2	F-1.6	247.6	C-5.1 242.3
427+0			250.8	— 243.2	243.1	F-7.7	F-1.5	249.3	C-5.1 244.2
426+0			252.1	—	243.9	F-8.2	F-3.3	248.8	C-2.8 246.0
T.P.	253.08			Rock in Rotary					
425+0			253.2	— 242.0	248.8	F-4.4	C-1.0	254.2	C-5.4 248.8
424+0			254.0	C-3.0 251.0	253.2	F-0.8	C-2.6	256.6	C-7.6 249.00
B.M.	258.02	257.95		Sp. in Twin Tree. 25' Lt 5th	422+80				
423+0			254.6	C-5.2 252.0	257.2	C-2.6	C-1.9	256.5	C-6.5 252.0
T.P.	259.89								
422+0			254.8	C-6.9 253.0	259.9	C-5.1	F-0.2	254.6	C-3.6 251.0

445+0			232.6	C-6.5 235.0	241.5	C-1.9	F-0.8	238.8	C-3.8 235.0
444+0			240.5	C-5.2 236.8	242.0	C-1.5	C-0.7	241.2	C-4.4 236.8
T.P.	242.48			E 443+00					
443+0			241.4	C-1.8 238.5	240.3	F-1.1	C-1.0	242.4	C-3.9 238.5
442+0			242.0	C-0.9 237.5	238.4	F-3.6	C-0.5	242.5	C-4.3 238.2
441+0			242.6	C-0.5 236.8	236.9	F-5.7	F-0.8	241.8	C-3.8 238.0
440+0			243.0	C-0.4 236.0	236.4	F-6.6	F-2.8	240.2	C-2.2 238.0
439+0			243.3	C-4.0 237.0	241.0	F-2.3	C-0.4	243.7	C-4.2 239.5
438+0			243.4	C-4.3 239.0	243.3	F-0.1	C-3.1	246.5	C-6.5 240.0
437+0	242.04		243.5	C-3.7 237.5	241.2	F-2.3	C-0.5	244.0	C-2.0 241.0
T.P.				E Nail 434+00					
436+0			243.6	C-1.1 236.5	237.6	F-6.0	F-2.0	241.6	C-2.6 238.0
435+0			243.7	C-0.5 235.0	235.1	F-8.6	F-3.1	240.6	C-3.6 237.0
434+0			243.8	- 235.0	235.0	F-8.8	F-3.1	240.7	C-3.7 237.0

			P.O.P. C ELEV.	Trop t. Ditch	SHAKE ELEV.	Q GROSS	Q GROSS	SHAKE ELEV.	Prop. Pt. Ditch
457+0			938.2	C 3.9 930.5	934.4	F 3.8	F 6.8 F 5.8	931.4 932.4	C 3.8 928.0
		932.75 933.75		± Nail 456+00					
456+0			937.5	C 3.8 929.5	933.3	F 4.2 457+0	F 10.5 F 9.5	927.0 928.0	C 3.8 927.0
T.B.M.		931.90 932.44		Crd. Sta. 58 1/2' Rl. Sta. 456+00					C 3.6
455+0			936.4	C 4.3 928.8	932.1	F 4.3	F 9.8 F 8.8	926.6 927.6	C 4.3 926.0
				C 3.2 C 4.2	930.2	F 4.9	F 9.0	926.1	C 1.1
454+0			935.1	927.0	931.2	F 3.9	F 8.0	927.1	C 4.2 925.0
				C 4.4 C 5.4	929.6	F 4.1	F 9.1	924.6	C 2.6
453+0			933.7	925.2	930.6	F 3.1	F 8.1	925.6	C 5.4 924.0
				C 3.1 925.2	928.3	F 4.5	F 9.2 F 8.2	923.6 924.6	C 3.1 924.1
452+0		930.07 931.08	932.8	± Nail 452+0					
				C 2.2 927.3	929.5	F 2.6	F 5.3	926.8	C 0.8
451+0			932.1						926.0
				C 5.2 929.1	934.3	C 1.1	F 2.7	930.5	C 2.5
450+0			933.2						928.0
				C 5.7 930.2	935.9	C 1.5	F 3.2	931.2	C 1.2
449+0			934.4						930.0
T.M.		937.84	937.83	SE Cor. Lower Conc. Step 90' Lt. 449+25					
				C 5.7 931.2	936.9	C 1.0	F 4.0	931.9	C 0.7
448+0			935.9						931.2
				C 5.3 932.1	937.4	C 0.1	F 3.8	933.5	C 1.4
447+0		Ladder	937.3						932.1
				C 5.9 933.2	939.1	C 0.6	F 2.5	936.0	C 2.8
446+0			938.5						933.2

		Prop E	Prop Lt. Ditch	Lt Stake Elev.	E Grade	E Grade	Rt Stake Elev.	L3 Prop Rt Ditch
469+0		926.2	917.0	916.2	F 10.0	F 4.6	921.6	C 1.6 920.0
468+0		928.6	C 0.8 920.0	919.2	F 9.4	F 4.6	924.0	C 1.3 922.7
TP	929.25		E Nail Sta 466+0					
467+0		930.9	C 1.6 921.0	922.6	F 8.3	F 4.4	926.5	C 1.4 925.1
466+0		932.8	C 0.3 925.8	926.1	F 6.7	F 3.6	929.2	C 1.4 927.8
TP	936.93							
465+0		934.5	C 2.0 928.6	930.6	F 3.9	F 0.9	933.6	C 3.4 930.2
464+0		936.0	C 3.5 931.5	935.0	F 1.0	C 1.6	937.6	C 4.6 933.0
463+0		937.1	C 4.5 934.6	939.1	C 2.0	C 3.7	940.8	C 6.2 934.6
462+0		938.0	C 7.6 935.0	942.6	C 4.6	C 2.1	940.1	C 5.1 935.0
461+0		938.6	C 8.1 934.5	942.6	C 4.0	F 2.0	936.6	C 2.1 934.5
460+0		938.9	C 7.6 936.0	943.6	C 4.7	F 2.9	936.0	C 0.5 935.5
TP	939.73		E Nail Sta 459+0					
459+0		938.9	C 5.6 935.0	940.6	C 1.7	F 1.2	937.7	C 2.7 935.0
458+0		938.7	C 5.1 931.5	936.6	F 2.1	F 2.8	935.9	C 4.4 931.5
TP	931.44		Grade Stake Sta 457+0			58.5 ft.		

