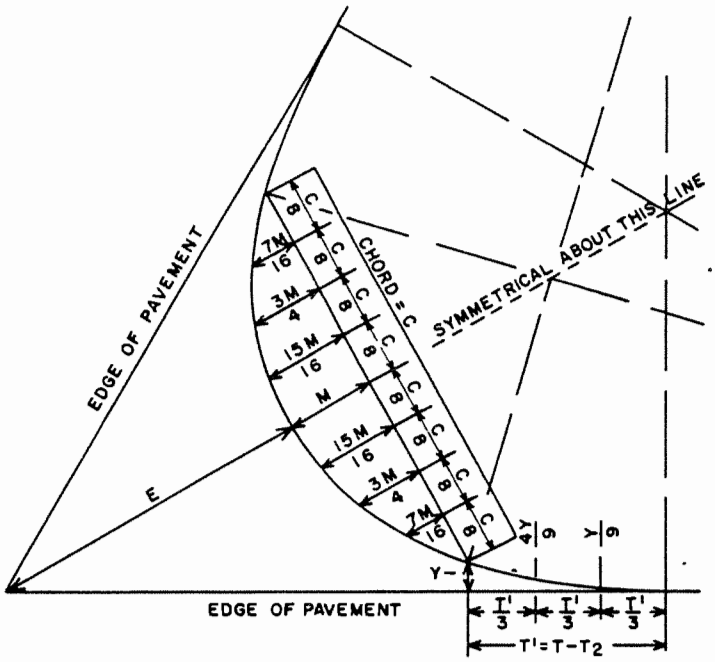


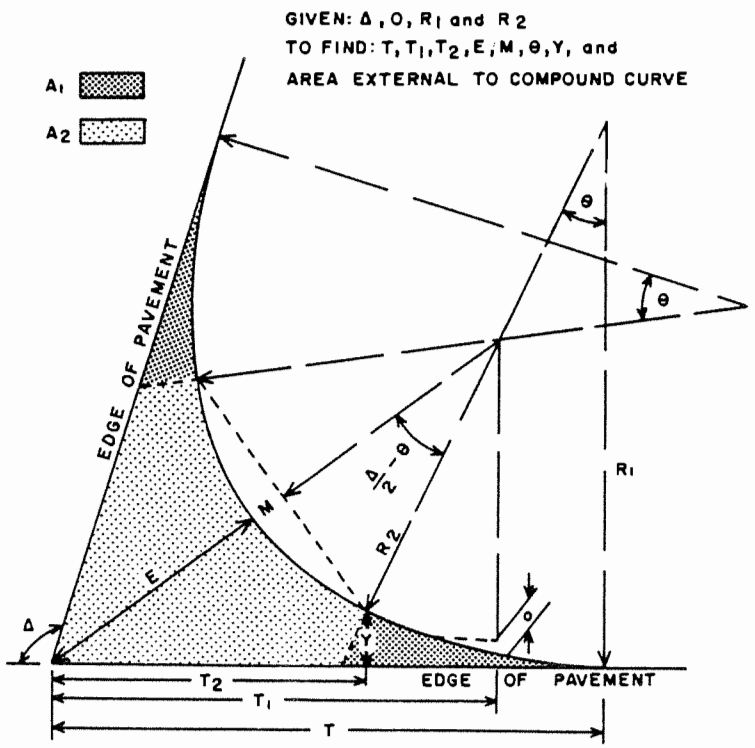
The following method is suggested for staking out 3-centred curves (when curve centres are inaccessible) by tangent offsets for the long radius curve and chord offsets for the short radius curve.

The curves are parabolic but any deviation from a circular curve is within tolerable limits.

The chord is determined by staking out the two points of compound curvature and then measuring the distance between these two points.

The Mid-Ordinate 'M' is determined by subtracting the External 'E' from the distance between the point of intersection of the two edges of pavement and the Mid-Point on the chord.

The value of 'M' may also be selected directly (or by interpolation) from Sheet 2.



