

STANDARD SYMBOLS

- LOCATION \mathbb{B}ALIGNMENT ON WHICH THE PROPOSED RIGHT-OF-WAY AND CONSTRUCTION IS BASED.
- STANDARD PAVEMENT.....THE TYPICAL PAVEMENT SECTION TO BE SHOWN ON THE ROAD PLANS.
- P.C.POINT OF BEGINNING OF BASELINE CIRCULAR CURVE.
- P.T.POINT OF ENDING OF BASELINE CIRCULAR CURVE.
- P.C.C.POINT OF BASELINE COMPOUND CURVATURE.
- P.R.C.....POINT OF BASELINE REVERSE CURVE.
- T.S.POINT OF CHANGE FROM TANGENT TO TRANSITION CURVE. (TANGENT TO SPIRAL)
- S.C.POINT OF CHANGE FROM TRANSITION CURVE TO CIRCULAR CURVE. (SPIRAL TO CIRCULAR)
- C.S.POINT OF CHANGE FROM CIRCULAR CURVE TO TRANSITION CURVE. (CIRCULAR TO SPIRAL)
- S.T.....POINT OF CHANGE FROM TRANSITION CURVE TO TANGENT. (SPIRAL TO TANGENT)
- RADIUSRADIUS OF BASELINE CIRCULAR CURVE.
- DVAPPROXIMATE MAXIMUM SAFE SPEED IN MILES PER HOUR USING STANDARD RATE OF SUPER-ELEVATION.
- NCAPPROXIMATE MAXIMUM SAFE SPEED IN MILES PER HOUR WITH NO SUPERELEVATION. FACTORS APPLY ONLY TO URBAN LOW SPEED CONDITIONS.
- LSLENGTH OF TRANSITION CURVE MEASURED ALONG BASELINE. WHERE NO TRANSITION CURVE IS APPLIED LS IS LENGTH OF SUPERELEVATION TRANSITION.
- W OR PWWIDTH OF STANDARD PAVEMENT.
- ZTDISTANCE FROM TRANSITIONED BASELINE TO EDGES OF TRANSITIONED PAVEMENT ($\frac{W}{2} + \frac{w}{2}$)
- wMAXIMUM TOTAL PAVEMENT WIDENING.
- ERATE OF SUPERELEVATION IN FEET PER FOOT OF PAVEMENT WIDTH.
- FSAFE SIDE FRICTION FACTOR.
- SAMOUNT OF SUPERELEVATION TO BE APPLIED TO THE BASELINE GRADE TO OBTAIN THE ELEVATIONS OF THE EDGES OF TRANSITIONED PAVEMENT.
- CSTANDARD PAVEMENT CROWN (DIFFERENCE IN ELEVATION BETWEEN CENTER AND EDGES).
- CRSTANDARD PAVEMENT CROWN TRANSITION OR CROWN RUNOFF LENGTH.
- CPCHORD POINT (1/10 INCREMENTS OF TRANSITION CURVE).

ALL DISTANCES (HORIZONTAL AND VERTICAL) ARE MEASURED IN FEET.

SPECIFICATION REFERENCE

TRANSITION CURVES FOR RURAL AND URBAN
HIGHWAYS AND STREET CONDITIONS

URBAN CONDITION

URBAN CONDITIONS APPLY TO URBAN STREET SYSTEMS AND ANY OTHER ROAD WITH PRESENT OR FUTURE URBAN STREET OPERATING CONDITIONS.

THESE TABLES CONTAIN SUPERELEVATION RATES AND TRANSITION LENGTHS FOR STANDARD URBAN PAVEMENT WIDTHS THROUGH A RANGE OF CURVES AND DESIGN VELOCITIES CONSIDERED MOST LIKELY TO BE USED IN URBAN ROAD DESIGN.

DEFINITIONS FOR THE STANDARD SYMBOLS USED THROUGHOUT THESE TABLES ARE FOUND ON SHEET 801.01.

A TABLE FOR "LOW SPEED URBAN" DESIGNS IS ON SHEET 801.20 WITH A RANGE OF STANDARD PAVEMENT WIDTHS (W), TRANSITION LENGTHS (LS), AND RADIUS OF CURVE WHEN SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN AND THE APPROXIMATE MAXIMUM SAFE SPEEDS (DV) AFFORDED THEREBY. VALUES IN THIS TABLE CAN BE USED ON STREETS WITH OPERATING SPEEDS LESS THAN OR EQUAL TO 45 MPH. ALSO SHOWN ARE THE APPROXIMATE MAXIMUM SAFE SPEEDS (NC) WITH NO SUPERELEVATION. VALUES FOR (NC) CAN BE USED ON URBAN ARTERIAL, COLLECTOR, AND LOCAL STREETS.

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR URBAN CONDITIONS SEE SHEETS 801.21 THRU 801.29

WHEN URBAN CONDITIONS APPLY THERE WILL BE NO BASELINE TRANSITION OR PAVEMENT WIDENING. THE LENGTH OF TRANSITION (LS) DETERMINES THE LENGTH OF SUPERELEVATION TRANSITION THROUGH WHICH THE OUTER EDGE OF PAVEMENT IS RAISED ABOVE THE BASELINE GRADE TO A MAXIMUM OF $E \left(\frac{W}{2}\right)$ SEE SHEET 801.07 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO SHEET 801.18 TO CALCULATE TRANSITION LENGTHS (LS).

LS SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES.

E SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES WITH URBAN STREET CONDITIONS.

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR URBAN CONDITIONS SEE SHEET 801.15.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 801.04.

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE
URBAN CONDITION

RURAL CONDITION

RURAL CONDITIONS APPLY TO INTERSTATE, ARTERIAL, PRIMARY AND SECONDARY SYSTEMS OR TO ANY OTHER ROAD WITH RURAL TYPE DESIGN AND OPERATING CONDITIONS.

THESE TABLES CONTAIN SUPERELEVATION AND WIDENING CORRECTIONS FOR STANDARD RURAL PAVEMENT WIDTHS THROUGH A RANGE OF RADII AND DESIGN VELOCITIES CONSIDERED MOST LIKELY TO BE USED IN RURAL HIGHWAY DESIGN.

DEFINITIONS FOR THE STANDARD SYMBOLS USED THROUGHOUT THESE TABLES ARE FOUND ON SHEET 801.01.

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR RURAL CONDITIONS SEE SHEETS 801.30 THRU 801.40.

ON CURVES WITH GREATER THAN 2865 FT RADIUS THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THE TABLES. SEE SHEET 801.06 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

ON CURVES WITH PAVEMENT WIDTHS OF 24' OR WIDER AND A RADIUS OF 881 FT. OR GREATER, THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THESE TABLES.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO SHEET 801.18 TO CALCULATE TRANSITION LENGTHS (LS) AND PAVEMENT WIDENING (w).

LS AND E SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES..

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR RURAL CONDITIONS SEE SHEET 801.16.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 801.04.

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE
RURAL CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

GENERAL CONDITION

ALL ORIGINAL CROSS SECTIONS SHALL BE TAKEN FROM THE BASELINE AT STATIONS, PLUS FIFTIES, AND UNUSUAL BREAKS IN THE GROUND AS ON TANGENT ALIGNMENT.

WHERE A PART OR ALL OF A SUPERELEVATION TRANSITION CURVE FALLS ON A VERTICAL CURVE, ELEVATIONS ON THE VERTICAL CURVE SHOULD BE COMPUTED FOR THE POSITIONS GIVEN ON SHEET 801.12 FOR CROWN TRANSITIONS, SHEET 801.13 FOR URBAN PROJECTS AND SHEET 801.14 FOR RURAL PROJECTS. THESE ELEVATIONS AND PLUSES SHOULD BE SHOWN ON THE PLANS FOR THE CONVENIENCE OF THE SURVEY PARTY IN STAKING OUT THE PROJECT. THROUGHOUT THESE SECTIONS OF THE GRADE, ELEVATIONS AT EVEN STATIONS AND PLUS FIFTIES SHOULD BE OMITTED.

SLOPE STAKES SHOULD BE SET AT THE POSITIONS ON THE TRANSITION GIVEN ON SHEETS 801.12, 801.13 AND 801.14 AND GROUND CROSS SECTIONS TAKEN AT THESE POSITIONS OMITTING THE STATIONS AND PLUS FIFTIES THROUGHOUT THE TRANSITION. IF UNUSUAL BREAKS IN THE GROUND OCCUR, ADDITIONAL SECTIONS SHOULD, OF COURSE, BE TAKEN. ADDITIONAL SECTIONS SHOULD ALSO BE TAKEN WHERE LOCATION IS THROUGH ROCK CUT IN ANTICIPATION OF UNUSUAL BREAKAGE WHICH MAY OCCUR DURING CONSTRUCTION.

AFTER ROUGH GRADING HAS BEEN DONE, FINE GRADING (BLUE TOP) AND FORM STAKES SHOULD BE SET AT THE POSITIONS GIVEN ON SHEET 801.12 FOR CROWN TRANSITIONS, SHEET 801.13 FOR URBAN PROJECTS OR AS GIVEN ON SHEET 801.14 FOR RURAL PROJECTS.

FINAL CROSS SECTIONS SHOULD, OF COURSE, BE TAKEN AT THOSE POSITIONS AT WHICH THE SLOPE STAKE SECTIONS WERE TAKEN. WHERE UNUSUAL BREAKAGE IN ROCK OCCURS AND THIS WAS NOT ANTICIPATED, ADDITIONAL FINAL SECTIONS SHOULD BE TAKEN AND ORIGINAL GROUND SECTIONS INTERPOLATED.

BASELINE STAKES SHOULD BE SET AT ALL P.C.'S, P.T.'S, T.S.'S, S.T.'S, S.C.'S, AND C.S.'S IN STAKING OUT ALIGNMENT BUT SLOPE STAKES NEED NOT BE SET NOR CROSS SECTIONS TAKEN AT P.C.'S OR P.T.'S EXCEPT WHERE CALLED FOR IN THE ACCOMPANYING TABLES. THE TRANSITION WILL TAKE ITS FORM FROM THE POSITIONS GIVEN ON SHEETS 801.13 AND 801.14.

THE RIGHT OF WAY SHALL, IN ALL CASES, BE REFERENCED FROM THE BASELINE.

THE DESIGNER SHOULD AVOID SITUATIONS NECESSITATING REVERSE CURVES AND CURVES WITH OVERLAPPING TRANSITIONS WHERE POSSIBLE.

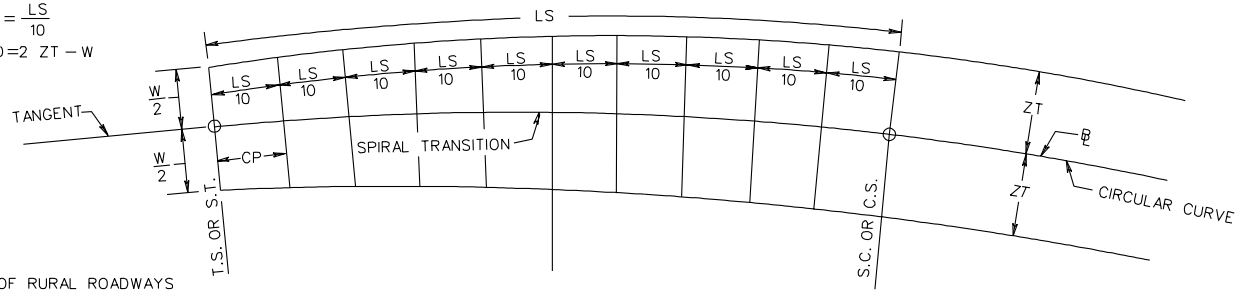
A DESIGN EXCEPTION IS NOT REQUIRED WHEN USING VALUES FROM SHEETS 801.21 THRU 801.40 SINCE THESE TABLES WERE DERIVED WITHIN AASHTO GUIDELINES.

ALL CROWN RUNOFF (CR) VALUES LISTED IN THE TABLES HAVE BEEN ROUNDED UP TO THE NEAREST FOOT. ALL CR VALUES ARE BASED ON A $\frac{1}{4}$ " : 1'-0" CROWN.

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE
GENERAL CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

CHORD POINTS (CP) = $\frac{LS}{10}$
 TOTAL WIDENING (W) = $2 ZT - W$

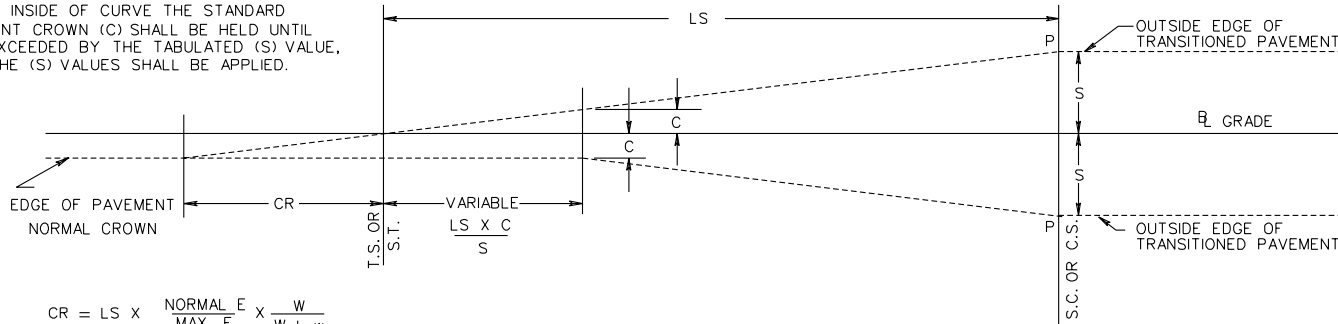


NOTE:
 PAVEMENT WIDENING OF RURAL ROADWAYS WILL BE ACHIEVED BY EQUAL WIDENING OF BOTH EDGES OF PAVEMENT OVER THE LS (LENGTH OF SPIRAL) TRANSITION.