Sta	8.9	PROP E	PROP DITCH	LT. STAKE ELEV.	E GRADE	E GRADE	RT. STAKE ELEV.	14 PROP RT. DITCH
481+0		897.7	C0.8 888.0	888.8	F8.9	F5.1	892.6	C2.6 890.0
480+0		900.0	C1.0 891.0	892.0	F8.0	F2.3	897.7	C5.2 892.5
TP	896.67							
479+0		902.4	C1.8 894.5	896.3	F6.1	F0.1	902.3	C6.3 896.0
BM	905.19	905.15	X" in So. Hd Wl. of 2x2x34' RCB @ Sta 477+78					
478+0			905.0	908.3			904.4	900.0
TP	906.05							
477+0		907.1	C0.0 903.0	902.9	F4.2	C1.2	908.3	C5.3 903.0
476+0		909.5	C1.3 906.0	907.3	F2.2	C3.2	912.7	C7.2 905.5
	914.50		E Nail @ Sta 475+0					
475+0		911.9	C2.2 909.0	911.2	F0.7	C4.9	916.8	C8.8 908.0
474+0		914.4	C2.1 911.5	913.6	F0.8	C4.8	919.2	C8.2 911.0
473+0		916.7	C0.0 914.0	913.5	F3.2	C2.4	919.1	C6.1 913.0
472+0		919.0	C0.0 913.5	913.0	F7.0	C0.1	919.1	C3.6 915.5
471+0		921.5	C0.0 —	914.0	F7.5	F0.8	920.7	C4.2 916.5
470+0		923.0	C0.8 914.0	914.8	F8.2	F2.4	920.6	C3.1 917.5
TP	LT. 921.25	RT. 918.91	E NAIL @ 470+0					

			PROP E	PROP DITCH	STAKE Elev	C Grd.	C Grd.	STAKE Elev.	PROP DITCH	15
										PROP DITCH
493+0			879.6	C 3.6 871.2	874.8	F 4.8	C 2.5	882.1	C 5.1 877.0	
492+0			880.7	C 3.2 872.4	875.6	F 5.1	C 1.4	882.1	C 4.1 878.0	
TP		884.10 4.19								
491+0			881.8	C 4.3 873.5	877.8	F 4.0	C 2.7	884.5	C 5.5 879.0	
490+0			882.8	C 3.7 875.0	878.7	F 4.1	C 2.9	885.7	C 5.7 880.0	
489+0			884.0	C 3.6 876.8	880.4	F 3.6	C 2.7	886.7	C 5.4 881.3	
488+0			885.8	C 3.8 878.0	881.8	F 4.0	C 0.5	886.3	C 4.3 882.0	
487+0			886.9	C 2.3 880.5	882.8	F 4.1	F 0.6	886.3	C 5.1 881.2	
TP		Rt. 886.61								
486+0			887.5	C 2.5 881.2	883.7	F 3.8	F 0.8	886.7	C 4.7 882.0	
TP		Lt 888.53			E Nail @ Sta. 485+0 (V)					
485+0			889.0	C 1.8 883.0	884.8	F 4.2	F 2.1	886.9	C 2.9 884.0	
484+0			890.8	C 1.7 884.0	885.7	F 5.1	F 4.2	886.6	C 1.6 885.0	
483+0			893.0	C 2.0 885.0	887.0	F 6.0	F 5.6	887.4	C 1.4 886.0	
482+0			895.2	C 2.1 886.3	888.4	F 6.8	F 5.6	889.6	C 2.6 887.0	

	Prop Elev.	LL Prop DITCH	16 Rt Prop DITCH
504+	870.0	C1.6 866.0	867.6 F2.4 F4.1 865.9 C0.9 865.0
503+0			
502+0	870.6	C1.4 866.0	867.4 F3.2 F1.1 869.5 C2.5 867.0
501+0	871.3	C1.1 866.7	867.8 F3.5 F0.2 871.1 C3.1 868.0
500+0	872.1	C0.9 867.1	868.0 F4.1 C0.4 872.5 C3.5 869.0
499+0	873.3	C0.7 867.8	868.5 F4.8 C0.9 874.2 C4.2 870.0
498+0	874.4	C0.6 868.2	868.8 F5.6 C2.6 877.0 C6.0 871.0
497+0	875.4	C2.5 868.9	871.4 F4.0 C3.2 878.6 C6.6 872.0
496+0	876.5	C3.5 869.5	873.0 F3.5 C1.8 878.3 C4.8 873.5
TP	Rt 874.01		
495+0	877.98	C5.9 870.0	F3.6 C-1.3 C-4.8 873.9 878.8 874.0
494+0	878.5	C3.8 870.5	874.3 F4.2 C2.5 881.0 C5.5 875.5
TBM #10	883.18	883.17 878.5	SPK. in LONG PINE 130' Rt. of Sta 496+50

			Prop Q ELEV	Lt. DITCH				17 RT. DITCH
516 ⁺⁰			95.8 893.3	C-4.1 C-4.6 888.8	F0.4 82.1	F6.6 F4.1	889.2	C0.2 882.0
		1.7		C-4.2 C-4.3	F0.1 82.0	F5.9 F3.8	888.0	C0.0 888.0
515 ⁺⁰			93.9 891.8	887.5	893.8			
TP	893.31	3.0		C-5.6 C-6.7	C-1.2 82.5	F4.3 F3.0	886.6	C1.4 885.2
514 ⁺⁰			90.9 889.6	885.2	892.1			
		3.7		C-4.8 C-6.2	C-1.3 84.7	F2.6 F2.2	884.6	C-1.9 882.3
513 ⁺⁰			87.2 886.8	882.3	888.5			
TP	884.04			C4.5				C3.3
512 ⁺⁰			883.0	878.5	883.0	F0.0 F1.2	881.8	878.5
				C1.4				C2.8
511 ⁺⁰			879.5	875.0	876.4	F3.1 F1.7	877.8	875.0
TP	875.66			SPK in PD-60' Lt. Sta 510 ⁺⁰				C0.0
510 ⁺⁰			876.4	871.7	872.9	F3.5 F5.2	871.2	872.0
			873.9	C2.2				C0.0
509 ⁺⁰			874.2	869.0	871.2	F2.7 F7.8	866.1	866.6
				C2.9				
508 ⁺⁰			872.0	867.5	870.4	F1.6 F8.4	863.6	—
				C2.5			862.5	—
507 ⁺⁰			870.7	867.1	869.6	F1.1 F8.2	863.5	863.0
TP	869.78			Q NAIL @ Sta 506 ⁺⁰				
506 ⁺⁰			870.0	866.7	869.2	F0.8 F6.9	863.1	864.0
				C2.5				
505 ⁺⁰			870.0	866.3	868.0	F2.0 F4.9	865.1	864.0
				C1.7				40.9

[illegible]