FORMULAS USED

$$T_1 = (R_2 + O) \tan \frac{\Delta}{2}$$

$$T = T_1 + (R_1 - R_2) \sin \theta$$

$$T_2 = T_1 - R_2 \sin \theta$$

$$E = \frac{R_2 + O}{\cos \frac{\Delta}{2}} - R_2$$

$$M = R_2 - \left[R_2 \cos \left(\frac{\Delta}{2} - \theta \right) \right]$$

$$\theta = \cos^{-1} \frac{R_1 - R_2 - O}{R_1 - R_2}$$

$$Y = (R_2 + O) - R_2 \cos \theta$$

$$\text{AREA} = A_1 + A_2$$

$$A_1 = R_1^2 \tan \theta - \frac{\pi R_1^2 \theta}{180}$$

$$A_2 = (R_2 + O) \left| T_1 - (R_2 + O) \tan \theta \right| - \frac{\pi R_2^2 \left(\frac{\Delta}{2} - \theta \right)}{180}$$

RECOMMENDED _____ ROAD DESIGN ENGINEER

APPROVED _____ CHIEF ENGINEER

DATE: SEPT. 7, 1976

SASKATCHEWAN DEPARTMENT OF HIGHWAYS

THREE-CENTRE CURVE FIELD LAYOUT METHOD

STANDARD PLAN No. 20605

CONSTANTS	DEG.	T2	T1	T	E	M	AREA SQ. m	CHORD	C/B	7M/16	3M/4	15M/16
		LENGTH IN METRES						LENGTH IN METRES				
DESIGN VEH WB-15	55	5.52	12.55	19.57	4.17	0.33	48.30	7.76	0.97	0.14	0.25	0.31
	56	5.79	12.81	19.84	4.29	0.36	50.15	8.15	1.02	0.16	0.27	0.34
R1 = 46	57	6.06	13.09	20.11	4.42	0.40	52.07	8.55	1.07	0.18	0.30	0.38
R2 = 23	58	6.33	13.36	20.39	4.55	0.44	54.05	8.94	1.12	0.19	0.33	0.41
O = 1.1	59	6.61	13.64	20.66	4.69	0.48	56.09	9.33	1.17	0.21	0.36	0.45
θ = 17°47'30"	60	6.89	13.91	20.94	4.83	0.52	58.20	9.73	1.22	0.23	0.39	0.49
T/3 = 4.69	61	7.17	14.20	21.22	4.97	0.56	60.37	10.12	1.26	0.25	0.42	0.53
Y = 2.20	62	7.45	14.48	21.51	5.12	0.61	62.62	10.51	1.31	0.27	0.46	0.57
Y/9 = 0.24	63	7.74	14.77	21.80	5.27	0.66	64.94	10.90	1.36	0.29	0.49	0.61
4Y/9 = 0.98	64	8.03	15.06	22.09	5.42	0.70	67.33	11.29	1.41	0.31	0.53	0.66
	65	8.33	15.35	22.38	5.58	0.75	69.80	11.68	1.46	0.33	0.57	0.71
DESIGN VEH WB-15	65	6.37	12.55	22.16	5.36	0.42	67.04	7.75	0.97	0.18	0.32	0.40
	66	6.62	12.79	22.40	5.49	0.46	69.00	8.06	1.01	0.20	0.34	0.43
	67	6.86	13.04	22.65	5.62	0.49	71.01	8.36	1.05	0.22	0.37	0.46
R1 = 46	68	7.11	13.29	22.90	5.76	0.53	73.08	8.67	1.08	0.23	0.40	0.50
R2 = 18	69	7.36	13.54	23.15	5.90	0.57	75.21	8.97	1.12	0.25	0.43	0.53
O = 1.7	70	7.62	13.79	23.40	6.05	0.61	77.40	9.28	1.16	0.27	0.46	0.57
θ = 20°04'05"	71	7.88	14.05	23.66	6.20	0.65	79.65	9.58	1.20	0.28	0.49	0.61
T/3 = 5.26	72	8.14	14.31	23.92	6.35	0.69	81.97	9.88	1.24	0.30	0.52	0.65
Y = 2.79	73	8.40	14.58	24.19	6.51	0.74	84.35	10.18	1.27	0.32	0.55	0.69
Y/9 = 0.31	74	8.67	14.85	24.45	6.67	0.78	86.80	10.48	1.31	0.34	0.59	0.73
4Y/9 = 1.24	75	8.94	15.12	24.72	6.83	0.83	89.31	10.78	1.35	0.36	0.62	0.76