PLAN OF TRANSITION

$ZT = \frac{W + w}{2}$

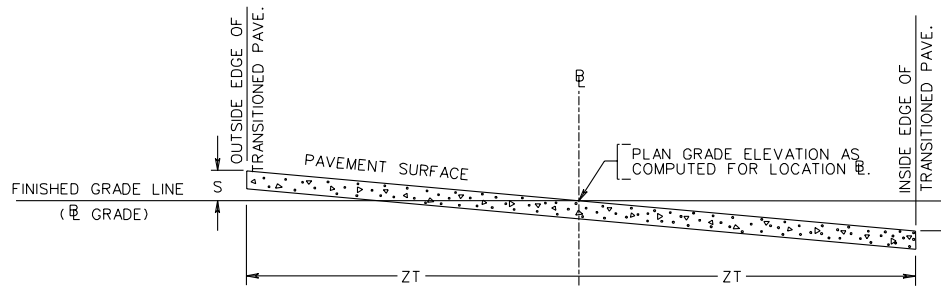
NOTE:
 ON THE INSIDE OF CURVE THE STANDARD PAVEMENT CROWN (C) SHALL BE HELD UNTIL IT IS EXCEEDED BY THE TABULATED (S) VALUE, THEN THE (S) VALUES SHALL BE APPLIED.



$CR = LS \times \frac{\text{NORMAL } E}{\text{MAX. } E} \times \frac{W}{W + w}$

PROFILE OF TRANSITION

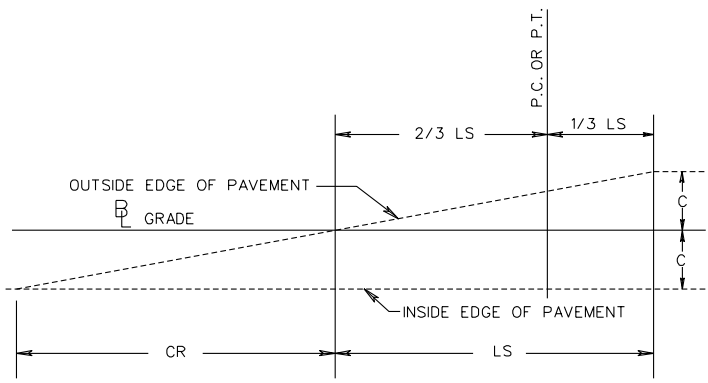
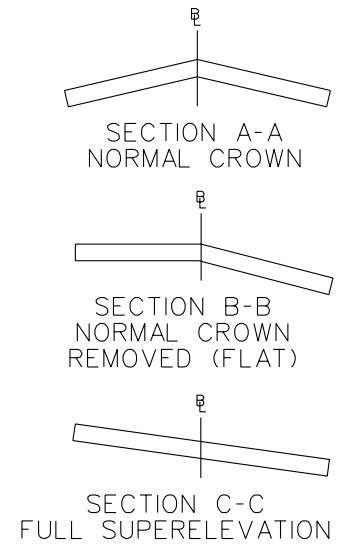
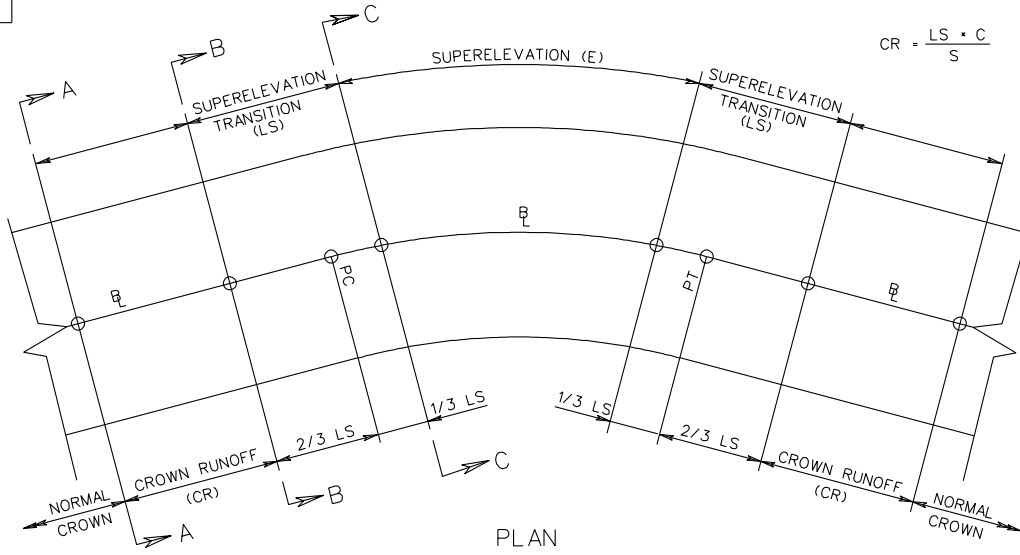
NOTE: SHORT VERTICAL CURVES SHOULD BE INSERTED BY EYE AT POINTS (P) IF CONSIDERED NECESSARY.



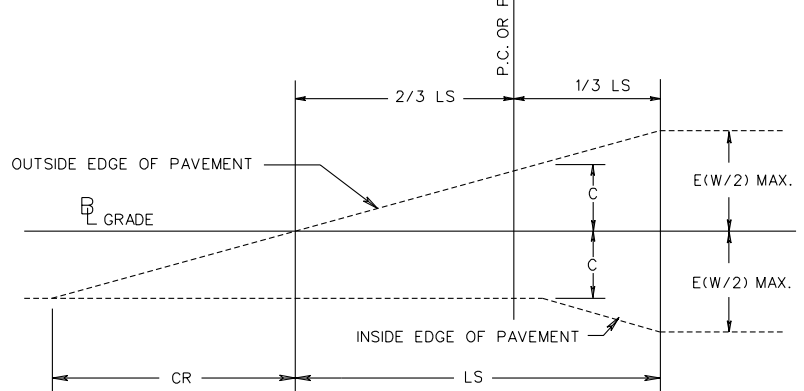
CROSS SECTION THRU TRANSITION

DETAILS FOR TRANSITIONED \mathcal{E}
 RURAL CONDITION WITH PAVEMENT WIDENING

TC-5



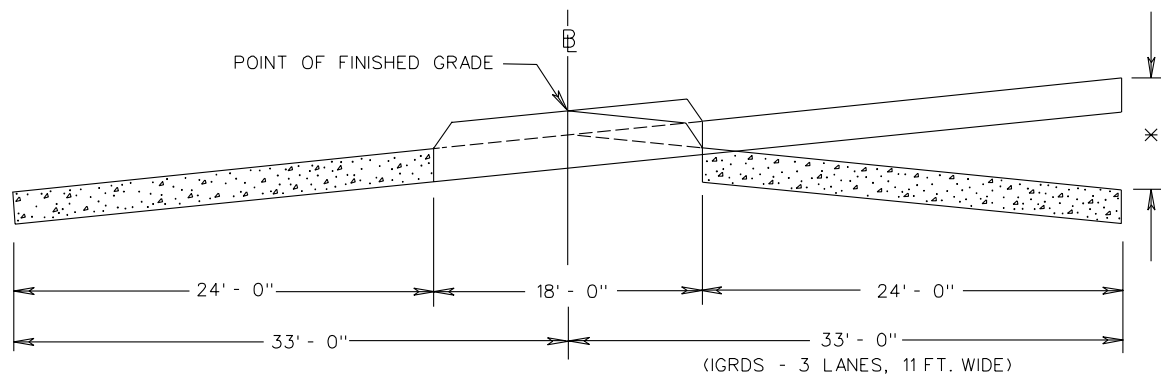
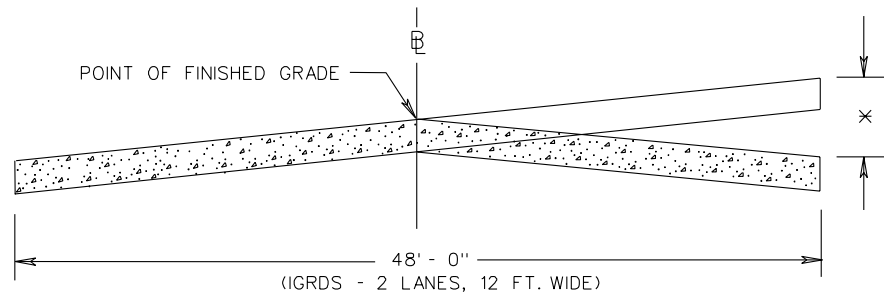
SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN



NOTE : ON THE INSIDE OF CURVE THE STANDARD PAVEMENT CROWN (C) SHALL BE HELD UNTIL IT IS EXCEEDED BY THE TABULATED RATE OF SUPERELEVATION (E).

SUPERELEVATED BY AN AMOUNT EXCEEDING THE STANDARD PAVEMENT CROWN

DETAILS FOR NON-TRANSITION $\frac{B}{L}$
 URBAN CONDITIONS AND RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

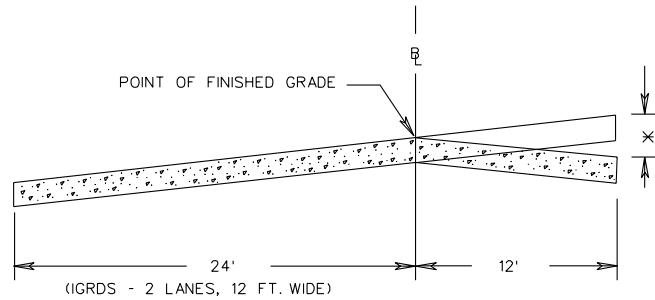


× THE ELEVATION DIFFERENTIAL BETWEEN NORMAL CROWN AND MAXIMUM SUPERELEVATION, RELATIVE TO THE BASELINE PROFILE.

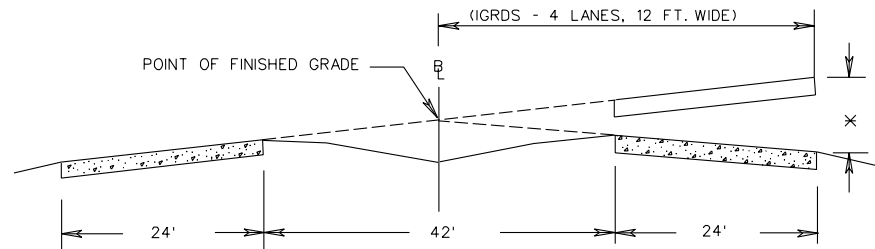
ADDITIONAL INFORMATION MAY BE OBTAINED FROM A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (AASHTO) BOOK, CHAPTER III - ELEMENTS OF DESIGN (SUPERELEVATION RUNOFF).

ON STANDARD TC-5ULS, TC-5U, AND TC-5R (WITHOUT PAVEMENT WIDENING) SUPERELEVATED CURVES, POSITION THE LS TWO THIRDS (2/3) ON THE TANGENT AND ONE THIRD (1/3) INTO THE CURVE. STATIONS AND ELEVATIONS FOR THESE TRANSITIONS WILL NEED TO BE COMPUTED FOR ALL CHORD POINTS AND SHOWN ON THE PROFILES.

DETAILS OF SUPERELEVATION ABOUT BASELINE



THE PAVEMENT WIDTHS SHOWN IN THE STANDARD TC-5 TABLES ON SHEET 801.20 THROUGH 801.40 REPRESENT TWICE THE DISTANCE FROM THE CROWNLIN TO THE EDGE OF PAVEMENT ON THE HIGH SIDE.



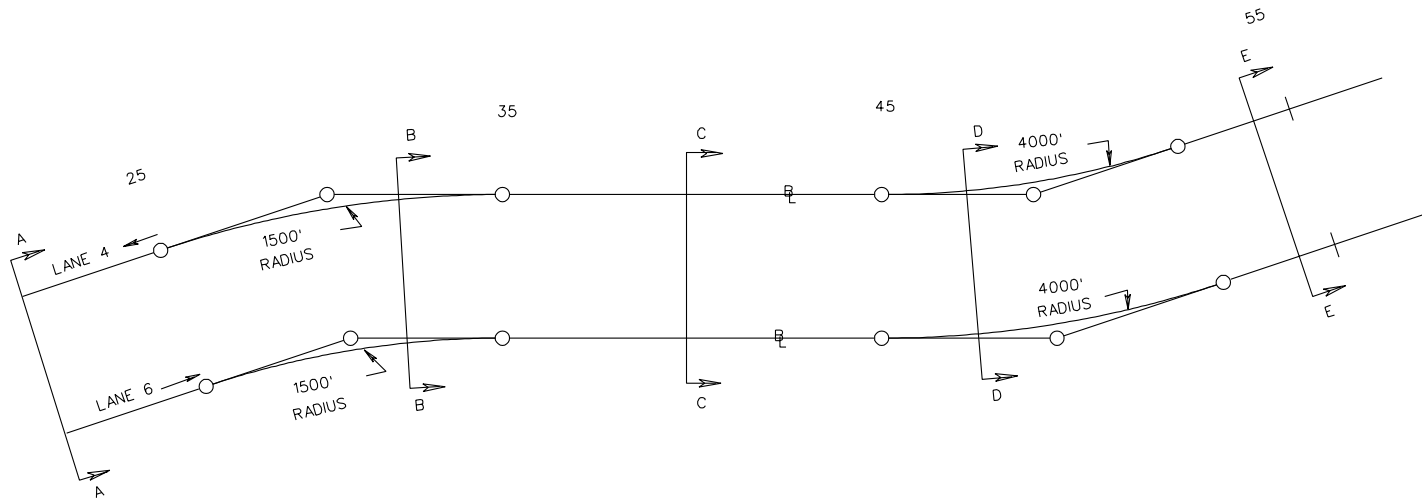
✕ THE ELEVATION DIFFERENTIAL BETWEEN NORMAL CROWN AND MAXIMUM SUPERELEVATION, RELATIVE TO THE BASELINE PROFILE.