				PROP E	LT. DITCH					RE. 19 DITCH
540 ¹⁰				897.8	C5.4 893.0	898.4	C0.6	F4.4	893.4	C2.4 891.0
539 ¹⁰				895.0	C4.7 889.5	894.2	F0.8	F4.4	890.6	C2.6 888.0
538 ¹⁰				892.8	C2.8 886.0	888.8	F4.0	F5.9	886.9	C1.9 885.0
537 ¹⁰				891.2	C0.9 883.5	884.4	F6.8	F9.3	881.9	C0.4 881.5
536 ¹⁰				890.3	C4.5 879.0	882.7 882.5	F7.6 F6.8	F11.7	878.4	C0.4 878.0 ✓
TP		886.96								
535 ¹⁰				889.8	C3.0 882.0	885.0	F4.8	F10.6	879.2	C0.2 879.0 ✓
534 ¹⁰				890.1	C5.5 884.0	889.5	F0.6	F5.0	884.1	C2.1 882.0
TBM		894.29	894.21		Spk in PP (NW Quad)	NE Cor	34-87-12			
533 ¹⁰				890.1	C7.4 886.0	893.4	C3.3	F3.2	886.9	C1.9 885.0
TP		LT. 892.19								
532 ¹⁰				889.7		895.5	C5.8	C0.5	890.2	
531 ¹⁰				889.1	C6.0' 886.0	892.0	F2.9	C0.1	889.2	C4.2 885.0
530 ¹⁰				888.1	C3.5 883.0	886.5	F1.6	F3.6	884.5	C3.5 881.0
TP		885.01			Spc in PP - Lt - 529 ¹⁰					
529 ¹⁰				886.9	C3.3 880.0	883.3	F3.6	F7.7	879.2	C1.2 878.0

			Prop E	26 DITCH					RL 20 DITCH
552+0			884.1		879.7	F-4.4	F-9.0	875.1	
551+89	E CULV.				Prop R 879.74 877.5 Cnd 3 ft. 60' Lt	(C2.2)	(C0.1)	875.10 60' RL	Prop R 75.00 C-1.4
551+0			885.3	876.5	880.4	F-4.9	F-7.9	877.4	876.0
		883.63		E Nail 530+0					
550+0			887.6	879.0	881.4	F-6.2	F-5.0	882.6	879.0
				C-2.4					C-3.6
549+0			890.9	882.0	884.6	F-6.3	F-4.9	886.0	883.0
TP		891.85		Rock in E Rd					
548+0			895.0	887.0	888.5	F-6.5	F-4.4	890.6	888.0
				C-1.5					C-2.6
547+0			898.5	892.0	893.4	F-5.1	F-1.4	897.1	893.5
				C-1.4					C-3.6
TP		900.76		STAKE 33' RL - Sta 546+50					
546+0			901.1	896.0	899.8	F-1.3	F-2.6	898.5	896.0
				C-3.9					C-2.5
545+0			902.8	898.0	907.5	C-4.7	F-1.7	901.1	898.0
				C-9.5					C-3.1
TBM #12		909.69 909.73		SPK. in 20" TREE - 80' Lt. of Sta 543+35					
544+0			903.6	901.6	910.8	C-1.2	F-0.2	903.4	901.6
				C-9.2					C-1.8
TP		904.87							
543+0			903.5		905.7	C-2.2	F-1.7	901.8	
542+0			902.5	898.0	903.0	C-0.5	F-4.2	898.3	898.0
				C-5.0					C-0.3
541+0			900.6	896.5	900.6	C-0.0	F-5.2	895.4	894.5
				C-4.1					C-0.9
TP		896.04							

			PROP. & Elev.	LT. DITCH					Rt. 21 DITCH
564+0			894.7	C-7.8 891.0	898.8	C-4.1	C-2.3	897.0	C-6.5 890.5
TBM #13	906.31	906.39		SPE. in Conc 16" PINE - 95' Lt				564 562+90	
563+0			894.8	C-11.8 892.7 (3')	894.5	C-2.7	C-4.9	899.7	C-7.7 892.0
	900.56								
562+0			894.7	C-11.3 893.0	894.3	C-2.6	C-3.0	897.7	C-4.7 893.0
561+0			894.3	C-2.7 892.0	891.7	C-7.4	C-2.7	897.0	C-5.0 892.0
560+0			893.6	C-7.3 891.0	898.3	C-4.7	C-3.1	896.7	C-5.7 891.0
T.P.	894.87			Rock in Rdwy. C-3.3					
559+0			892.7	889.5	892.8	C-0.1	F-0.4	892.3	C-2.3 889.0
558+0			891.4	C-2.6 888.0	890.6	F-0.8	F-3.9	885.5	—
557+0			889.9	C-4.1 886.0	890.1	C-0.2	F-7.1	882.8	885.0
556+0			888.2	C-7.1 884.0	891.1	C-2.9	F-3.4	884.8	C-1.8 883.0
555+0			886.1	C-6.6 881.5	888.1	C-2.0	F-0.5	885.6	C-4.6 881.0
T.P.	885.67			Rock in Rd. & C-4.7					
554+0			884.4	879.0	883.7	F-0.7	F-2.0	882.4	C-4.4 878.0
553+0			883.7	C-2.0 877.0	881.0	F-2.7	F-6.0	877.7	C-1.7 870.0

		PROP Elev	LT. DITCH C.O.						RL-22 DITCH C.O.
5+00		856.4	-	849.2	F7.2	F7.4	846.5	845.0	
TP	856.16								
4+00		862.4	C.O.	858.1	F4.3	F6.6	855.8	854.0	C1.8
TP	863.12								
3+00		868.3	C.O.			F2.3	866.0	863.0	C3.0
TP	871.51								
2+00		874.2	C15.2 869.0	984.2	C10.0	C0.3	874.5	870.0	C4.5
TP	879.87								
1+00		879.7	C18.6 875.0	893.6	C13.9	C4.6	884.3	877.0	C7.3
La Porte CITY LIMITS									
571+0		884.7	C16.7 880.0	896.9	C12.2	C-1.5	886.2	884.0	
TBM #14	886.36			SPK in 1/4" LONG PINE 120' RT. of STA. 569+87					
570+0		887.8	C12.6 883.8	896.41	C8.6	C-0.3	888.1	-	
TP	889.94			STAKE @ Sta 568+00 Lt.					
569+0		890.0	C8.0 887.0	895.0	C5.0	F-0.9	889.1	-	
T.B.M.	888.62			E Nail Sta. 570+0					
568+0		891.5	C-4.9 885.0	889.9	F-1.6	F-7.7	883.8	882.0	C-1.8
CULVERT									
567+0	E Culvert	892.7	C1.3 884.0	885.28	F-7.4	F-12.6	880.14	880.0	C0.1
TP	891.12			Top of F.P. Rt.					
566+0		893.6	C-1.6 885.0	886.6	F-7.0	F-7.7	885.9	884.0	C-1.9
CULVERT									
565+0		894.3	C-3.5 889.0	892.5	F-1.8	F-2.7	891.6	888.0	C-3.6
TP	890.04			E Nail					