DESIGN VEH WB-15	75	9.15	14.96	24.00	6.58	0.95	82.72	11.52	1.44	0.41	0.71	0.89
	76	9.42	15.24	24.28	6.75	1.00	85.20	11.82	1.48	0.44	0.75	0.93
	77	9.70	15.51	24.55	6.92	1.05	87.75	12.11	1.51	0.46	0.79	0.98
R1 = 46	78	9.98	15.79	24.83	7.09	1.10	90.38	12.41	1.55	0.48	0.83	1.03
R2 = 18	79	10.26	16.07	25.12	7.27	1.16	93.09	12.70	1.59	0.51	0.87	1.09
O = 1.5	80	10.55	16.36	25.40	7.46	1.21	95.88	13.00	1.62	0.53	0.91	1.14
θ = 18°50'21"	81	10.84	16.65	25.70	7.64	1.27	98.74	13.29	1.66	0.56	0.95	1.19
T/3 = 4.95	82	11.14	16.95	25.99	7.84	1.33	101.70	13.58	1.70	0.58	1.00	1.25
Y = 2.46	83	11.44	17.25	26.29	8.04	1.39	104.74	13.87	1.73	0.61	1.04	1.30
Y/9 = 0.27	84	11.75	17.56	26.60	8.24	1.45	107.88	14.16	1.77	0.63	1.09	1.36
4Y/9 = 1.10	85	12.06	17.87	26.91	8.45	1.51	111.11	14.45	1.81	0.66	1.13	1.42
DESIGN VEH WB-15	85	10.51	15.12	24.65	7.38	1.36	87.31	12.49	1.56	0.60	1.02	1.28
	86	10.78	15.39	24.91	7.56	1.42	89.75	12.73	1.59	0.62	1.06	1.33
	87	11.05	15.66	25.18	7.75	1.47	92.26	12.96	1.62	0.64	1.10	1.38
R1 = 46	88	11.32	15.93	25.46	7.94	1.53	94.85	13.20	1.65	0.67	1.15	1.43
R2 = 15	89	11.61	16.21	25.74	8.13	1.59	97.52	13.43	1.68	0.69	1.19	1.49
O = 1.5	90	11.89	16.50	26.03	8.33	1.65	100.27	13.67	1.71	0.72	1.24	1.54
θ = 17°53'48"	91	12.18	16.79	26.32	8.54	1.71	103.10	13.90	1.74	0.75	1.28	1.60
T/3 = 4.71	92	12.48	17.09	26.61	8.75	1.77	106.01	14.13	1.77	0.77	1.33	1.66
Y = 2.23	93	12.78	17.39	26.91	8.97	1.83	109.02	14.36	1.80	0.80	1.37	1.72
Y/9 = 0.25	94	13.08	17.69	27.22	9.19	1.89	112.12	14.59	1.82	0.83	1.42	1.78
4Y/9 = 0.99	95	13.40	18.01	27.53	9.42	1.96	115.31	14.82	1.85	0.86	1.47	1.84
DESIGN VEH WB-15	95	11.24	15.39	27.15	9.87	1.33	107.88	10.99	1.37	0.58	1.00	1.25
	96	11.51	15.66	27.42	9.07	1.38	110.46	11.18	1.40	0.60	1.04	1.29
	97	11.79	15.94	27.70	9.28	1.43	113.12	11.36	1.42	0.63	1.07	1.34
R1 = 46	98	12.07	16.22	27.98	9.49	1.48	115.85	11.55	1.44	0.65	1.11	1.39
R2 = 12	99	12.36	16.51	28.27	9.71	1.53	118.67	11.73	1.47	0.67	1.15	1.44
O = 2.1	100	12.65	16.80	28.57	9.94	1.58	121.57	11.91	1.49	0.69	1.19	1.48
θ = 20°14'34"	101	12.95	17.10	28.87	10.17	1.63	124.56	12.09	1.51	0.72	1.23	1.53
T/3 = 5.31	102	13.26	17.41	29.18	10.41	1.69	127.63	12.27	1.53	0.74	1.27	1.58
Y = 2.84	103	13.57	17.73	29.49	10.65	1.74	130.81	12.45	1.56	0.76	1.31	1.63
Y/9 = 0.32	104	13.90	18.05	29.81	10.90	1.80	134.08	12.63	1.58	0.79	1.35	1.68
4Y/9 = 1.26	105	14.22	18.38	30.14	11.16	1.85	137.45	12.81	1.60	0.81	1.39	1.74