ADDITIONAL INFORMATION MAY BE OBTAINED FROM A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (AASHTO) BOOK, CHAPTER III - ELEMENTS OF DESIGN (SUPERELEVATION RUNOFF).

PROJECTS IN WHICH LANES MAY BE ADDED IN THE FUTURE IN THE MEDIAN AREA SHOULD BE DESIGNED WITH THE CONSTRUCTION BASELINE AND POINT OF FINISHED GRADE LOCATED IN THE MIDDLE OF THE MEDIAN. SUPERELEVATION IS TO BE ROTATED FROM THIS BASELINE POINT. THIS WILL PREVENT UNEVEN PAVEMENT PROBLEMS (WHEN ADDITIONAL LANES ARE ADDED IN THE MEDIAN AREA) SUCH AS CROSSOVER GRADES AS WELL AS THE NEED FOR RETAINING WALLS, MEDIAN BARRIERS AND SPECIAL DESIGN DRAINAGE STRUCTURES. ADDITIONAL RIGHT OF WAY OR EASEMENTS, IN MOST SITUATIONS, WILL NOT BE REQUIRED.

DETAILS OF SUPERELEVATION ABOUT BASELINE

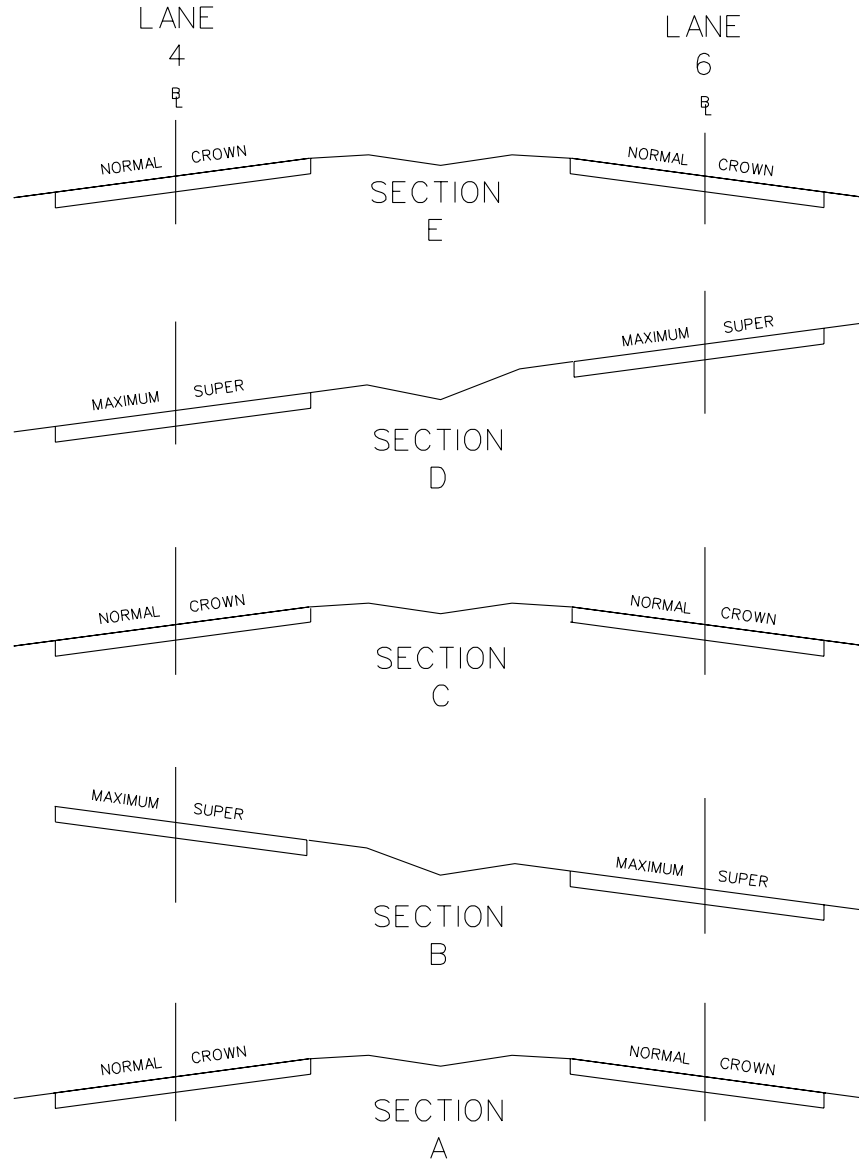
VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:
WHEN \bar{E} (CROWNLINER) IS ON THE INSIDE EDGE OF PAVEMENT,
TANGENT SECTIONS ARE TO BE CODED AS STRAIGHT.

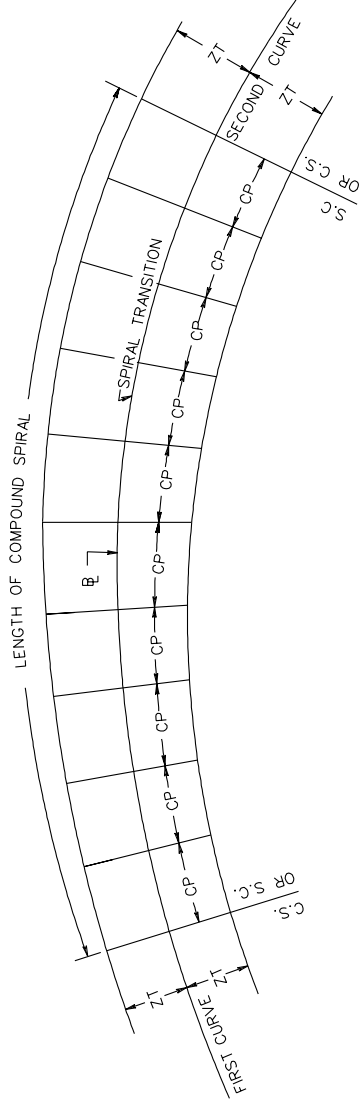
EXAMPLE FOR FOUR LANE ROADWAYS

VIRGINIA DEPARTMENT OF TRANSPORTATION

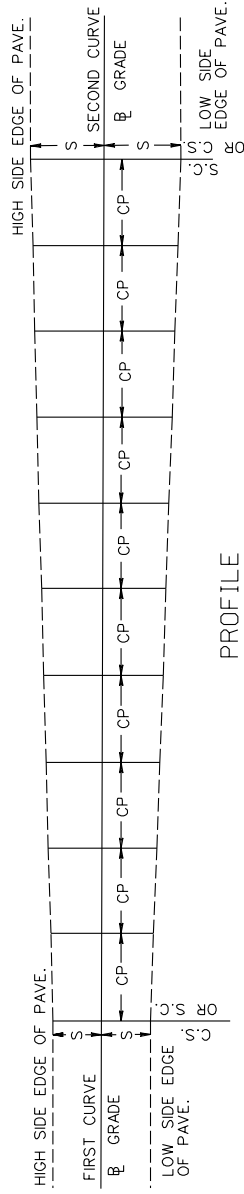


CROSS SECTION - FOUR LANE ROADWAY
VIRGINIA DEPARTMENT OF TRANSPORTATION

$$\text{CHORD POINT (CP)} = \frac{\text{LENGTH OF COMPOUND SPIRAL}}{\text{DIVIDED BY TEN (10)}}$$



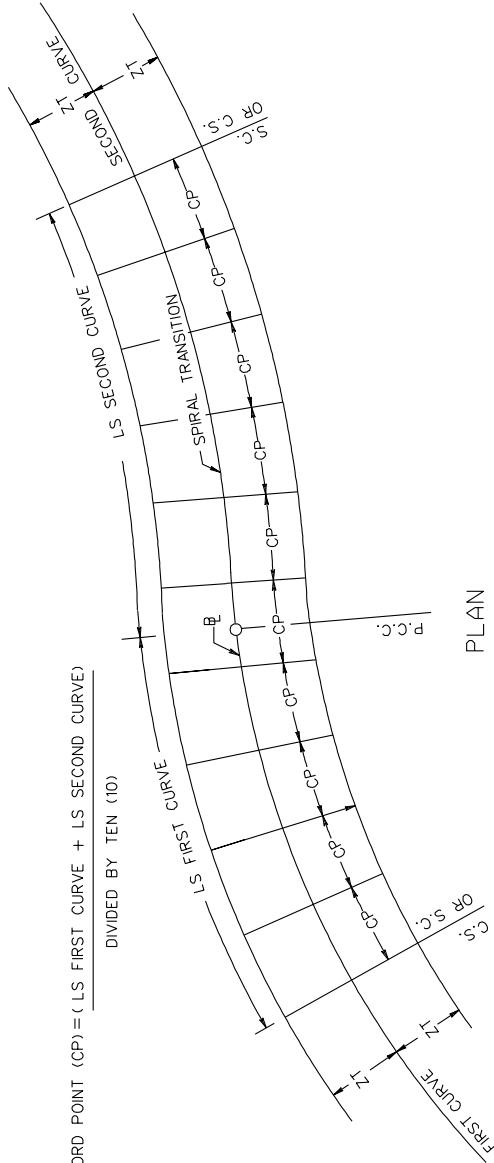
PLAN



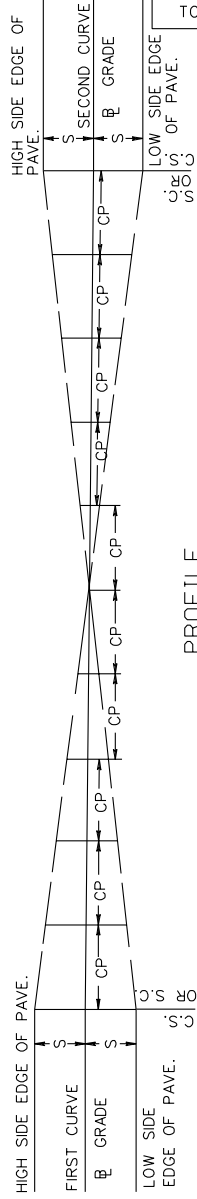
PROFILE

COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.

$$\text{CHORD POINT (CP)} = \frac{(\text{LS FIRST CURVE} + \text{LS SECOND CURVE})}{\text{DIVIDED BY TEN (10)}}$$



PLAN



PROFILE

TC-5

METHOD OF APPLYING TC-5 ON COMPOUND AND REVERSE CURVES RURAL CONDITION ONLY WITH PAVEMENT WIDENING

TRANSITION TABLE

LENGTH OF CROWN RUNOFF (CR)	START/END OF TRANSITION (LS)	DISTANCE IN FEET FROM START/END OF TRANSITION (LS)				NORMAL CROWN
		1	2	3	4	
220	0	44	88	132	176	220
200	0	40	80	120	140	200
180	0	36	72	108	144	180
160	0	32	64	96	128	160
140	0	28	56	84	112	140
120	0	24	48	72	96	120
100	0	20	40	60	80	100
90	0	18	36	54	72	90
80	0	16	32	48	64	80
60	0	15	30	45	——	60
40	0	20	——	——	——	40

NOTE:

TABLE LISTS POSITIONS ON TRANSITIONS AT WHICH SLOPE STAKES SHOULD BE SET,
CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP)
SET, AND FOR STAKES SET (CONCRETE PAVEMENT ONLY).

CROWN TRANSITION/ CROWN RUNOFF (CR) TABLE

VIRGINIA DEPARTMENT OF TRANSPORTATION

URBAN CONDITIONS
RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT
(LS POSITIONED $2/3 \pm$ ON TANGENT, $1/3 \pm$ ON CURVE)

LENGTH OF TRANSITION (LS)	END/ BEGIN CROWN RUNOFF (CR)	DISTANCE IN FEET FROM P.C. OR P.T. ON TANGENT						P.C. OR P.T.	DISTANCE IN FEET FROM P.C. OR P.T. ON CURVE			FULL SUPER ELEVATION (E)
		1	2	3	4	5	6		7	8	9	
480	320	272	224	176	128	80	32	STAKE	16	64	112	160
460	307	261	215	169	123	77	31	STAKE	15	61	107	153
440	293	249	205	161	117	73	29	STAKE	15	59	103	147
420	280	238	196	154	112	70	28	STAKE	14	56	98	140
400	267	227	187	147	107	67	27	STAKE	13	53	93	133
380	253	215	177	139	101	63	25	STAKE	13	51	89	127
360	240	204	168	132	96	60	24	STAKE	12	48	84	120
340	227	193	159	125	91	57	23	STAKE	11	45	79	113
320	213	181	149	117	85	53	21	STAKE	11	43	75	107
300	200	170	140	110	80	50	20	STAKE	10	40	70	100
280	187	159	131	103	75	47	19	STAKE	9	37	65	93
260	173	147 *	121	95 *	69	43 *	17	STAKE *	9	35 *	61	87
240	160	136 *	112	88 *	64	40 *	16	STAKE *	8	32 *	56	80
220	147	125 *	103	81 *	59	37 *	15	STAKE *	7	29 *	51	73
200	133	113 *	93	73 *	53	33 *	13	STAKE *	7	27 *	47	67
180	120	102 *	84	66 *	48	30 *	12	STAKE *	6	24 *	42	60
160	107	91 *	75	59 *	43	27 *	11	STAKE *	5	21 *	37	53

NOTE :

TABLE GIVING POSITIONS ON CURVES AT WHICH SLOPE STAKES SHOULD BE SET,
CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP) SET,
AND FORM STAKES SET (CONCRETE PAVEMENT ONLY).