Prop
&
ELEV. DITCH

Rt. 23
DITCH

17+00			827.0	20.0	830.0	C3.0	F10.5	816.5	C0.0
TP - Lt.	823.30								
16+00			827.0	23.3	822.8	F4.2	F11.5	815.5	C0.0
TP	819.25								
15+00			827.1	27.2	828.7	C1.6	F11.7	816.0	C0.0
14+38	CULVERT STAKE	816.07		Prop H 819.0	823.15	C4.1	F0.1	816.07	Prop H 816.2
14+00			827.8	29.4	829.9	C2.1	F11.4	816.4	C0.0
13+00			828.9	24.1	837.1	C8.2	F11.9	817.0	C1.5
12+00			830.7	24.4	850.4	C19.7	F12.0	818.7	C0.7
TP	825.68								
11+00			833.1	27.1	857.1	C24.0	F8.0	825.1	C0.0
10+00			835.9	24.5	856.5	C20.6	F5.3	830.6	C1.6
9+00			838.8	17.7	852.7	C13.9	F8.0	830.8	C0.8
TP	832.43								
8+00			842.1	10.8	849.8	C7.7	F10.4	831.7	C0.0
TBM	840.31								
7+00			845.1	3.4	845.4	C0.3	F10.3	834.8	C0.0
6+89	CULVERT STAKES	Rt. 835.38' Lt. 845.54		Prop H 840.5	C5.0'			Prop H 835.0	C0.4'
6+00			850.7	0.0	846.1	F4.9	F11.4	839.5'	C0.5
TP	847.87								

PROP.
@
Elev.

lt.
DITCH

Rt 24
DITCH

25+00		822.7							
24+00		823.7							
23+00		824.7	C 5.5						
BM	824.25 824.72	821.0	826.5	C 1.8	C 0.0	824.7		C 3.2	821.5
22+00		825.7	"X" Hdwl. of RCB @ Sta 20+90.5 - Lt 22'					C 1.3	
TP	826.26	820.5	824.7	F 1.0	F 2.4	823.3		822.0	
21+00		826.6	Box Culvert @ 21+00						
			822.6	F 4.0	F 6.2	820.4			
20+00		826.7	C 0.0					C 0.0	
			822.1	F 4.8	F 8.0	818.9			
19+00		827.0	C 0.0					C 0.0	
			826.2	F 0.8	F 10.0	817.0			
18+00		827.0	C 0.0					C 0.0	
			825.9	F 1.1	F 10.1	816.9			

25-36

CLEAN

CULVERT STAKES (GRADES)

38

426+26.1 CROSS ROAD PIPE 50.0' RT. 953.3 Prop E 07.3' 04.1' Prop H 0749.1
50.0' WEST 0746.0 0745.0' 50.0' EAST

426+0 0748.8 GRADE STAKE 58.5' RT, R

411+71 944.5 Prop H 045' F0.4 Prop H 038.6
60.0' LT. 940.0' 939.0' 60.0' RT

412+0 944.5 GRADE STAKE 58.5' LT. R

390+68 932.4 Prop E 01.1 03.2 Prop H 937.7
60' LT. 931.3 934.5 60' RT

391+00 933.0 GRADE STAKE 58.5' LT. R

369+80 5.18, Prop H 00.4 to R 01.8' Prop H 918.0
60' 914.8 916.2 60'

370+0 916.4 GRADE STAKE 58.5' LT. R

CROSS ROAD GRADE STAKES

(2) Sta. $426 + 26.1$

Sta.

PROP.
E. ELEV.PROP LT.
TCH ELEV.

Lt.
STAKE
ELEV.

GRADE
to
C

GRADE
to
C

RT.
STAKE
ELEV.

PROP. RT.
DITCH ELEV

426 + 26.1
200' Lt.

942.0

AT

GRADE

$426 + 26.1$
100 Lt.

946.7

0.0

943.8

FZ. 9

F5.3

941.4

C.O.O

426 + 26.1
100 Rt.

953.7

0.0

957.9

F.O.B

C O. 4

954.1

C.O.O

426 + 26.1
200' Rt.

957.5'

At

GRADE

TBM

248.8'

STAKE @ Sta 426+0

58.5' RA

477+78

(36" C.R.P.C. NEW PIPE)

898.1
60.0'

Prop. R
899.0' F 0.9 C 5.9

Prop. R
900.0'

905.9
60.0'

477+0

477+0

902.9

GRADE STAKE 57.3' Lt.

452+47

36" RCP (EXT.)

928.6
60.0'

Prop. R
925.0' C 3.6 C 0.8'

Prop. R
922.5'

923.3'
60.0'

452+0

928.3

GRADE STAKE 59.7' Lt.

440+47

24" RCP (EXT.)

936.2
60.0'

Prop. R
935.7' C 0.5 C 2.6

Prop. R
937.8'

940.4
60.0'

440+0

940.2'

GRADE STAKE 58.5' Rt.

434+24

24" RCP (EXT.)

934.0
60.0'

Prop. R
934.0' C 0.0 C 3.8

Prop. R
936.8'

940.64
60.0'

434+0

940.7

GRADE STAKE 58.5' Rt.

CULVERT GRADE STAKES

41

535+73 42" R.C.P. (RELAY & EXT.)

883.1 Prop. H 878.1 C5.0 C0.7 Prop. H 878.2
60.0 877.5 60.0

535+0 885.0'

526+03 48" R.C.P. (EXT.)

78.7 Prop. H 871.6
60.0 871.6 60.0
C6.1 C2.5 869.1

526+0 ~~773.7~~ 878.5 GRADE STAKE Lt. 58.5'

487+06 36" R.C.P. (EXT.)

82.7 Prop. H 886.4
60.0 886.4 60.0

487+0 36" R.C.P. (EXT.) ~~886.7~~

82.8 Prop. H 886.3
60.0 886.3 60.0

486+0 886.7 GRADE STAKE Rt. 58.5'

~~478+0~~

~~478+0~~

Co. Rd. "N"

JAN. 14, 1969

SHOFF 
McCord

46

CLEARING & GRUBBING COUNT (ESTIMATE)

SIZE (DIA.)	CLEARING ONLY	GRUBBING ONLY	CLEARING & GRUBBING	
3" to 6"				3"-6"
6" to 9"				6"-9"
9" to 12"				9"-12"
12" to 15"				12"-15"
15" to 18"				15"-18"
18" to 24"				18"-24"
24" to 30"				24"-30"
30" to 36"				30"-36"
36" to 42"				36"-42"
42" to 48"				42"-48"
48" to 60"				48"-60"
60" to 72"				60"-72"
over 72"				over 72"

HEDGE ROW (sta.)

BRUSH (squares)

|||||

Co. Rd. N

70' R.O.W.