DESIGN VEH WB-15	105	14.13	17.98	28.90	10.67	2.03	124.47	13.34	1.67	0.89	1.52	1.90
	106	14.46	18.31	29.23	10.93	2.08	127.75	13.52	1.69	0.91	1.56	1.95
	107	14.80	18.65	29.57	11.20	2.14	131.14	13.69	1.71	0.94	1.61	2.01
R1 = 46	108	15.14	18.99	29.91	11.48	2.20	134.64	13.86	1.73	0.96	1.65	2.07
R2 = 12	109	15.49	19.35	30.26	11.76	2.26	138.25	14.03	1.75	0.99	1.70	2.12
O = 1.8	110	15.86	19.71	30.62	12.06	2.33	141.98	14.20	1.77	1.02	1.74	2.18
θ = 18°43'38"	111	16.23	20.08	31.00	12.36	2.39	145.84	14.37	1.80	1.04	1.79	2.24
T/3 = 4.92	112	16.61	20.46	31.38	12.68	2.45	149.83	14.53	1.82	1.07	1.84	2.30
Y = 2.44	113	17.00	20.85	31.77	13.00	2.51	153.96	14.70	1.84	1.10	1.89	2.36
Y/9 = 0.27	114	17.40	21.25	32.17	13.34	2.58	158.23	14.87	1.86	1.13	1.93	2.42
4Y/9 = 1.08	115	17.81	21.66	32.58	13.68	2.64	162.65	15.03	1.88	1.16	1.98	2.48
DESIGN VEH WB-15	115	16.42	21.03	31.94	13.94	1.74	169.87	11.88	1.49	0.76	1.31	1.63
	116	16.83	21.44	32.36	14.29	1.79	174.32	12.04	1.51	0.79	1.35	1.68
	117	17.25	21.87	32.78	14.65	1.85	178.92	12.20	1.53	0.81	1.39	1.73
R1 = 37	118	17.69	22.30	33.21	15.02	1.90	183.69	12.36	1.55	0.83	1.43	1.78
R2 = 11	119	18.13	22.75	33.66	15.40	1.96	188.63	12.52	1.57	0.86	1.47	1.83
O = 2.4	120	18.59	23.21	34.12	15.80	2.01	193.75	12.68	1.58	0.88	1.51	1.88
θ = 24°48'42"	121	19.07	23.68	34.59	16.21	2.07	199.06	12.83	1.60	0.90	1.55	1.94
T/3 = 5.18	122	19.56	24.17	35.08	16.64	2.12	204.56	12.99	1.62	0.93	1.59	1.99
Y = 3.42	123	20.06	24.68	35.59	17.08	2.18	210.28	13.14	1.64	0.95	1.63	2.04
Y/9 = 0.38	124	20.59	25.20	36.11	17.54	2.24	216.22	13.30	1.66	0.98	1.68	2.10
4Y/9 = 1.52	125	21.13	25.74	36.66	18.02	2.30	222.39	13.45	1.68	1.00	1.72	2.15
DESIGN VEH WB-15	115	12.93	15.54	21.62	9.43	2.17	74.58	11.73	1.47	0.95	1.63	2.04
	116	13.24	15.84	21.93	9.69	2.22	76.88	11.85	1.48	0.97	1.67	2.09
	117	13.55	16.16	22.24	9.95	2.28	79.26	11.97	1.50	1.00	1.71	2.13
R1 = 30	118	13.87	16.48	22.56	10.22	2.33	81.72	12.08	1.51	1.02	1.75	2.18
R2 = 9	119	14.20	16.81	22.89	10.51	2.39	84.27	12.20	1.52	1.04	1.79	2.23
O = 0.9	120	14.54	17.15	23.23	10.80	2.44	86.95	12.31	1.54	1.07	1.83	2.28
θ = 16°50'06"	121	14.89	17.50	23.58	11.10	2.49	89.73	12.43	1.55	1.09	1.87	2.33
T/3 = 2.90	122	15.25	17.86	23.94	11.42	2.54	92.60	12.54	1.57	1.11	1.91	2.38
Y = 1.29	123	15.63	18.23	24.32	11.75	2.60	95.59	12.65	1.58	1.14	1.95	2.44
Y/9 = 0.14	124	16.01	18.62	24.70	12.09	2.65	98.71	12.76	1.60	1.16	1.99	2.49
4Y/9 = 0.57	125	16.41	19.02	25.10	12.44	2.71	101.94	12.87	1.61	1.19	2.03	2.54