* DENOTES ADDITIONAL STAKING POSITIONS FOR USE WITH CONCRETE PAVEMENT ONLY.

TABLE I

VIRGINIA DEPARTMENT OF TRANSPORTATION

RURAL CONDITIONS WITH PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT

LENGTH OF TRANSITION (LS)	T.S. OR S.T.	DISTANCE IN FEET FROM T.S. OR S.T. ALONG SPIRAL TRANSITION									S.C. OR C.S.
		1	2	3	4	5	6	7	8	9	
480	0	48	96	144	192	240	288	336	384	432	480
460	0	46	92	138	184	230	276	322	368	414	460
440	0	44	88	132	176	220	264	308	352	396	440
420	0	42	84	126	168	210	252	294	336	378	420
400	0	40	80	120	160	200	240	280	320	360	400
380	0	38	76	114	152	190	228	266	304	342	380
360	0	36	72	108	144	180	216	252	288	324	360
340	0	34	68	102	136	170	204	238	272	306	340
320	0	32	64	96	128	160	192	224	256	288	320
300	0	30	60	90	120	150	180	210	240	270	300
280	0	28	56	84	112	140	168	196	224	252	280
260	0	26 *	52	78 *	104	130 *	156	182 *	208	234 *	260
240	0	24 *	48	72 *	96	120 *	144	168 *	192	216 *	240
220	0	22 *	44	66 *	88	110 *	132	154 *	176	198 *	220
200	0	20 *	40	60 *	80	100 *	120	140 *	160	180 *	200
180	0	18 *	36	54 *	72	90 *	108	126 *	144	162 *	180
160	0	16 *	32	48 *	64	80 *	96	112 *	128	144 *	160

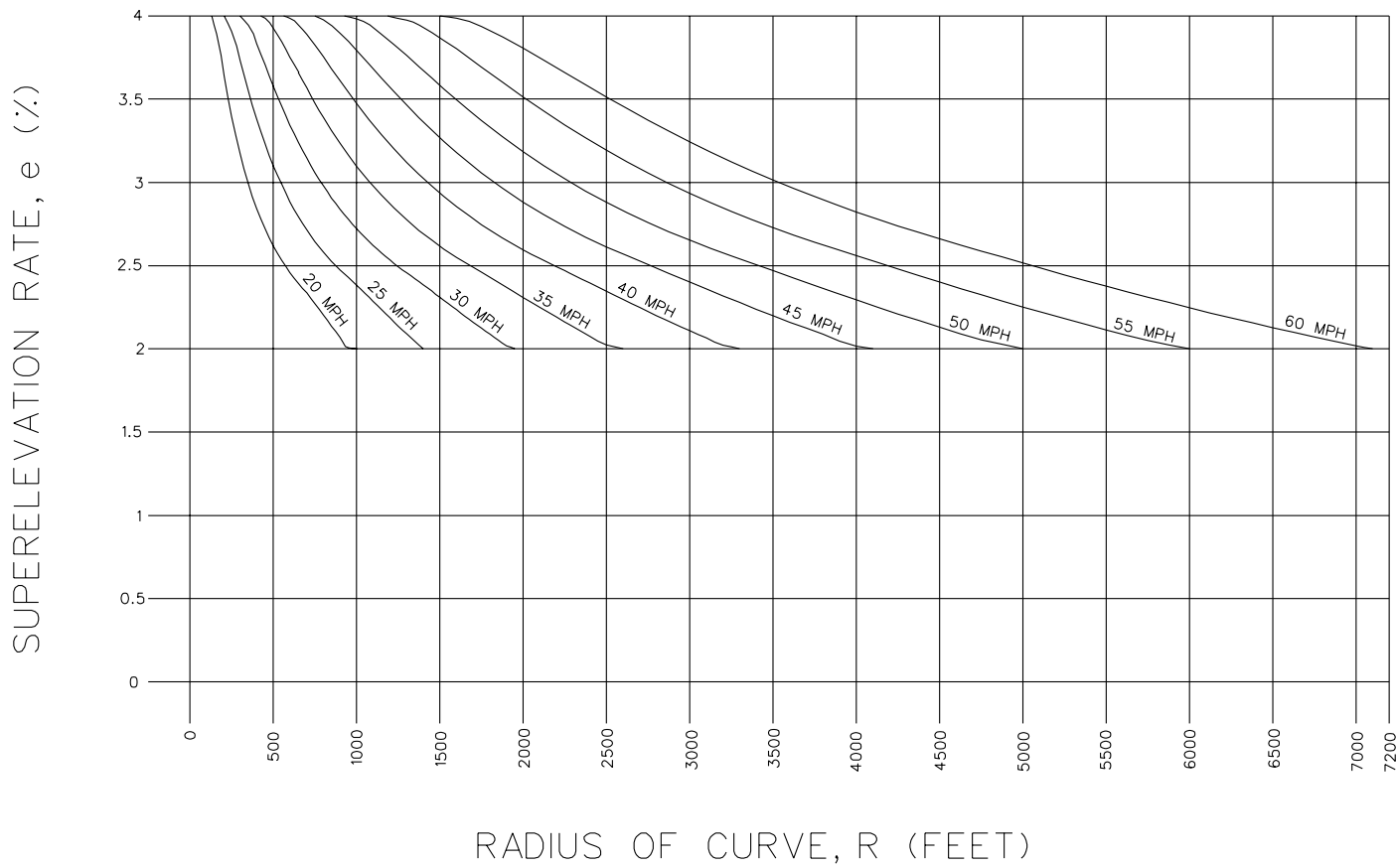
NOTE :

TABLE GIVING POSITIONS ON TRANSITION CURVES AT WHICH SLOPE STAKES SHOULD BE SET,
CONSTRUCTION AND FINAL CROSS-SECTIONS TAKEN, FINE GRADING STAKES (BLUE TOP) SET,
AND FORM STAKES SET (CONCRETE PAVEMENT ONLY).

* DENOTES ADDITIONAL STAKING POSITIONS FOR USE WITH CONCRETE PAVEMENT ONLY.

TABLE 2

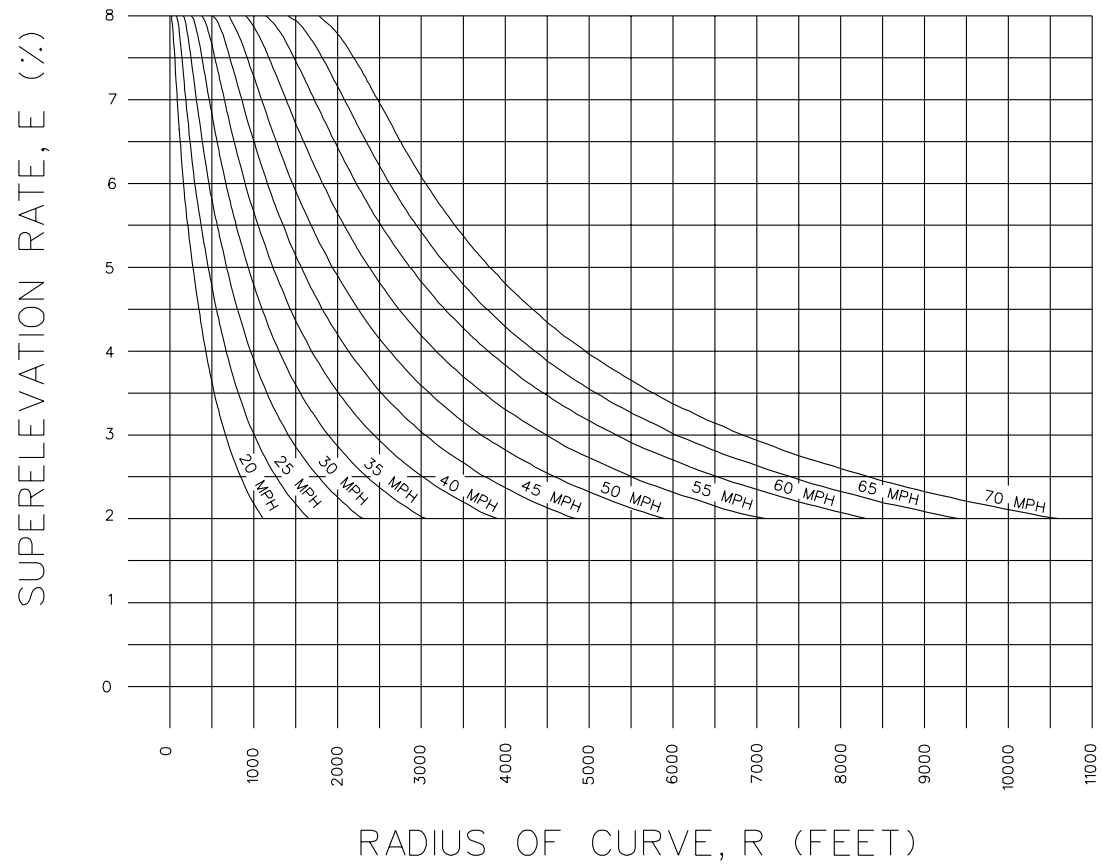
VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:
INTERMEDIATE UNITS OF SUPERELEVATION AND RADI NOT LISTED ON
GRAPH CAN BE GRAPHED USING A CIVIL ENGINEER'S 10 SCALE WITH
EACH MARK EQUAL TO 100' OF RADIUS AND 0.1% OF SUPERELEVATION.

DESIGN SUPERELEVATION RATES URBAN CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:
 INTERMEDIATE UNITS OF SUPERELEVATION AND RADI NOT LISTED ON
 GRAPH CAN BE GRAPHED USING A CIVIL ENGINEER'S 20 SCALE WITH
 EACH MARK EQUAL TO 100' OF RADIUS AND 0.1% OF SUPERELEVATION.

DESIGN SUPERELEVATION RATES
 RURAL CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

LEGEND

- C- RATE OF CHANGE OF SIDE FRICTION (f) IN FT./SEC.³
- e- SUPERELEVATION RATE IN PERCENT.
- f- FRICTION FACTOR.
- LS- LENGTH OF SUPERELEVATION TRANSITION.
- R- RADIUS OF CURVE.
- DV- DESIGN VELOCITY UTILIZING SUPERELEVATION.
- NC- MAXIMUM VELOCITY WITH NO SUPERELEVATION (NORMAL CROWN).

URBAN LOW SPEED DESIGN TABLE

DV/NC	MAX. f	C	LS
45	0.161	2.75	140
40	0.178	3.00	120
35	0.197	3.25	120
30	0.221	3.50	100
25	0.252	3.75	90
20	0.300	4.00	90

FRICTION FACTORS (f) FOR ODD VELOCITIES NOT LISTED SHOULD BE DERIVED BY INTERPOLATION.

FOR LS LENGTHS FOR INTERMEDIATE VELOCITIES NOT LISTED IN TABLE USE THE LS FOR NEXT LOWER VELOCITY IN TABLE.

GENERAL DESIGN CONSIDERATIONS

1. WHEN "URBAN LOW SPEED" DESIGNS UTILIZE SUPERELEVATION, THEY WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN (TYPICALLY 2.1%) AND THE APPROXIMATE MAXIMUM SAFE SPEED (DV) AFFORDED THEREBY.
2. WHEN "URBAN LOW SPEED DESIGN" WITH NO SUPERELEVATION, THE APPROXIMATE MAXIMUM SAFE SPEED (NC) IS CALCULATED USING A NEGATIVE NORMAL CROWN (TYPICALLY -2.1%). WHEN THE CURVE IS SUPERELEVATED, THE LS IS APPLIED IN THE SAME MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).
3. MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).

4. PLEASE NOTE THAT THE RADIUS VALUES LISTED ON PAGE 801.20 HAVE BEEN ROUNDED UP TO THE NEAREST TWENTY FIVE FOOT INCREMENT.

EXAMPLES

DV = 21 mph
 e = +2.1%
 $f = 300 - [1/5(0.300 - 0.252)] = 0.2904$ (ROUND TO 0.29)
 LS = $47.2 f DV/C = 47.2(0.29)(21)/4 = 71.862$ FT.
 = 71.862 < 90 THEREFORE LS=90 FT.
 $R_{min} = (21)^2 / 15(0.021 + 0.29) = 94.53376206$ FT.

NC = 37 mph
 e = -2.1%
 $f = 0.197 - [2/5(0.197 - 0.178)] = 0.1894$ (ROUND TO 0.189)
 $R_{min} = (37)^2 / 15(-0.021 + 0.189) = 543.2539683$ FT.