47

CLEARING

GRUBBING

3" to 6"

6" to 9"

9" to 12"

12" to 15"

15" to 18"

18" to 24"

29" / 30"

30" to 36"

36" to 42"

42" to 48"

98" to 60"

60" to 72"

72" & over

HEDGE Row

BRUSH (100' sq.) - 1111111111 (+100)

CLEARING & GRUBBING

//////////////////// + 29

//////////////////// +40

////////////////////

1471777

✓✓✓

W

1

1

Road Profile Co. Rd "G"

598+00 to 613+00

T.P. 4.37 908.65 6.51 904.28

601+00

600+00

599+00

598+00

910.8

T.B.M. 8.37 910.79 6.01 902.42

T.B.M. 2.78 908.43 9.62 905.65

B.M. 4.07 915.27 911.20

11' Lt 901.5 65 118 Rt

10' Lt 905.3 55 104 Rt

9' Lt 906.7 4' 85 Rt

62 ditch Lt 908.8 20 68 ditch Rt

Nail in gate post 50' Lt sta 600+00 (S. side field ent)

Southeast cor. of upper conc. step @ SE Cor Barn
(step chipped) 150'± NW of Bridge

Iron pin at NE Cor 33-88-13

608100

607100

T.P. 10.80 916.7 916.69 2.76 905.89

606100

605100

604100

603100

602100

908.6

89

6⁶

$$\frac{133}{Rt}$$

908.0

$$\frac{113}{Lt}$$

87

$$\frac{154}{Rt}$$

$$\frac{71}{Lt}$$

28

$$\frac{93}{Rt}$$

$$\frac{93}{Lt}$$

45

$$\frac{107}{Rt}$$

$$\frac{95}{Lt}$$

51

$$\frac{97}{Rt}$$

$$\frac{94}{Lt}$$

51

$$\frac{105}{Rt}$$

$$\frac{89}{ditch Lt}$$

47

$$\frac{102}{ditch Rt}$$

B.M. 5.49 911.20 911.20 Iron pin @ NE Cor 33-88-13

G13+00

911.4
 $\frac{96}{L+}$ 53 $\frac{106}{R+}$

G12+00

911.6
 $\frac{93}{L+}$ 51 $\frac{111}{R+}$

G11+00

911.8
 $\frac{88}{L+}$ 49 $\frac{108}{R+}$

G.10+00

912.0
 $\frac{90}{L+}$ 47 $\frac{112}{R+}$

G09+00

911.6
 $\frac{86}{L+}$ 51 $\frac{119}{R+}$

Stream Bed Profile @ sta 604+29

B.M.

2.14 905.65 905.65 upper step SE cor

+53

12

17 903.1
896.0

+43

112

118 edge water

+38

132

156 892.1

+32

149

152 896.6

+26

147

149 896.9

+20

135

132 894.1

604+15

+14

112

118 896.0

13

13 edge water

48

50 902.6

↑
Bridge profile

604+29

↑
Profile stream

11'	118	120	121	126	126
100	300	200	150	100	50

897.1	896.0	896.3	896.7	896.6	896.2
-------	-------	-------	-------	-------	-------

126	130	134	138	139	148
50	100	150	200	300	400

896.1	896.3	896.4	896.0	895.9	895.0
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B.M. 2.14 907.79

905.65

Southeast cor upper step @ Southeast cor. barn

Shot	Horiz $\angle$	Horiz Dist	Crosshair	Vert $\angle$	Elev	Description
------	----------------	------------	-----------	---------------	------	-------------

0°00' = Sta 600+00 N. to NE 33-88-13

T.B.M.	8.15	910.57 910.6			902.42	Nail in gate post 50' Lt Sta 600+00
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# 1	167°10'	250'	1.8	0°00'	908.8	Fe N.S. Row
# 2	134°42'	364'	+1.1		911.7	EL
3	116°47'	444'	3.45		907.2	EL.
4	96°46'	695'	1.24		909.4	EL.
5	62°09'	600'	11.45		899.2	EL.
6	08°15'	360'	11.66		898.9	Fe Cor N.S. & E.W.
7	07°40'	422'	11.35		899.2	T.B. Rt
8	07°40'	450'	12.80		897.8	T.B. Lt
9	05°36'	530'	10.9		899.7	Fe Cor N.S. & E.W.
10	22°44'	510'	12.0		898.6	T.B. Lt
11	23°51'	491'	12.8		897.8	T.B. Rt
12	32°51'	480'	12.4		898.2	T.B. Rt

T.P.	8.24	910.7 910.66	8.15	902.42	902.42	Nail in gate post 50' Lt Sta 600+00
------	------	-----------------	------	--------	--------	-------------------------------------

0°00' = Sta 600+00 N. on sec line to NE 33-88-13

13	19°22'	470'	16.0		894.7	#
14	38°05'	510'	16.7		894.0	#
15	43°27'	575'	15.4		895.3	T.B. Lt

shot	Horiz. $\angle$	Horiz. Dist	Cross hair	Vert. $\angle$	Elev	Description
		910.66 910.7				
16	42° 58'	580'	13.6		897.1	T.B. Rt ✓
17	41° 53'	630'	13.5		897.2	G.E.
18	47° 40'	615'	14.4		896.3	T.B. Rt ✓
19	49° 18'	600'	14.1		896.6	T.B. Lt ✓
20	49° 30'	640'	17.9		892.8	FL
21	52° 19'	700'	15.2		895.5	T.B. Lt ✓
22	51° 46'	720'	14.9		895.8	T.B. Rt ✓
23	51° 45'	860'	14.7		896.0	Fe. Cor EW to NS
24	62° 47'	840'	14.5		896.2	Fe. Cor EW to NS
25	40° 35'	970'	14.1		896.6	G.E.
26	26° 20'	1170'	12.2		898.5	G.E.
27	17° 51'	1040'	8.9		901.8	G.E.
28	02° 51'	998'	2.9		907.8	fe Row
29	04° 06'	692'	5.7		905.0	G.E. along fe
30	358° 18'	438'	7.1		903.6	N.W. cor bridge
31	01° 30'	442' ¹⁴⁰	7.4		903.3	NE " "
32	01° 33'	417' ^{141.5}	7.4		903.3	SE " "
33	358° 24'	422'	7.3		903.4	SW " "
34	355° 48'	466'	10.1		900.6	Fe. Cor ^{Elev} NS & W
35	356° 54'	600'	7.2		903.5	Fe. Cor. Remains nearest to barn

Shot	Hor. A	Hor. Dist	Cross hair	Vert. A	Elev	Description
		910.69 910.7				
36	354° 45'	780	+1.9		912.6	SE Cor House (measured 37x49)
37	352° 03'	698	4.1		906.6	NE Cor Barn
38	351° 20'	598	6.3		904.4	SE " "
39	344° 51'	618	6.0		904.7	SW " "
40	336° 33'	594'	4.8		905.9	SE Cor Hog House
41	333° 08'	605'	4.6		906.1	SW " " "
42	317° 18'	620'	6.5		904.2	fe cor N S & E
43	329° 20'	442'	12.1		898.6	T.B. Lt
44	329° 09'	426'	12.5		898.2	T.B. Rt
45	332° 13'	428'	15.1		895.6	FE
46	350° 29'	414'	13.4		897.3	T.B. Lt,
47	350° 53'	405'	11.7		899.0	T.B. Rt.
48	328° 53'	332'	10.6		900.1	S.E.
49	308° 56'	386'	13.2		897.5	T.B. Lt
50	309° 10'	390'	11.8		898.9	T.B. Rt
51	306° 26'	384'	14.4		896.3	FE
52	285° 13'	444'	9.8		900.9	E cor N & SW
53	284° 00'	418'	11.7		899.0	T.B. Lt
54	283° 55'	410'	11.6		899.1	T.B. Rt
55	279° 12'	416'	13.9		896.8	FE
56	272° 45'	396'	9.2		901.5	E cor E & SW
57	271° 15'	658'	8.5		902.2	E cor NE - N & West