CONSTANTS	DEG.	T2	T1	T	E	M	AREA SQ. m	CHORD	C/R	7M/16	3M/4	15M/16
		LENGTH IN METRES						LENGTH IN METRES				
DESIGN VEH. SU-9	75	7.06	9.67	15.11	3.88	1.12	28.68	10.11	1.26	0.49	0.84	1.05
	76	7.23	9.84	15.29	3.99	1.16	29.64	10.30	1.29	0.51	0.87	1.09
R1 = 37	77	7.41	10.02	15.47	4.10	1.21	30.63	10.49	1.31	0.53	0.91	1.13
R2 = 12	78	7.59	10.20	15.65	4.21	1.25	31.66	10.68	1.33	0.55	0.94	1.18
O = 0.6	79	7.77	10.39	15.83	4.33	1.30	32.71	10.87	1.36	0.57	0.98	1.22
θ = 12°34'42"	80	7.96	10.57	16.02	4.45	1.35	33.80	11.05	1.38	0.59	1.01	1.26
T/3 = 2.69	81	8.15	10.76	16.21	4.57	1.40	34.92	11.24	1.40	0.61	1.05	1.31
Y = 0.89	82	8.34	10.95	16.40	4.70	1.45	36.08	11.42	1.43	0.63	1.08	1.36
Y/9 = 0.10	83	8.53	11.15	16.59	4.82	1.50	37.27	11.61	1.45	0.65	1.12	1.40
4Y/9 = 0.39	84	8.73	11.35	16.79	4.95	1.55	38.50	11.79	1.47	0.68	1.16	1.45
	85	8.93	11.55	16.99	5.09	1.60	39.77	11.97	1.50	0.70	1.20	1.50
DESIGN VEH. SU-9	85	8.93	11.55	16.99	5.09	1.60	39.77	11.97	1.50	0.70	1.20	1.50
	86	9.14	11.75	17.19	5.23	1.65	41.09	12.15	1.52	0.72	1.24	1.55
	87	9.34	11.96	17.40	5.37	1.71	42.44	12.33	1.54	0.75	1.28	1.60
R1 = 37	88	9.55	12.17	17.61	5.52	1.76	43.84	12.51	1.56	0.77	1.32	1.65
R2 = 12	89	9.77	12.38	17.83	5.67	1.81	45.28	12.69	1.59	0.79	1.36	1.70
O = 0.89	90	9.99	12.60	18.04	5.82	1.87	46.77	12.87	1.61	0.82	1.40	1.75
θ = 12°34'42"	91	10.21	12.82	18.27	5.98	1.93	48.31	13.04	1.63	0.84	1.45	1.81
T/3 = 2.69	92	10.43	13.05	18.49	6.14	1.98	49.90	13.22	1.65	0.87	1.49	1.86
Y = 0.89	93	10.66	13.28	18.72	6.30	2.04	51.54	13.39	1.67	0.89	1.53	1.91
Y/9 = 0.10	94	10.90	13.51	18.96	6.48	2.10	53.24	13.57	1.70	0.92	1.58	1.97
4Y/9 = 0.39	95	11.14	13.75	19.19	6.65	2.16	54.99	13.74	1.72	0.95	1.62	2.03
DESIGN VEH. SU-9	95	10.31	12.66	18.21	6.17	2.01	47.80	12.67	1.58	0.88	1.51	1.88
	96	10.53	12.88	18.44	6.34	2.06	49.34	12.83	1.60	0.90	1.55	1.93
	97	10.76	13.11	18.66	6.51	2.12	50.93	12.98	1.62	0.93	1.59	1.99
R1 = 37	98	10.99	13.34	18.90	6.68	2.18	52.58	13.14	1.64	0.95	1.63	2.04
R2 = 11	99	11.23	13.58	19.14	6.86	2.23	54.28	13.29	1.66	0.98	1.66	2.09
O = 0.6	100	11.47	13.82	19.38	7.05	2.29	56.03	13.44	1.68	1.00	1.72	2.15
θ = 12°19'59"	101	11.72	14.07	19.63	7.24	2.35	57.85	13.60	1.70	1.03	1.76	2.20
T/3 = 2.63	102	11.98	14.32	19.88	7.43	2.41	59.73	13.75	1.72	1.05	1.81	2.26
Y = 0.85	103	12.23	14.58	20.14	7.63	2.47	61.67	13.89	1.74	1.08	1.85	2.32
Y/9 = 0.09	104	12.50	14.85	20.40	7.84	2.53	63.68	14.04	1.76	1.11	1.90	2.37
4Y/9 = 0.38	105	12.77	15.12	20.67	8.06	2.59	65.75	14.19	1.77	1.13	1.95	2.43
DESIGN VEH. SU-9	105	10.66	13.16	20.93	7.59	1.75	62.51	10.68	1.33	0.77	1.32	1.65