METHODOLOGIES FOR CALCULATING TC-5 VALUES FOR URBAN LOW-SPEED STREETS

IGRDS HA.TBL TABLES

CURVE WIDENING TABLES

SU DESIGN VEHICLE

COMPONENT	SIZE
OVERALL WIDTH (u)	8.5 ft
WHEELBASE (L)	20 ft
FRONT OVERHANG (A)	4 ft

LATERAL CLEARANCE

LANE WIDTH	CLEARANCE (C)
8 ft	1 ft
9 ft	1.5 ft
10 ft	2 ft
11 ft	2.5 ft
12 ft	3 ft
16 ft	5 ft

EFFECTIVE WIDTHS

NUMBER OF LANES	EFFECTIVE WIDTHS (W)						EFFECTIVE WIDTH FACTOR (f)
	8 ft LANES	9 ft LANES	10 ft LANES	11 ft LANES	12 ft LANES	16 ft LANES	
1	8.0	9.0	10.0	11.0	12.0	16.0	1
1.5	9.6	10.8	12.0	13.2	14.4	19.2	1.2
2	12.0	13.5	15.0	16.5	18.0	24.0	1.5
3	16.0	18.0	20.0	22.0	24.0	32.0	2
4	32.0	36.0	40.0	44.0	48.0	64.0	4
5	40.0	45.0	50.0	55.0	60.0	80.0	5
6	48.0	54.0	60.0	66.0	72.0	96.0	6
7	56.0	63.0	70.0	77.0	84.0	112.0	7
8	64.0	72.0	80.0	88.0	96.0	128.0	8

RELATIVE GRADIENTS

DESIGN SPEED V _D MPH	RELATIVE GRADIENT (rg)		MIN. TRANSITION LENGTH IN FEET 2 SECOND RULE	
	UP TO 3 LANES	4 OR MORE LANES		
			URBAN	RURAL
20	0.75	1.14	100	60
25	0.71	1.07	100	80
30	0.67	1.00	100	100
35	0.63	0.93	120	120
40	0.58	0.86	120	120
45	0.54	0.81	140	140
50	0.50	0.75	160	160
55	0.47	0.69	180	180
60	0.45	0.67	180	180
65	0.41	0.62	200	200
70	0.40	0.60	220	220

DEFINITIONS

- A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- E - SUPERELEVATION RATE IN DECIMAL FROM APPROPRIATE TABLE OR CALCULATED PER AASHTO METHOD 5.
- F_A - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.
- L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- LS - LENGTH OF SPIRAL OR SUPERELEVATION TRANSITION LENGTH.
- M - MULTIPLE LANE (2+) FACTOR.
- N - NUMBER OF LANES.
- P_w - PAVEMENT WIDTH.
- R - RADIUS OF CURVE.
- rg - RELATIVE GRADIENT FROM APPROPRIATE TABLE.
- U - CALCULATED TRACK WIDTH OF DESIGN VEHICLE.
- u - TRACK WIDTH OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- V_D - DESIGN VELOCITY.
- w - CALCULATED WIDENING.
- W - EFFECTIVE WIDTH FROM APPROPRIATE TABLE.
- W_C - CALCULATED TOTAL CURVE WIDTH.
- W_n - WIDTH OF LANE.
- Z - CALCULATED EXTRA WIDTH ALLOWANCE.

GENERAL DESIGN CONSIDERATIONS

- WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE TRANSITION LENGTH (LS).
- THE COMPUTED TRANSITION LENGTH (LS) IS ROUNDED UP TO THE NEAREST TWENTY FOOT INCREMENT. COMPUTED LENGTHS THAT FALL ON THE TWENTY FOOT INCREMENT ARE NOT ROUNDED.
- WHEN THE TRANSITION LENGTH (LS) IS CALCULATED, IT MUST BE COMPARED WITH THE MINIMUM VALUE LISTED IN THE APPROPRIATE COLUMN ON THE RELATIVE GRADIENT TABLE.
- CROWN RUNOFF IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION.
- NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.
- NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH A CURVE RADIUS GREATER THAN 2865 FEET.
- NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH 12 FOOT WIDE LANES AND A CURVE RADIUS GREATER THAN 881 FEET.
- PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (w) IS EQUAL TO OR GREATER THAN 2 FEET.
- WHEN CALCULATING WIDENING (w) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "W" AND THE ANSWER (w) IS THEN MULTIPLIED BY THE MULTIPLE LANE FACTOR (M). FOR FOUR LANE UNDIVIDED PAVEMENTS (48'), THE LS IS 1.5 TIMES (M=1.5) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS; AND FOR SIX LANE UNDIVIDED PAVEMENTS (72'), THE LS IS TWO TIMES (M=2) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS.
- CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 FOOT.

FORMULAS USED TO CALCULATE TRANSITION LENGTH (LS) AND WIDENING (W)

$LS = (100WE)/rg$ (NO WIDENING REQUIRED)
 $LS = [100(W + w/2)E]/rg$ (WIDENING REQUIRED)
 $LS = M[100(P_w/N + w/N)E]/rg$ (MULT-LANE WIDENING REQUIRED)

$U = u + R - \sqrt{R^2 - L^2}$
 $F = \sqrt{R^2 + A(2L + A)} - R$

$Z = (V_D / \sqrt{R})$
 $W_C = N(U + C) + F + Z_A$
 $w = W_C - 2W_n$

FOR SOLVED PROBLEMS USING THIS METHODOLOGY, SEE THE EXAMPLES ON PAGE 801.19.

METHODOLOGIES FOR CALCULATING TC-5 VALUES

RURAL EXAMPLE
20 FT PAVEMENT WIDTH
(IGRDS - 1 LANE AT 10 FT)

$$V_D = 50 \text{ MPH} \quad R = 1000 \text{ FT}$$

$$W_n = 10 \text{ FT} \quad r_g = 0.50$$

$$E = 0.076 \text{ (7.6\% CALCULATED PER AASHTO METHOD 5)}$$

$$U = u + R - \sqrt{R^2 - L^2}$$

$$U = 8.5 + 1000 - \sqrt{(1000)^2 - (20)^2}$$

$$U = 8.70002$$

$$F_A = \sqrt{R^2 + A(2L + A)} - R$$

$$F_A = \sqrt{(1000)^2 + 4[2(20) + 4]} - 1000$$

$$F_A = .087996$$

$$Z = (V_D / \sqrt{R})$$

$$Z = (50 / \sqrt{1000})$$

$$Z = 1.58$$

$$W_C = 2(U + C) + F_A + Z$$

$$W_C = 2(8.70002 + 2) + 0.08996 + 1.58$$

$$W_C = 23.0692$$

$$w = W_C - 2W_n = 23.069 - 2(10) = 3.069$$

($R < 2865$ & $w > 2$ THEREFORE WIDENING IS REQUIRED)

$$LS = [100(W + w/2)E] / r_g$$

$$LS = [100(10 + 3.068/2) \cdot 0.076] / 0.50$$

$$LS = 175.56 \text{ (180 ROUNDED)}$$

RURAL EXAMPLE
72 FT PAVEMENT WIDTH
(IGRDS - 3 LANES AT 12 FT)

$$V_D = 40 \text{ MPH} \quad R = 600 \text{ FT}$$

$$W_n = 24 \text{ FT} \quad r_g = 0.58$$

$$E = 0.077 \text{ (7.7\% CALCULATED PER AASHTO METHOD 5)}$$

COMPUTE FOR 24' PAVEMENT WIDTH (IGRDS 1 @ 12')

$$U = u + R - \sqrt{R^2 - L^2}$$

$$U = 8.5 + 600 - \sqrt{(600)^2 - (20)^2}$$

$$U = 8.8334$$

$$F_A = \sqrt{R^2 + A(2L + A)} - R$$

$$F_A = \sqrt{(600)^2 + 4[2(20) + 4]} - 600$$

$$F_A = .14665$$

$$Z = (V_D / \sqrt{R})$$

$$Z = (40 / \sqrt{600})$$

$$Z = 1.6329$$

$$W_C = 2(U + C) + F_A + Z$$

$$W_C = 2(8.8334 + 3.0) + .14665 + 1.632$$

$$W_C = 25.4464$$

$$w = W_C - 2W_n = 25.4455 - 2(12) = 1.4464(1.5)$$

FOR 72' PAVEMENT WIDTH
 $w = 3(1.5) = 4.5$

($R < 881$ & $w > 2$ THEREFORE WIDENING IS REQUIRED)

$$LS = M[100(P_w/N + w/N)E] / r_g$$

$$LS = 2[100(72/6 + 4.5/6) \cdot 0.077] / 0.58$$

$$LS = 2[100(12.75) \cdot 0.77] / 0.58$$

$$LS = 2(98.175 / 0.58)$$

$$LS = 2(169.2672414)$$

$$LS = 338.5344828 \text{ (ROUNDED TO 340)}$$

URBAN EXAMPLES

24 FT PAVEMENT WIDTH
(IGRDS - 1 LANE AT 12 FT)

$$V_D = 40 \text{ MPH} \quad R = 600 \text{ FT}$$

$$W_n = 12 \text{ FT} \quad r_g = 0.58$$

$$E = 0.04 \text{ (4\% PER PAGE 801.25)}$$

$$LS = (100WE) / r_g \text{ (NO WIDENING REQUIRED)}$$

$$LS = [100(12)(0.04)] / 0.58$$

$$LS = 82.759 < 120 \text{ (MIN. LS) THEREFORE}$$

$$LS = 120$$

66 FT PAVEMENT WIDTH
(IGRDS - 3 LANES AT 11 FT)

$$V_D = 40 \text{ MPH} \quad R = 600 \text{ FT}$$

$$W_n = 22 \text{ FT} \quad r_g = 0.58$$

$$E = 0.04 \text{ (4\% PER PAGE 801.25)}$$

$$LS = (100WE) / r_g \text{ (NO WIDENING REQUIRED)}$$

$$LS = [100(22)(0.04)] / 0.58$$

$$LS = 151.72 \text{ (ROUND TO 160) } > 120 \text{ (MIN. LS)}$$

$$LS = 160$$

CALCULATED TC-5 EXAMPLES

TC-5

RADIUS (FEET)	E (%)	F	DV (MPH)	NC (MPH)	PAVEMENT WIDTH	
					W ≤ 72 FT.	W > 72 FT
					LS (FEET)	
≥ 975	2.1	.161	45	45	140	NOTE: FOR PAVEMENTS WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY IGRDS WITH AN ABSOLUTE MINIMUM LS OF 90 FEET.
750	2.1	.161	45	41	140	
700	2.1	.164	44	40	120	
550	2.1	.178	40	37	120	
475	2.1	.186	38	35	120	
375	2.1	.197	35	32	120	
300	2.1	.211	32	30	100	
250	2.1	.221	30	28	100	
200	2.1	.240	27	25	100	
175	2.1	.252	25	24	90	
100	2.1	.290	21	20	90	
90	2.1	.300	20	20	90	

SUMMARY OF STD. TC-5ULS (URBAN-LOW SPEED) DESIGN FACTORS

801.20

VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 20 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
20000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
15000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
10000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
7000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
5000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
4000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
3000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2500	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2250	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1750	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1500	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1300	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1150	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
900	2.1	100	100	100	100	100	100	100	100	100	100	100	100
800	2.3	92	100	92	100	92	100	92	100	92	100	92	100
750	2.3	92	100	92	100	92	100	92	100	92	100	92	100
700	2.4	88	100	88	100	88	100	88	100	88	100	88	100
650	2.5	84	100	84	100	84	100	84	100	84	100	84	100
600	2.5	84	100	84	100	84	100	84	100	84	100	84	100
550	2.6	81	100	81	100	81	100	81	100	81	100	81	100
500	2.7	78	100	78	100	78	100	78	100	78	100	78	100
475	2.7	78	100	78	100	78	100	78	100	78	100	78	100
450	2.8	75	100	75	100	75	100	75	100	75	100	75	100
425	2.8	75	100	75	100	75	100	75	100	75	100	75	100
400	2.9	73	100	73	100	73	100	73	100	73	100	73	100
375	3.0	70	100	70	100	70	100	70	100	70	100	70	100
350	3.1	68	100	68	100	68	100	68	100	68	100	68	100
325	3.1	68	100	68	100	68	100	68	100	68	100	68	100
300	3.2	66	100	66	100	66	100	66	100	66	100	79	120
280	3.3	64	100	64	100	64	100	64	100	64	100	77	120
265	3.4	62	100	62	100	62	100	62	100	62	100	75	120
250	3.5	60	100	60	100	60	100	60	100	72	120	72	120
235	3.5	60	100	60	100	60	100	60	100	72	120	72	120
220	3.6	59	100	59	100	59	100	59	100	70	120	70	120
205	3.7	57	100	57	100	57	100	57	100	69	120	69	120
190	3.8	56	100	56	100	56	100	67	120	67	120	78	140
175	3.9	54	100	54	100	54	100	65	120	65	120	76	140
160	3.9	54	100	54	100	54	100	65	120	65	120	76	140
145	4.0	53	100	53	100	53	100	63	120	63	120	74	140
130	4.0	53	100	53	100	53	100	63	120	63	120	74	140
⊗127	4.0	53	100	53	100	53	100	63	120	63	120	74	140

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 100 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

TC-5		DESIGN FACTORS FOR A DESIGN SPEED OF 25 MPH (URBAN) USING E= 4% MAX.											
RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
20000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
15000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
10000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
7000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
5000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
4000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
3000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2500	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2250	2.1	100	100	100	100	100	100	100	100	100	100	100	100
2000	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1750	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1500	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1300	2.1	100	100	100	100	100	100	100	100	100	100	100	100
1150	2.3	92	100	92	100	92	100	92	100	92	100	92	100
1000	2.4	88	100	88	100	88	100	88	100	88	100	88	100
900	2.5	84	100	84	100	84	100	84	100	84	100	84	100
800	2.6	81	100	81	100	81	100	81	100	81	100	81	100
750	2.7	78	100	78	100	78	100	78	100	78	100	78	100
700	2.8	75	100	75	100	75	100	75	100	75	100	75	100
650	2.9	73	100	73	100	73	100	73	100	73	100	73	100
600	2.9	73	100	73	100	73	100	73	100	73	100	73	100
550	3.0	70	100	70	100	70	100	70	100	70	100	84	120
500	3.2	66	100	66	100	66	100	66	100	66	100	79	120
475	3.2	66	100	66	100	66	100	66	100	66	100	79	120
450	3.3	64	100	64	100	64	100	64	100	77	120	77	120
425	3.4	62	100	62	100	62	100	62	100	75	120	75	120
400	3.4	62	100	62	100	62	100	62	100	75	120	75	120
375	3.5	60	100	60	100	60	100	60	100	72	120	72	120
350	3.6	59	100	59	100	59	100	70	120	70	120	82	140
325	3.7	57	100	57	100	57	100	69	120	69	120	80	140
300	3.8	56	100	56	100	56	100	67	120	67	120	78	140
280	3.9	54	100	54	100	54	100	65	120	76	140	76	140
265	3.9	54	100	54	100	54	100	65	120	76	140	76	140
250	4.0	53	100	53	100	63	120	63	120	74	140	74	140
235	4.0	53	100	53	100	63	120	63	120	74	140	74	140
220	4.0	53	100	53	100	63	120	63	120	74	140	74	140
⊕204	4.0	53	100	53	100	63	120	63	120	74	140	74	140

NOTE:
CR AND LS VALUES IN FEET.
FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 100 FEET.