Shot	Hor. Δ	Hor. dist.	Cross hair	Vert. Δ	Elev	Description
		910.66 910.7				
58	265° 30'	600'	11.4		899.3	TB Lt
59	265° 01'	602'	12.6		898.1	R
60	264° 56'	598'	10.9		899.8	TB. Rt
61	259° 32'	594'	8.1		902.6	fe cor NE & WNW
62	236° 22'	688'	5.3		905.4	G.E.
63	227° 45'	881'	+1.3		912.0	G.E.
64	208° 53'	666'	1.4		909.3	G.E.
65	190° 10'	292'	1.8		908.9	fe NS Row
66	230° 46'	328'	7.4		903.3	G.E.
67	302° 45'	41'	9.7		901.0	fe cor ^{NS} Row & W Row changes to 33'
68	0° 00'					NE cor 33-88-13 sta 613+30
T.B.M.			8.26		902.42	Spike in gate post 50' Lt sta 600+00

3.8' water
under
bridge
East

Cross Sections on Bridge

900's. of NE Cor 33-88-13

57

604+44 End wing No.

604+16 End wing 50.

604+00

603+75

603+50

603+25

B.M. 4.38 910.03

905.65 SE Cor upper step @ SE Cor barn

10³ 11⁰ 11⁸ 12⁹ 10² 6⁷ CA 6⁵ 13⁹ 15¹ 14³ 14⁹
100 58 32 20 15 13 11 20 41 81 100

903.6

729

903.5

9 13² 14⁸ 12⁵ 12⁷ 11⁷ 11⁵ 7⁹ 6⁸ 6⁵ 7⁰ 10⁷ 11⁰ 10⁹ 10⁹ 10⁷ 11⁰
64 58 48 36 26 21 16 12 13 20 28 43 51 70 100
T.B. Lt T.B. Rt

12⁴ 14⁸ 11² 11⁰ 12¹ 11¹ 10⁸ 10⁹ 8⁰ 6⁸ 6⁵ 6⁹ 11⁰ 10⁸ 10⁹ 10⁷
88 65 54 44 37 33 29 23 18 13 12 22 37 46 100
T.B. Lt T.B. Rt

903.5

10² 10⁷ 11⁴ 10⁷ 10⁰ 7⁵ 6⁹ 6⁵ 7³ 10⁷ 11⁴ 10⁵ 10⁷ 11¹
100 44 35 32 21 16 12 14 22 33 46 52 100

903.5

10² 10⁶ 11² 10⁷ 10⁹ 8¹ 7⁰ 6⁷ 7⁴ 11¹ 11⁴ 11¹ 11³ 11³
100 45 36 32 23 17 13 14 25 35 46 51 100
fe fe

903.3

10³ 10⁶ 11² 10⁶ 11⁰ 10² 8¹ 6⁹ 6⁵ 6⁹ 8⁶ 11² 12⁰ 11⁸ 11⁰ 11⁶
100 50 35 33 30 22 18 13 12 18 27 36 45 51 100
fe fe

903.4

T.B.M. 4.37 905.66 905.65 SE Cor upper step SE Cor Barn

605+25

$\frac{11^6}{100} \frac{10^4}{51} \frac{11^4}{44} \frac{11^9}{34} \frac{11^5}{26} \frac{6^1}{14} \frac{5^8}{11}$
 $\frac{5^5}{11} \frac{5^7}{15} \frac{6^6}{21} \frac{9^8}{28} \frac{10^1}{33} \frac{8^9}{52} \frac{8^7}{100}$

605+00

$\frac{9^0}{100} \frac{9^1}{32} \frac{10^2}{29} \frac{10^2}{22} \frac{6^0}{12}$
 $\frac{6^1}{11} \frac{6^3}{13} \frac{11^4}{25} \frac{12^2}{38} \frac{11^1}{51} \frac{11^8}{96}$

604+75

$\frac{9^1}{100} \frac{9^5}{72} \frac{9^5}{32} \frac{10^1}{27} \frac{9^8}{21} \frac{6^9}{15} \frac{6^1}{11}$
 $\frac{6^3}{11} \frac{6^8}{14} \frac{11^0}{23} \frac{11^3}{35} \frac{10^6}{52} \frac{11^2}{100}$

	DIFF.	TP Elev.	STAKE Elev.	
BM ↓		958.62		SPK in Elm TREE - 16. SCA 337+0
TP		952.86	952.85	BT @ 343+0
SHOT		9.94	9.94	BT @ 346+0
SHOT		8.55	8.54	BT @ 347+0
TP	0.12 -	6.99	4.87	BT @ 348
TP	0.13 -	0.25	0.14	BT @ 351+0
TP	0.14 -	4.36	04.24	BT @ 353+0
TP	0.12 -	7.67	7.55	
	0.12	921.24	921.12	

TBM #1	-0.19	921.31	921.12	X" So. Hdw/- T. 12' x 45' RCB
TP	-0.19	922.42	922.23	BT @ 366+0
TP	0.16	927.22	927.06	BT @ 371+0
BM ↑	0.14 -	927.19	927.05	SPK. in PP Rt. 373+27

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

2.7
2.8
1.9

DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope $1\frac{1}{2}$ 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.

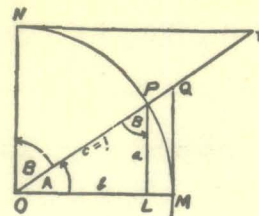


TABLE II
TRIGONOMETRIC FORMULÆ.