	106	10.91	13.40	21.17	7.78	1.80	64.24	10.80	1.35	0.79	1.35	1.69
	107	11.15	13.65	21.42	7.98	1.85	66.02	10.93	1.37	0.81	1.39	1.73
R1 = 37	108	11.40	13.90	21.67	8.18	1.90	67.86	11.05	1.38	0.83	1.42	1.78
R2 = 9	109	11.66	14.16	21.93	8.39	1.95	69.76	11.18	1.40	0.85	1.46	1.82
O = 1.1	110	11.93	14.42	22.20	8.61	1.99	71.72	11.30	1.41	0.87	1.50	1.87
θ = 16°06'48"	111	12.20	14.70	22.47	8.83	2.04	73.76	11.42	1.43	0.89	1.53	1.92
T/3 = 3.42	112	12.48	14.97	22.74	9.06	2.09	75.86	11.54	1.44	0.92	1.57	1.96
Y = 1.45	113	12.76	15.26	23.03	9.30	2.14	78.04	11.66	1.46	0.94	1.61	2.01
Y/9 = 0.16	114	13.05	15.55	23.32	9.54	2.20	80.29	11.78	1.47	0.96	1.65	2.06
4Y/9 = 0.65	115	13.36	15.85	23.62	9.80	2.25	82.63	11.90	1.49	0.98	1.69	2.11
DESIGN VEH. SU-9	115	13.36	15.85	23.62	9.80	2.25	82.63	11.90	1.49	0.98	1.69	2.11
	116	13.67	16.16	23.93	10.06	2.30	85.05	12.02	1.50	1.01	1.72	2.16
	117	13.98	16.48	24.25	10.33	2.35	87.55	12.13	1.52	1.03	1.76	2.21
R1 = 37	118	14.31	16.81	24.58	10.61	2.41	90.16	12.25	1.53	1.05	1.80	2.26
R2 = 9	119	14.65	17.15	24.92	10.90	2.46	92.85	12.36	1.55	1.08	1.84	2.31
O = 1.1	120	15.00	17.49	25.26	11.20	2.51	95.66	12.48	1.56	1.10	1.89	2.36
θ = 16°06'48"	121	15.35	17.85	25.62	11.51	2.57	98.56	12.59	1.57	1.12	1.93	2.41
T/3 = 3.42	122	15.72	18.22	25.99	11.83	2.62	101.59	12.70	1.59	1.15	1.97	2.46
Y = 1.45	123	16.10	18.60	26.37	12.17	2.68	104.73	12.81	1.60	1.17	2.01	2.51
Y/9 = 0.16	124	16.50	19.00	26.77	12.51	2.74	107.99	12.92	1.62	1.20	2.05	2.56
4Y/9 = 0.65	125	16.90	19.40	27.17	12.87	2.79	111.39	13.03	1.63	1.22	2.09	2.62
DESIGN VEH. SU-9	125	16.53	19.40	26.11	12.87	2.51	110.31	12.48	1.56	1.10	1.88	2.36
	126	16.95	19.82	26.53	13.25	2.57	113.85	12.59	1.57	1.12	1.93	2.41
	127	17.38	20.26	26.96	13.64	2.62	117.54	12.70	1.59	1.15	1.97	2.46
R1 = 30	128	17.83	20.71	27.42	14.04	2.68	121.39	12.81	1.60	1.17	2.01	2.51
R2 = 9	129	18.30	21.18	27.88	14.46	2.73	125.40	12.92	1.62	1.20	2.05	2.56
O = 1.1	130	18.78	21.66	28.37	14.90	2.79	129.58	13.03	1.63	1.22	2.09	2.62
θ = 18°37'37"	131	19.29	22.16	28.87	15.36	2.85	133.95	13.14	1.64	1.25	2.14	2.67
T/3 = 3.19	132	19.81	22.68	29.39	15.83	2.91	138.53	13.24	1.66	1.27	2.18	2.72
Y = 1.57	133	20.35	23.23	29.94	16.33	2.96	143.31	13.35	1.67	1.30	2.22	2.78
Y/9 = 0.17	134	20.92	23.79	30.50	16.85	3.02	148.31	13.45	1.68	1.32	2.27	2.83
4Y/9 = 0.70	135	21.51	24.38	31.09	17.39	3.08	153.56	13.56	1.69	1.35	2.31	2.89

RECOMMENDED _____
ROAD DESIGN ENGINEER

APPROVED _____
CHIEF ENGINEER

DATE SEPT. 7, 1976

SASKATCHEWAN DEPARTMENT OF HIGHWAYS

THREE CENTRE CURVE FIELD LAYOUT METHOD

STANDARD PLAN No 20605

SHEET 2 OF 2