⊕MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 30 MPH
(URBAN) USING E=4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH													
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT			
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)													
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'			
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
20000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
15300	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
10000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
7000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
5300	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
4000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
3000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
2530	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
2250	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
2000	2.1	100	100	100	100	100	100	100	100	100	100	100	100	100	
1750	2.2	96	100	96	100	96	100	96	100	96	100	96	100	100	
1500	2.4	88	100	88	100	88	100	88	100	88	100	88	100	100	
1000	2.5	84	100	84	100	84	100	84	100	84	100	84	100	100	
1150	2.6	81	100	81	100	81	100	81	100	81	100	81	100	100	
1000	2.8	75	100	75	100	75	100	75	100	75	100	90	120	100	
900	2.9	73	100	73	100	73	100	73	100	73	100	87	120	100	
800	3.0	70	100	70	100	70	100	70	100	70	100	84	120	100	
750	3.1	68	100	68	100	68	100	68	100	82	120	82	120	100	
700	3.2	66	100	66	100	66	100	66	100	79	120	79	120	100	
650	3.3	64	100	64	100	64	100	64	100	77	120	77	120	100	
600	3.4	62	100	62	100	62	100	75	120	75	120	87	140	100	
570	3.5	60	100	60	100	60	100	72	120	72	120	84	140	100	
500	3.6	59	100	59	100	59	100	70	120	70	120	82	140	100	
475	3.7	57	100	57	100	57	100	69	120	80	140	80	140	100	
450	3.8	56	100	56	100	67	120	67	120	78	140	78	140	100	
425	3.8	56	100	56	100	67	120	67	120	78	140	78	140	100	
400	3.9	54	100	54	100	65	120	65	120	76	140	76	140	100	
375	3.9	54	100	54	100	65	120	65	120	76	140	76	140	100	
350	4.0	53	100	53	100	63	120	63	120	74	140	84	160	100	
325	4.0	53	100	53	100	63	120	63	120	74	140	84	160	100	
⊗ 300	4.0	53	100	53	100	63	120	63	120	74	140	84	160	100	

NOTE:
CR AND LS VALUES IN FEET.
FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 100 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 35 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
20000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
15000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
10000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
7000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
5000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
4000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
3000	2.1	120	120	120	120	120	120	120	120	120	120	120	120
2500	2.1	120	120	120	120	120	120	120	120	120	120	120	120
2250	2.2	115	120	115	120	115	120	115	120	115	120	115	120
2000	2.4	105	120	105	120	105	120	105	120	105	120	105	120
1750	2.5	101	120	101	120	101	120	101	120	101	120	101	120
1500	2.7	94	120	94	120	94	120	94	120	94	120	94	120
1300	2.8	90	120	90	120	90	120	90	120	90	120	90	120
1150	3.0	84	120	84	120	84	120	84	120	84	120	84	120
1000	3.2	79	120	79	120	79	120	79	120	79	120	92	140
900	3.3	77	120	77	120	77	120	77	120	77	120	90	140
800	3.5	72	120	72	120	72	120	72	120	84	140	84	140
750	3.5	72	120	72	120	72	120	72	120	84	140	84	140
700	3.6	70	120	70	120	70	120	70	120	82	140	82	140
650	3.7	69	120	69	120	69	120	69	120	80	140	91	160
600	3.8	67	120	67	120	67	120	78	140	78	140	89	160
550	3.9	65	120	65	120	65	120	76	140	76	140	87	160
500	4.0	63	120	63	120	63	120	74	140	74	140	84	160
475	4.0	63	120	63	120	63	120	74	140	74	140	84	160
450	4.0	63	120	63	120	63	120	74	140	74	140	84	160
425	4.0	63	120	63	120	63	120	74	140	74	140	84	160
⊗ 420	4.0	63	120	63	120	63	120	74	140	74	140	84	160

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 120 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 40 MPH
(URBAN) USING E= 4 % MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
20000	2.1	120	120	120	120	120	120	120	120	120	120	120	
15000	2.1	120	120	120	120	120	120	120	120	120	120	120	
10000	2.1	120	120	120	120	120	120	120	120	120	120	120	
7000	2.1	120	120	120	120	120	120	120	40	120	120	120	
5000	2.1	120	120	120	120	120	120	120	120	120	120	120	
4000	2.1	120	120	120	120	120	120	120	120	120	120	120	
3000	2.2	115	120	115	120	115	120	115	120	115	120	120	
2500	2.4	105	120	105	120	105	120	105	120	105	120	120	
2250	2.5	101	120	101	120	101	120	101	120	101	120	120	
2000	2.7	94	120	94	120	94	120	94	120	94	120	120	
1750	2.8	90	120	90	120	90	120	90	120	90	120	120	
1500	3.0	84	120	84	120	84	120	84	120	84	120	140	
1300	3.2	79	120	79	120	79	120	79	120	92	140	140	
1150	3.3	77	120	77	120	77	120	77	120	90	140	140	
1000	3.5	72	120	72	120	72	120	84	140	84	140	160	
900	3.7	69	120	69	120	69	120	80	140	91	160	160	
800	3.8	67	120	67	120	67	120	78	140	89	160	160	
750	3.9	65	120	65	120	76	140	76	140	87	160	180	
700	3.9	65	120	65	120	76	140	76	140	87	160	180	
650	4.0	63	120	63	120	74	140	74	140	84	160	180	
600	4.0	63	120	63	120	74	140	74	140	84	160	180	
⊕563	4.0	63	120	63	120	74	140	74	140	84	160	180	

NOTE:
CR AND LS VALUES IN FEET.
FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 120 FEET.

⊕ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 45 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH												
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'		
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	
20000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
15000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
10000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
7000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
5000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
4000	2.1	140	140	140	140	140	140	140	140	140	140	140	140	140
3000	2.5	118	140	118	140	118	140	118	140	118	140	118	140	140
2500	2.7	109	140	109	140	109	140	109	140	109	140	109	140	140
2250	2.8	105	140	105	140	105	140	105	140	105	140	105	140	140
2000	2.9	102	140	102	140	102	140	102	140	102	140	102	140	140
1750	3.1	95	140	95	140	95	140	95	140	95	140	95	140	140
1500	3.3	90	140	90	140	90	140	90	140	90	140	102	160	160
1300	3.5	84	140	84	140	84	140	84	140	96	160	96	160	160
1150	3.7	80	140	80	140	80	140	80	140	91	160	103	180	180
1000	3.9	76	140	76	140	76	140	87	160	87	160	97	180	180
900	4.0	74	140	74	140	74	140	84	160	95	160	95	180	180
800	4.0	74	140	74	140	74	140	84	160	95	180	95	180	180
750	4.0	74	140	74	140	74	140	84	160	95	180	95	180	180
⊗ 732	4.0	74	140	74	140	74	140	84	160	95	180	95	180	180

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 140 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 50 MPH
(URBAN) USING E = 4 % MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
20000	2.1	160	160	160	160	160	160	160	160	160	160	160	160
15000	2.1	160	160	160	160	160	160	160	160	160	160	160	160
10000	2.1	160	160	160	160	160	160	160	160	160	160	160	160
7000	2.1	160	160	160	160	160	160	160	160	160	160	160	160
5000	2.1	160	160	160	160	160	160	160	160	160	160	160	160
4000	2.4	140	160	140	160	140	160	140	160	140	160	140	160
3000	2.7	125	160	125	160	125	160	125	160	125	160	125	160
2500	2.9	116	160	116	160	116	160	116	160	116	160	116	160
2250	3.1	109	160	109	160	109	160	109	160	109	160	109	160
2000	3.2	105	160	105	160	105	160	105	160	105	160	105	160
1750	3.4	99	160	99	160	99	160	99	160	99	160	112	180
1500	3.6	94	160	94	160	94	160	94	160	94	160	105	180
1300	3.8	89	160	89	160	89	160	89	160	100	180	111	200
1150	3.9	87	160	87	160	87	160	87	160	97	180	108	200
1000	4.0	84	160	84	160	84	160	84	160	95	180	105	200
⊗ 929	4.0	84	160	84	160	84	160	84	160	95	180	105	200

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 160 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 55 MPH
(URBAN) USING E= 4% MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH												
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'		
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	
20000	2.1	180	180	180	180	180	180	180	180	180	180	180	180	180
15000	2.1	180	180	180	180	180	180	180	180	180	180	180	180	180
10000	2.1	180	180	180	180	180	180	180	180	180	180	180	180	180
7000	2.1	180	180	180	180	180	180	180	180	180	180	180	180	180
5000	2.3	165	180	165	180	165	180	165	180	165	180	165	180	180
4000	2.6	146	180	146	180	146	180	146	180	146	180	146	180	180
3000	3.0	126	180	126	180	126	180	126	180	126	180	126	180	180
2500	3.3	115	180	115	180	115	180	115	180	115	180	115	180	180
2250	3.4	112	180	112	180	112	180	112	180	112	180	112	180	180
2000	3.6	105	180	105	180	105	180	105	180	105	180	117	200	200
1750	3.8	100	180	100	180	100	180	100	180	100	180	111	200	200
1500	3.9	97	180	97	180	97	180	97	180	108	200	108	200	200
1300	4.0	95	180	95	180	95	180	95	180	105	200	116	220	220
⊗ 1190	4.0	95	180	95	180	95	180	95	180	105	200	116	220	220

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 180 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 60 MPH
(URBAN) USING E= 4 % MAX.

RADIUS (FEET)	E (%)	PAVEMENT WIDTH											
		24 FT		36 FT		48 FT		60 FT		66 FT		72 FT	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
20000	2.1	180	180	180	180	180	180	180	180	180	180	180	
15000	2.1	180	180	180	180	180	180	180	180	180	180	180	
10000	2.1	180	180	180	180	180	180	180	180	180	180	180	
7000	2.1	180	180	180	180	180	180	180	180	180	180	180	
5000	2.6	146	180	146	180	146	180	146	180	146	180	180	
4000	2.9	131	180	131	180	131	180	131	180	131	180	180	
3000	3.3	115	180	115	180	115	180	115	180	115	180	180	
2500	3.6	105	180	105	180	105	180	105	180	105	180	200	
2250	3.7	103	180	103	180	103	180	103	180	114	200	200	
2000	3.9	97	180	97	180	97	180	97	180	108	200	220	
1750	4.0	95	180	95	180	95	180	95	180	105	200	220	
⊗1505	4.0	95	180	95	180	95	180	95	180	105	200	220	

NOTE:

CR AND LS VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS WITH AN
ABSOLUTE MINIMUM LS OF 180 FEET.