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

$$R = OP = c = 1$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

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

Area of a triangle:

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

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

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

$$360^\circ = 21600' = 1296000''$$

$$\text{Radius} = \text{arc of } 57.2957790^\circ$$

$$\text{Arc of } 1^\circ (\text{radius} = 1) = .017453292$$

$$\text{Arc of } 1' (\text{radius} = 1) = .000290888$$

$$\text{Arc of } 1'' (\text{radius} = 1) = .000004848$$

$$\pi = 3.141592654$$

$$\sqrt{\frac{1}{\pi}} = 0.564190$$

$$\frac{\pi}{4} = 0.785398163$$

$$\sqrt[3]{\frac{6}{\pi}} = 1.240700982$$

$$\frac{\pi}{6} = 0.523598776$$

$$\pi^2 = 9.869604401$$

$$\sqrt{\frac{4}{\pi}} = 1.128379167$$

$$\frac{1}{\pi^2} = 0.101321184$$

$$\frac{\pi}{6} = 0.523598776$$

$$\sqrt{\pi} = 1.772453851$$

$$\frac{4\pi}{3} = 4.188790205$$

$$\frac{1}{\pi} = 0.3183099$$

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 $11\frac{1}{2}$ 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 FORMULAE

$$\text{Horizontal Distance} = R - R \sin^2 a + C \cos a$$

$$\text{Vertical Distance} = R \frac{1}{2} \sin 2a + C \sin a$$

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

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

a = angle of elevation for mid Reading

TABLE 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	.3674	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
90	60'	cos	60'	cot	cos	60'	cot	cos	60'	cot	cos	60'	cot

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	E	30'	576.95	28.974	E	30'	1087.8	102.35	E
40'	83.34	.606	.03	40'	585.36	29.824	.06	40'	1096.4	103.97	.10
50'	91.68	.733	E	50'	593.79	30.686	E	50'	1105.1	105.60	E
2°	100.01	.873	.001	12°	602.21	31.561	.006	22°	1113.7	107.24	.013
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	20° C.	30'	830.76	59.914	20° C.	30'	1349.2	156.70	20° C.
40'	333.71	9.710	T	40'	839.27	61.141	T	40'	1358.0	158.72	T
50'	342.08	10.202	.13	50'	847.78	62.381	.26	50'	1366.8	160.76	.39
7°	350.44	10.707	E	17°	856.30	63.634	E	27°	1375.6	162.81	E
10'	358.81	11.224	.006	10'	864.82	64.900	.022	10'	1384.4	164.86	.051
20'	367.17	11.753		20'	873.35	66.178		20'	1393.2	166.95	
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	25° C.	10'	916.03	72.764	25° C.	10'	1437.4	177.55	25° C.
20'	417.41	15.184	T	20'	924.58	74.119	T	20'	1446.3	179.72	T
30'	425.79	15.799	.16	30'	933.13	75.488	.32	30'	1455.1	181.89	.49
40'	434.17	16.426	E	40'	941.69	76.869	E	40'	1464.0	184.08	E
50'	442.55	17.065	.007	50'	950.25	78.264	.028	50'	1472.9	186.29	.065
9°	450.93	17.717		19°	958.81	79.671		29°	1481.8	188.51	
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	E	30'	2170.8	397.4	E	30'	2763.7	631.7	E
40'	1624.9	226.0	.13	40'	2180.3	400.8	.17	40'	2773.9	636.2	.21
50'	1633.9	228.4	E	50'	2189.9	404.2	E	50'	2784.2	640.7	E
32°	1643.0	230.9	.023	42°	2199.4	407.6	.037	52°	2794.0	645.2	.056
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	20° C.	30'	2461.7	506.4	20° C.	30'	3078.7	774.7	20° C.
40'	1898.6	306.4	T	40'	2471.5	510.3	T	40'	3089.4	779.8	T
50'	1907.9	309.3	.53	50'	2481.4	514.3	.68	50'	3100.2	784.9	.84
37°	1917.1	312.2	E	47°	2491.3	518.2	E	57°	3110.9	790.1	E
10'	1926.4	315.2	.093	10'	2501.2	522.2	.151	10'	3121.7	795.2	.225
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	25° C.	10'	2561.0	546.3	25° C.	10'	3186.9	826.7	25° C.
20'	1991.5	336.3	T	20'	2571.0	550.4	T	20'	3197.8	832.0	T
30'	2000.9	339.3	.67	30'	2581.0	554.5	.85	30'	3208.8	837.3	.105
40'	2010.2	342.4	E	40'	2591.0	558.6	E	40'	3219.7	842.7	E
50'	2019.6	345.5	.117	50'	2601.1	562.8	.189	50'	3230.7	848.1	.283
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	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	.102	20'	3330.3	897.5	.127
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	