⊗ MINIMUM ALLOWABLE RADIUS

TC-5		DESIGN FACTORS FOR A DESIGN SPEED OF 20 MPH (RURAL) USING E= 8% MAX.																	
DESIGN VELOCITY=20		WIDTH-16 FT			WIDTH- 18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 8'			1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'		
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
15000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
10000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
7000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
5000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
4000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
3000	2.1	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
2500	2.1	13	60	3.6	14	60	2.6	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
2250	2.1	13	60	3.7	14	60	2.7	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
2000	2.1	13	60	3.7	14	60	2.7	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
1750	2.1	13	60	3.8	14	60	2.8	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
1500	2.1	13	60	3.9	14	60	2.9	60	60	0.0	60	60	0.0	60	60	0.0	60	60	0.0
1300	2.1	13	60	4.0	14	60	3.0	15	60	2.0	60	60	0.0	60	60	0.0	60	60	0.0
1150	2.1	13	60	4.1	14	60	3.1	15	60	2.1	60	60	0.0	60	60	0.0	60	60	0.0
1000	2.4	13	60	4.2	14	60	3.2	15	60	2.2	53	60	0.0	53	60	0.0	53	60	0.0
900	2.6	13	60	4.3	14	60	3.3	15	60	2.3	49	60	0.0	49	60	0.0	65	80	0.0
800	2.9	13	60	4.4	14	60	3.4	15	60	2.4	44	60	0.0	44	60	0.0	58	80	0.0
750	3.1	13	60	4.4	14	60	3.4	15	60	2.4	41	60	0.0	41	60	0.0	55	80	0.0
700	3.3	13	60	4.5	14	60	3.5	14	60	2.5	39	60	0.0	39	60	0.0	51	80	0.0
650	3.4	13	60	4.6	14	60	3.6	14	60	2.6	38	60	0.0	38	60	0.0	62	100	0.0
600	3.7	13	60	4.7	14	60	3.7	14	60	2.7	35	60	0.0	35	60	0.0	57	100	0.0
550	3.9	13	60	4.8	14	60	3.8	14	60	2.8	33	60	0.0	44	80	0.0	54	100	0.0
500	4.2	13	60	4.9	18	80	3.9	19	80	2.9	40	80	0.0	40	80	0.0	60	120	0.0
475	4.3	16	80	5.0	18	80	4.0	19	80	3.0	20	80	2.0	40	80	0.0	31	120	2.0
450	4.5	16	80	5.1	18	80	4.1	19	80	3.1	20	80	2.1	38	80	0.0	31	120	2.2
425	4.7	16	80	5.2	18	80	4.2	19	80	3.2	20	80	2.2	36	80	0.0	30	120	2.4
400	4.8	16	80	5.3	17	80	4.3	19	80	3.3	20	80	2.3	35	80	0.0	35	140	2.6
375	5.0	16	80	5.4	17	80	4.4	18	80	3.4	24	100	2.4	34	80	0.0	35	140	2.8
350	5.2	16	80	5.5	17	80	4.5	23	100	3.5	24	100	2.5	41	100	0.0	35	140	3.0
325	5.4	16	80	5.7	21	100	4.7	23	100	3.7	24	100	2.7	39	100	0.0	35	140	3.4
300	5.6	20	100	5.8	21	100	4.8	23	100	3.8	24	100	2.8	38	100	0.0	40	160	3.6
280	5.8	20	100	6.0	21	100	5.0	22	100	4.0	24	100	3.0	30	120	2.0	39	160	4.0
265	6.0	20	100	6.1	21	100	5.1	22	100	4.1	28	120	3.1	29	120	2.1	39	160	4.2
250	6.1	19	100	6.3	21	100	5.3	22	100	4.3	28	120	3.3	29	120	2.3	44	180	4.6
235	6.3	19	100	6.4	21	100	5.4	26	120	4.4	28	120	3.4	29	120	2.4	43	180	4.8
220	6.5	19	100	6.6	25	120	5.6	26	120	4.6	28	120	3.6	29	120	2.6	43	180	5.2
205	6.7	23	120	6.8	24	120	5.8	26	120	4.8	27	120	3.8	29	120	2.8	43	180	5.6
190	6.9	22	120	7.1	24	120	6.1	26	120	5.1	31	140	4.1	33	140	3.1	47	200	6.2
175	7.2	22	120	7.4	24	120	6.4	29	120	5.4	31	140	4.4	33	140	3.4	46	200	6.8
160	7.4	22	120	7.7	27	140	6.7	29	140	5.7	31	140	4.7	32	140	3.7	51	220	7.4
145	7.6	25	140	8.1	27	140	7.1	29	140	6.1	30	140	5.1	36	160	4.1	50	220	8.2
130	7.9	24	140	8.6	26	140	7.6	32	160	6.6	34	160	5.6	36	160	4.6	53	240	9.2
115	8.0	24	140	9.2	26	140	8.2	31	160	7.2	33	160	6.2	35	160	5.2	52	240	10.4
107	8.0	23	140	9.6	29	160	8.6	31	160	7.6	33	160	6.6	35	160	5.6	52	240	11.2

NOTE:
CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 25 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY-25		WIDTH-16 FT			WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 8'			1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'		
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
15000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
10000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
7000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
5000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
4000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
3000	2.1	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
2500	2.1	18	80	3.7	19	80	2.7	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
2250	2.1	17	80	3.8	19	80	2.8	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
2000	2.1	17	80	3.9	19	80	2.9	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
1750	2.1	17	80	3.9	19	80	2.9	80	80	0.0	80	80	0.0	80	80	0.0	80	80	0.0
1500	2.4	17	80	4.0	18	80	3.0	20	80	2.0	70	80	0.0	70	80	0.0	70	80	0.0
1300	2.7	17	80	4.1	18	80	3.1	20	80	2.1	63	80	0.0	63	80	0.0	63	80	0.0
1150	2.9	17	80	4.2	18	80	3.2	19	80	2.2	58	80	0.0	58	80	0.0	58	80	0.0
1000	3.3	17	80	4.3	18	80	3.3	19	80	2.3	51	80	0.0	51	80	0.0	64	100	0.0
900	3.6	17	80	4.4	18	80	3.4	19	80	2.4	47	80	0.0	47	80	0.0	59	100	0.0
800	3.9	17	80	4.5	18	80	3.5	19	80	2.5	44	80	0.0	44	80	0.0	54	100	0.0
750	4.1	17	80	4.6	18	80	3.6	19	80	2.6	41	80	0.0	41	80	0.0	62	120	0.0
700	4.3	17	80	4.7	18	80	3.7	19	80	2.7	40	80	0.0	40	80	0.0	59	120	0.0
650	4.6	17	80	4.8	18	80	3.8	19	80	2.8	37	80	0.0	37	80	0.0	55	120	0.0
600	4.8	17	80	4.9	18	80	3.9	19	80	2.9	35	80	0.0	44	100	0.0	62	140	0.0
550	5.1	16	80	5.0	18	80	4.0	23	100	3.0	25	100	2.0	42	100	0.0	36	140	2.0
500	5.3	20	80	5.1	22	100	4.1	23	100	3.1	24	100	2.1	39	100	0.0	41	160	2.2
475	5.5	20	100	5.2	22	100	4.2	23	100	3.2	24	100	2.2	39	100	0.0	40	160	2.4
450	5.7	20	100	5.3	22	100	4.3	23	100	3.3	24	100	2.3	37	100	0.0	40	160	2.6
425	5.8	20	100	5.4	22	100	4.4	23	100	3.4	24	100	2.4	37	100	0.0	40	160	2.8
400	6.0	20	100	5.5	21	100	4.5	23	100	3.5	29	120	2.5	42	120	0.0	45	180	3.0
375	6.2	20	100	5.6	21	100	4.6	27	120	3.6	29	120	2.6	41	120	0.0	45	180	3.2
350	6.4	20	100	5.8	25	100	4.8	27	120	3.8	28	120	2.8	40	120	0.0	44	180	3.6
325	6.7	24	120	5.9	25	120	4.9	27	120	3.9	28	120	2.9	38	120	0.0	49	200	3.8
300	6.9	23	120	6.1	25	120	5.1	27	120	4.1	33	140	3.1	34	140	2.1	49	200	4.2
280	7.1	23	120	6.3	25	120	5.3	31	140	4.3	32	140	3.3	34	140	2.3	48	200	4.6
265	7.3	23	120	6.4	29	140	5.4	31	140	4.4	32	140	3.4	34	140	2.4	53	220	4.8
250	7.4	23	120	6.6	29	140	5.6	30	140	4.6	32	140	3.6	34	140	2.6	53	220	5.2
235	7.6	26	140	6.8	28	140	5.8	30	140	4.8	32	140	3.8	38	160	2.8	52	220	5.6
220	7.7	26	140	7.0	28	140	6.0	30	140	5.0	36	160	4.0	38	160	3.0	52	220	6.0
205	7.9	26	140	7.2	28	140	6.2	34	160	5.2	36	160	4.2	38	160	3.2	56	240	6.4
190	8.0	26	140	7.4	28	140	6.4	34	160	5.4	35	160	4.4	37	160	3.4	56	240	6.8
175	8.0	25	140	7.7	27	140	6.7	33	160	5.7	35	160	4.7	37	160	3.7	55	240	7.4
⊕ 171	8.0	25	140	7.8	27	140	6.8	33	160	5.8	35	160	4.8	37	160	3.8	55	240	7.6

NOTE:
CR, LS & w VALUES IN FEET.

⊕ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 30 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=30		WIDTH=16 FT			WIDTH=18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 8'			1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
15000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
10000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
7000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
5000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
4000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
3000	2.1	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
2500	2.1	22	100	3.8	23	100	2.8	100	100	0.0	100	100	0.0	100	100	0.0	100	100	0.0
2250	2.2	22	100	3.9	23	100	2.9	96	100	0.0	96	100	0.0	96	100	0.0	96	100	0.0
2000	2.4	21	100	4.0	23	100	3.0	24	100	2.0	88	100	0.0	88	100	0.0	88	100	0.0
1750	2.7	21	100	4.0	23	100	3.0	24	100	2.0	78	100	0.0	78	100	0.0	78	100	0.0
1500	3.1	21	100	4.1	23	100	3.1	24	100	2.1	68	100	0.0	68	100	0.0	68	100	0.0
1300	3.5	21	100	4.3	23	100	3.3	24	100	2.3	60	100	0.0	60	100	0.0	60	100	0.0
1150	3.8	21	100	4.4	23	100	3.4	24	100	2.4	56	100	0.0	56	100	0.0	67	120	0.0
1000	4.2	21	100	4.5	22	100	3.5	24	100	2.5	50	100	0.0	50	100	0.0	60	120	0.0
900	4.6	21	100	4.6	22	100	3.6	24	100	2.6	46	100	0.0	46	100	0.0	64	140	0.0
800	4.9	21	100	4.7	22	100	3.7	24	100	2.7	43	100	0.0	43	100	0.0	60	140	0.0
750	5.2	21	100	4.8	22	100	3.8	24	100	2.8	41	100	0.0	41	100	0.0	57	140	0.0
700	5.4	21	100	4.9	22	100	3.9	23	100	2.9	39	100	0.0	39	100	0.0	63	160	0.0
650	5.6	20	100	5.0	22	100	4.0	23	100	3.0	29	120	2.0	45	120	0.0	60	160	2.0
600	5.9	20	100	5.1	22	100	4.1	28	120	3.1	29	120	2.1	43	120	0.0	46	180	2.2
550	6.1	20	100	5.2	26	120	4.2	28	120	3.2	29	120	2.2	42	120	0.0	45	180	2.4
500	6.4	24	120	5.4	26	120	4.4	27	120	3.4	29	120	2.4	40	120	0.0	50	200	2.8
475	6.6	24	120	5.5	26	120	4.5	27	120	3.5	33	140	2.5	39	120	0.0	50	200	3.0
450	6.8	24	120	5.5	26	120	4.5	27	120	3.5	33	140	2.5	44	140	0.0	50	200	3.0
425	7.0	24	120	5.7	25	120	4.7	32	140	3.7	33	140	2.7	42	140	0.0	54	220	3.4
400	7.1	24	120	5.8	30	140	4.8	31	140	3.8	33	140	2.8	42	140	0.0	54	220	3.6
375	7.3	24	120	5.9	29	140	4.9	31	140	3.9	33	140	2.9	41	140	0.0	54	220	3.8
350	7.5	27	140	6.0	29	140	5.0	31	140	4.0	33	140	3.0	39	160	2.0	54	220	4.0
325	7.7	27	140	6.2	29	140	5.2	30	140	4.2	37	160	3.2	39	160	2.2	58	240	4.4
300	7.9	27	140	6.4	29	140	5.4	35	160	4.4	37	160	3.4	39	160	2.4	58	240	4.8
280	8.0	27	140	6.6	33	160	5.6	35	160	4.6	37	160	3.6	38	160	2.6	57	240	5.2
265	8.0	26	140	6.7	32	160	5.7	35	160	4.7	36	160	3.7	38	160	2.7	57	240	5.4
⊗ 250	8.0	26	140	6.9	32	160	5.9	34	160	4.9	36	160	3.9	43	180	2.9	61	260	5.8

NOTE:
CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 35 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY-35		WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT			WIDTH-72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
15000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
10000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
7000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
5000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
4000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
3000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
2500	2.5	28	120	2.9	101	120	0.0	101	120	0.0	101	120	0.0	101	120	0.0	101	120	0.0
2250	2.8	27	120	3.0	29	120	2.0	90	120	0.0	90	120	0.0	90	120	0.0	90	120	0.0
2000	3.0	27	120	3.1	29	120	2.1	84	120	0.0	84	120	0.0	84	120	0.0	84	120	0.0
1750	3.4	27	120	3.2	29	120	2.2	75	120	0.0	75	120	0.0	75	120	0.0	87	140	0.0
1500	3.8	27	120	3.3	29	120	2.3	67	120	0.0	67	120	0.0	67	120	0.0	89	160	0.0
1300	4.3	27	120	3.4	29	120	2.4	59	120	0.0	59	120	0.0	69	140	0.0	88	180	0.0
1150	4.7	27	120	3.5	28	120	2.5	54	120	0.0	54	120	0.0	63	140	0.0	81	180	0.0
1000	5.2	27	120	3.6	28	120	2.6	49	120	0.0	49	120	0.0	65	160	0.0	81	200	0.0
900	5.5	27	120	3.8	28	120	2.8	46	120	0.0	46	120	0.0	62	160	0.0	84	220	0.0
800	5.9	26	120	3.9	28	120	2.9	43	120	0.0	43	120	0.0	65	180	0.0	61	240	2.7
750	6.1	26	120	4.0	28	120	3.0	29	120	2.0	42	120	0.0	51	200	2.0	66	260	3.0
700	6.4	26	120	4.1	28	120	3.1	34	140	2.1	46	140	0.0	51	200	2.2	66	260	3.3
650	6.6	26	120	4.2	32	140	3.2	34	140	2.2	45	140	0.0	50	200	2.4	70	280	3.6
600	6.9	30	140	4.3	32	140	3.3	34	140	2.3	43	140	0.0	55	220	2.6	70	280	3.9
550	7.1	30	140	4.4	32	140	3.4	34	140	2.4	42	140	0.0	55	220	2.8	75	300	4.2
500	7.4	30	140	4.6	32	140	3.6	38	160	2.6	46	160	0.0	60	240	3.2	79	320	4.8
475	7.6	30	140	4.7	36	160	3.7	38	160	2.7	45	160	0.0	59	240	3.4	79	320	5.1
450	7.7	30	140	4.8	36	160	3.8	38	160	2.8	44	160	0.0	59	240	3.6	79	320	5.4
425	7.8	34	160	4.9	36	160	3.9	38	160	2.9	44	160	0.0	64	260	3.8	83	340	5.7
400	7.9	33	160	5.0	35	160	4.0	37	160	3.0	44	180	2.0	63	260	4.0	83	340	6.0
375	8.0	33	160	5.2	35	160	4.2	37	160	3.2	44	180	2.2	63	260	4.4	82	340	6.6
⊗ 350	8.0	33	160	5.3	35	160	4.3	42	180	3.3	44	180	2.3	63	260	4.6	82	340	6.9

NOTE:
 CR, LS, & w VALUES IN FEET.
 FOR PAVEMENT WIDTHS
 GREATER THAN 72 FEET
 USE LS VALUES DEVELOPED
 BY IGRDS.