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'	3388.3	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	10° C.	72°	4162.8	1352.6	10° C.	82°	4980.7	1862.2	10° C.
10'	3454.1	960.6	T	10'	4175.6	1360.1	T	10'	4995.4	1871.8	T
20'	3465.4	966.5	.51	20'	4188.5	1367.6	.61	20'	5010.0	1881.5	.72
30'	3476.8	972.4	E	30'	4201.2	1375.2	E	30'	5024.8	1891.2	E
40'	3488.3	978.3	.159	40'	4214.0	1382.8	.220	40'	5039.5	1900.9	.299
50'	3499.7	984.3	15° C.	50'	4226.8	1390.4	15° C.	50'	5054.3	1910.7	15° C.
63°	3511.1	990.2	20° C.	73°	4239.7	1398.0	20° C.	83°	5069.2	1920.5	20° 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	15° C.	50'	4304.6	1436.8	15° C.	50'	5143.9	1970.3	15° C.
64°	3580.3	1026.6	20° C.	74°	4317.6	1444.6	20° C.	84°	5159.0	1980.4	20° C.
10'	3591.9	1032.8	T	10'	4330.7	1452.5	T	10'	5174.1	1990.5	T
20'	3603.5	1039.0	.51	20'	4343.8	1460.4	.61	20'	5189.3	2000.6	.72
30'	3615.1	1045.2	E	30'	4356.9	1468.4	E	30'	5204.4	2010.8	E
40'	3626.8	1051.4	.159	40'	4370.1	1476.4	.220	40'	5219.7	2021.1	.299
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	20° C.	75°	4396.5	1492.4	20° C.	85°	5250.3	2041.7	20° C.
10'	3661.9	1070.2	T	10'	4409.8	1500.5	T	10'	5265.6	2052.1	T
20'	3673.7	1076.6	.51	20'	4423.1	1508.6	.61	20'	5281.0	2062.5	.72
30'	3685.4	1082.9	E	30'	4436.4	1516.7	E	30'	5296.4	2073.0	E
40'	3697.2	1089.3	.159	40'	4449.7	1524.9	.220	40'	5311.9	2083.5	.299
50'	3709.0	1095.7	15° C.	50'	4463.1	1533.1	15° C.	50'	5327.4	2094.1	15° C.
66°	3720.9	1102.2	20° C.	76°	4476.5	1541.4	20° C.	86°	5343.0	2104.7	20° C.
10'	3732.7	1108.6	T	10'	4489.9	1549.7	T	10'	5358.6	2115.3	T
20'	3744.6	1115.1	.51	20'	4503.4	1558.0	.61	20'	5374.2	2126.0	.72
30'	3756.5	1121.7	E	30'	4516.9	1566.3	E	30'	5389.9	2136.7	E
40'	3768.5	1128.2	.159	40'	4530.4	1574.7	.220	40'	5405.6	2147.5	.299
50'	3780.4	1134.8	15° C.	50'	4544.0	1583.1	15° C.	50'	5421.4	2158.4	15° C.
67°	3792.4	1141.4	20° C.	77°	4557.6	1591.6	20° C.	87°	5437.2	2169.2	20° C.
10'	3804.4	1148.0	T	10'	4571.2	1600.1	T	10'	5453.1	2180.2	T
20'	3816.4	1154.7	.51	20'	4584.8	1608.6	.61	20'	5469.0	2191.1	.72
30'	3828.4	1161.3	E	30'	4598.5	1617.1	E	30'	5484.9	2202.2	E
40'	3840.5	1168.1	.159	40'	4612.2	1625.7	.220	40'	5500.9	2213.2	.299
50'	3852.6	1174.8	15° C.	50'	4626.0	1634.4	15° C.	50'	5517.0	2224.3	15° C.
68°	3864.7	1181.6	20° C.	78°	4639.8	1643.0	20° C.	88°	5533.1	2235.5	20° C.
10'	3876.8	1188.4	T	10'	4653.6	1651.7	T	10'	5549.2	2246.7	T
20'	3889.0	1195.2	.51	20'	4667.4	1660.5	.61	20'	5565.4	2258.0	.72
30'	3901.2	1202.0	E	30'	4681.3	1669.2	E	30'	5581.6	2269.3	E
40'	3913.4	1208.9	.159	40'	4695.2	1678.1	.220	40'	5597.8	2280.6	.299
50'	3925.6	1215.8	15° C.	50'	4709.2	1686.9	15° C.	50'	5614.2	2292.0	15° C.
69°	3937.9	1222.7	20° C.	79°	4723.2	1695.8	20° C.	89°	5630.5	2303.5	20° C.
10'	3950.2	1229.7	T	10'	4737.2	1704.7	T	10'	5646.9	2315.0	T
20'	3962.5	1236.7	.51	20'	4751.2	1713.7	.61	20'	5663.4	2326.6	.72
30'	3974.8	1243.7	E	30'	4765.3	1722.7	E	30'	5679.9	2338.2	E
40'	3987.2	1250.8	.159	40'	4779.4	1731.7	.220	40'	5696.4	2349.8	.299
50'	3999.5	1257.9	15° C.	50'	4793.6	1740.8	15° C.	50'	5713.0	2361.5	15° C.
70°	4011.9	1265.0	20° C.	80°	4807.7	1749.9	20° C.	90°	5729.7	2373.3	20° C.
10'	4024.4	1272.1	T	10'	4822.0	1759.0	T	10'	5746.3	2385.1	T
20'	4036.8	1279.3	.51	20'	4836.2	1768.2	.61	20'	5763.1	2397.0	.72
30'	4049.3	1286.5	E	30'	4850.5	1777.4	E	30'	5779.9	2408.9	E
40'	4061.8	1293.6	.159	40'	4864.8	1786.7	.220	40'	5796.7	2420.9	.299
50'	4074.4	1300.9	15° C.	50'	4879.2	1796.0	15° C.	50'	5813.6	2432.9	15° C.

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

$$E = R \operatorname{exsec} \frac{1}{2} I$$

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	+ 5° C. T .43 E .200	101°	6950.6	3278.1	+ 5° C. T .51 E .268	111°	8336.7	4386.1	+ 5° C. T .62 E .360
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	.200	102°	7075.5	3374.9	.268	112°	8494.6	4516.6	.360
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. T .86 E .401	103°	7203.2	3474.4	10° C. T .103 E .536	113°	8656.6	4651.3	10° C. T 1.25 E .721
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	10° C. T .86 E .401	104°	7333.6	3576.8	10° C. T .103 E .536	114°	8822.9	4790.4	10° C. T 1.25 E .721
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		50'	7444.6	3664.5		50'	8965.0	4909.9	
95°	6252.8	2751.3	T 1.30 E .604	105°	7467.0	3682.3	T 1.56 E .806	115°	8993.8	4934.1	T 1.93 E 1.09
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	20° C. T 1.74 E .809	106°	7603.5	3791.0	20° C. T 2.08 E 1.08	116°	9169.4	5082.7	20° C. T 2.52 E 1.46
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	E .809	107°	7743.2	3902.9	E 1.08	117°	9349.9	5236.2	E 1.46
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	25° C. T 2.18 E 1.02	108°	7886.2	4018.2	25° C. T 2.61 E 1.36	118°	9535.7	5395.1	25° C. T 3.16 E 1.83
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	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. T 2.62 E 1.22	110°	8182.8	4259.7	30° C. T 3.14 E 1.63	120°	9924.0	5729.7	30° C. T 3.81 E 2.20
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 X.
MIDDLE ORDINATES OF RAILS
Length of Rail (feet)

C o /	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch	C o	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

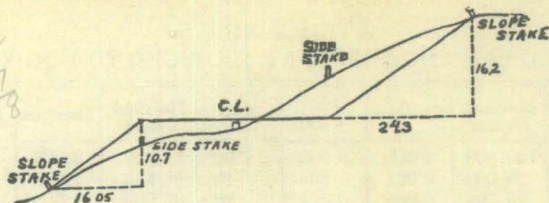
To find length of curve divide angle from P. C. to P. T. by central angle of chord, and multiply by length of chord.

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	18 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 1/4 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.

- 1) 8.72 - SCRAPER
 - 2) 5.72 - 11+00 STAKE 79.6
 - 3) 7.69 8+00 STAKE 79.8
 - 4) 0.51 TOP PIPE - 6+80 9.8
 - 5) 0.29 STAKE 1+50
 - 6) 3.62
 - 7) 5.21
 - 8) 8.06
 - 9) 1.66
 - 10) 4.08
 - 11) 6.41 STAKE 570+0
 - 12) 9.51
 - 13) 6.87
 - 14) 5.10
 - 15) 3.76
 - 16) 0.43 STAKE @ 12+00
 - 17) 9.82
 - 18) 9.21 STAKE @
- Handwritten calculations and notes on the right side of the page include:
- 8.72 - SCRAPER
 - 11+00 STAKE 79.6
 - 8+00 STAKE 79.8
 - TOP PIPE - 6+80 9.8
 - 0.29 STAKE 1+50
 - 3.62
 - 5.21
 - 8.06
 - 1.66
 - 4.08
 - 6.41 STAKE 570+0
 - 9.51
 - 6.87
 - 5.10
 - 3.76
 - 0.43 STAKE @ 12+00
 - 9.82
 - 9.21 STAKE @

4.72 ✓ $\begin{array}{r} 11.842 \\ 3.04 \\ \hline 6.86 \end{array}$

$$\begin{array}{r} 6.7 \\ 5.2 \\ \hline 1.5 \end{array}$$

9.1
3.3

0.71

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

5.49

9144

6.5
905.15