⊗ MINIMUM ALLOWABLE RADIUS.

DESIGN FACTORS FOR A DESIGN SPEED OF 40 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=40		WIDTH=18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT			WIDTH=72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
15000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
10000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
7000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
5000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
4000	2.1	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0	120	120	0.0
3000	2.6	97	120	0.0	97	120	0.0	97	120	0.0	97	120	0.0	97	120	0.0	97	120	0.0
2500	3.1	27	120	3.0	29	120	2.0	82	120	0.0	82	120	0.0	82	120	0.0	95	140	0.0
2250	3.4	27	120	3.1	29	120	2.1	75	120	0.0	75	120	0.0	75	120	0.0	99	160	0.0
2000	3.7	27	120	3.2	29	120	2.2	69	120	0.0	69	120	0.0	69	120	0.0	91	160	0.0
1750	4.1	27	120	3.3	29	120	2.3	62	120	0.0	62	120	0.0	72	140	0.0	93	180	0.0
1500	4.6	27	120	3.4	29	120	2.4	55	120	0.0	55	120	0.0	74	160	0.0	92	200	0.0
1300	5.1	27	120	3.5	28	120	2.5	50	120	0.0	50	120	0.0	66	160	0.0	91	220	0.0
1150	5.5	27	120	3.7	28	120	2.7	45	120	0.0	45	120	0.0	68	180	0.0	90	240	0.0
1000	6.0	27	120	3.8	28	120	2.8	42	120	0.0	49	140	0.0	70	200	0.0	91	270	0.0
900	6.4	31	140	3.9	33	140	2.9	46	140	0.0	46	140	0.0	66	200	0.0	92	280	0.0
800	6.8	30	140	4.1	32	140	3.1	39	160	2.1	50	160	0.0	61	240	2.2	76	300	3.3
750	7.0	30	140	4.2	32	140	3.2	39	160	2.2	48	160	0.0	60	240	2.4	80	340	3.6
700	7.3	34	160	4.3	37	160	3.3	39	160	2.3	47	160	0.0	60	240	2.6	80	340	3.9
650	7.5	34	160	4.4	36	160	3.4	38	160	2.4	45	160	0.0	65	270	2.8	85	340	4.2
600	7.7	34	160	4.5	36	160	3.5	43	180	2.5	44	160	0.0	65	270	3.0	84	340	4.5
550	7.9	34	160	4.6	41	180	3.6	43	180	2.6	48	180	0.0	69	280	3.2	89	360	4.8
500	8.0	34	160	4.8	40	180	3.8	42	180	2.8	48	180	0.0	69	280	3.6	88	360	5.4
475	8.0	34	160	4.9	40	180	3.9	42	180	2.9	48	180	0.0	69	280	3.8	88	360	5.7
⊗ 465	8.0	33	160	5.0	40	180	4.0	42	180	3.0	44	180	2.0	68	280	4.0	88	360	6.0

NOTE:

CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

DESIGN FACTORS FOR A DESIGN SPEED OF 45 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=45		WIDTH=18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT			WIDTH=72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0
15000	2.1	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0
10000	2.1	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0
7000	2.1	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0
5000	2.1	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0	140	140	0.0
4000	2.5	118	140	0.0	118	140	0.0	118	140	0.0	118	140	0.0	118	140	0.0	118	140	0.0
3000	3.2	92	140	0.0	92	140	0.0	92	140	0.0	92	140	0.0	92	140	0.0	105	160	0.0
2500	3.7	32	140	3.1	34	140	2.1	80	140	0.0	80	140	0.0	80	140	0.0	103	180	0.0
2250	4.0	32	140	3.2	34	140	2.2	74	140	0.0	74	140	0.0	74	140	0.0	95	180	0.0
2000	4.4	32	140	3.3	33	140	2.3	67	140	0.0	67	140	0.0	77	160	0.0	96	200	0.0
1750	4.9	31	140	3.4	33	140	2.4	60	140	0.0	60	140	0.0	78	180	0.0	95	220	0.0
1500	5.4	31	140	3.5	33	140	2.5	55	140	0.0	55	140	0.0	70	180	0.0	94	240	0.0
1300	6.0	31	140	3.7	33	140	2.7	49	140	0.0	49	140	0.0	70	200	0.0	98	280	0.0
1150	6.4	31	140	3.8	33	140	2.8	46	140	0.0	53	160	0.0	73	220	0.0	99	300	0.0
1000	6.9	35	160	4.0	37	160	3.0	39	160	2.0	49	160	0.0	74	240	0.0	98	320	0.0
900	7.3	35	160	4.1	37	160	3.1	44	180	2.1	52	160	0.0	75	260	0.0	98	340	0.0
800	7.6	34	160	4.3	41	180	3.3	43	180	2.3	50	180	0.0	70	280	2.6	90	360	3.9
750	7.8	39	180	4.3	41	180	3.3	43	180	2.3	49	180	0.0	70	280	2.6	95	380	3.9
700	7.9	38	180	4.4	41	180	3.4	43	180	2.4	48	180	0.0	70	280	2.8	95	380	4.2
650	8.0	38	180	4.6	41	180	3.6	47	200	2.6	48	180	0.0	74	300	3.2	94	380	4.8
⊗ 602	8.0	38	180	4.7	40	180	3.7	47	200	2.7	48	180	0.0	74	300	3.4	99	400	5.1

NOTE:

CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

DESIGN FACTORS FOR A DESIGN SPEED OF 50 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY-50		WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT			WIDTH-72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0
15000	2.1	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0
10000	2.1	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0
7000	2.1	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0	160	160	0.0
5000	2.4	140	160	0.0	140	160	0.0	140	160	0.0	140	160	0.0	140	160	0.0	140	160	0.0
4000	2.9	116	160	0.0	116	160	0.0	116	160	0.0	116	160	0.0	116	160	0.0	116	160	0.0
3000	3.7	91	160	0.0	91	160	0.0	91	160	0.0	91	160	0.0	91	160	0.0	103	180	0.0
2500	4.3	36	160	3.2	38	160	2.2	79	160	0.0	79	160	0.0	79	160	0.0	108	220	0.0
2250	4.7	36	160	3.3	38	160	2.3	72	160	0.0	72	160	0.0	81	180	0.0	108	240	0.0
2000	5.1	36	160	3.4	38	160	2.4	66	160	0.0	66	160	0.0	83	200	0.0	108	260	0.0
1750	5.6	36	160	3.5	38	160	2.5	60	160	0.0	60	160	0.0	83	220	0.0	105	280	0.0
1500	6.2	35	160	3.7	38	160	2.7	55	160	0.0	55	160	0.0	82	240	0.0	102	300	0.0
1300	6.7	35	160	3.8	37	160	2.8	51	160	0.0	57	180	0.0	82	260	0.0	107	340	0.0
1150	7.2	35	160	3.9	42	180	2.9	47	160	0.0	53	180	0.0	76	260	0.0	105	360	0.0
1000	7.6	39	180	4.1	41	180	3.1	48	200	2.1	56	200	0.0	78	280	0.0	105	380	0.0
900	7.9	39	180	4.3	46	200	3.3	48	200	2.3	54	200	0.0	80	300	0.0	102	380	0.0
800	8.0	38	180	4.4	45	200	3.4	48	200	2.4	53	200	0.0	80	320	2.8	105	420	4.2
⊗ 760	8.0	38	180	4.5	45	200	3.5	48	200	2.5	53	200	0.0	80	320	3.0	104	420	4.5

NOTE:

CR, LS & w VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

⊗ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 55 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=55		WIDTH=18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT			WIDTH=72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
15000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
10000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
7000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
5000	2.8	135	180	0.0	135	180	0.0	135	180	0.0	135	180	0.0	135	180	0.0	135	180	0.0
4000	3.4	112	180	0.0	112	180	0.0	112	180	0.0	112	180	0.0	112	180	0.0	112	180	0.0
3000	4.4	86	180	0.0	86	180	0.0	86	180	0.0	86	180	0.0	86	180	0.0	115	240	0.0
2500	5.0	40	180	3.3	43	180	2.3	76	180	0.0	76	180	0.0	84	200	0.0	110	260	0.0
2250	5.4	40	180	3.4	43	180	2.4	70	180	0.0	70	180	0.0	86	220	0.0	109	280	0.0
2000	5.9	40	180	3.5	42	180	2.5	65	180	0.0	65	180	0.0	86	240	0.0	114	320	0.0
1750	6.4	40	180	3.6	42	180	2.6	60	180	0.0	60	180	0.0	86	260	0.0	112	340	0.0
1500	7.0	40	180	3.8	42	180	2.8	54	180	0.0	54	180	0.0	84	280	0.0	108	360	0.0
1300	7.5	39	180	4.0	46	200	3.0	49	200	2.0	56	200	0.0	84	300	0.0	112	400	0.0
1150	7.8	43	200	4.1	46	200	3.1	48	200	2.1	54	200	0.0	81	300	0.0	108	400	0.0
1000	8.0	43	200	4.3	46	200	3.3	53	220	2.3	58	220	0.0	84	320	0.0	111	420	0.0
⊗ 964	8.0	43	200	4.3	46	200	3.3	53	220	2.3	58	220	0.0	84	320	0.0	111	420	3.9

NOTE:

CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 60 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=60		WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT			WIDTH-72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
15000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
10000	2.1	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0	180	180	0.0
7000	2.4	158	180	0.0	158	180	0.0	158	180	0.0	158	180	0.0	158	180	0.0	158	180	0.0
5000	3.3	115	180	0.0	115	180	0.0	115	180	0.0	115	180	0.0	115	180	0.0	115	180	0.0
4000	4.0	95	180	0.0	95	180	0.0	95	180	0.0	95	180	0.0	95	180	0.0	116	220	0.0
3000	5.0	76	180	0.0	76	180	0.0	76	180	0.0	76	180	0.0	84	200	0.0	118	280	0.0
2500	5.8	40	180	3.4	43	180	2.4	66	180	0.0	66	180	0.0	87	240	0.0	116	320	0.0
2250	6.2	40	180	3.5	42	180	2.5	61	180	0.0	61	180	0.0	89	260	0.0	116	340	0.0
2000	6.7	40	180	3.6	42	180	2.6	57	180	0.0	57	180	0.0	88	280	0.0	113	360	0.0
1750	7.2	40	180	3.8	47	200	2.8	53	180	0.0	59	200	0.0	88	300	0.0	117	400	0.0
1500	7.7	44	200	3.9	46	200	2.9	55	200	0.0	60	220	0.0	88	320	0.0	115	420	0.0
1300	8.0	43	200	4.1	50	220	3.1	58	220	2.1	58	220	0.0	84	320	0.0	116	440	0.0
⊕ 1204	8.0	43	200	4.2	50	220	3.2	58	220	2.2	58	220	0.0	84	320	0.0	116	440	0.0

NOTE:

CR, LS & w VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

⊕ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 65 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=65		WIDTH=18 FT			WIDTH=20 FT			WIDTH=22 FT			WIDTH=24 FT			WIDTH=48 FT			WIDTH=72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS(FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0
15000	2.1	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0
10000	2.1	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0	200	200	0.0
7000	2.7	156	200	0.0	156	200	0.0	156	200	0.0	156	200	0.0	156	200	0.0	156	200	0.0
5000	3.7	114	200	0.0	114	200	0.0	114	200	0.0	114	200	0.0	114	200	0.0	125	220	0.0
4000	4.4	96	200	0.0	96	200	0.0	96	200	0.0	96	200	0.0	96	200	0.0	125	260	0.0
3000	5.6	75	200	0.0	75	200	0.0	75	200	0.0	75	200	0.0	98	260	0.0	128	340	0.0
2500	6.5	44	200	3.5	47	200	2.5	65	200	0.0	65	200	0.0	97	300	0.0	130	400	0.0
2250	6.9	44	200	3.6	47	200	2.6	61	200	0.0	67	220	0.0	98	320	0.0	128	420	0.0
2000	7.4	44	200	3.7	51	220	2.7	57	200	0.0	63	220	0.0	97	340	0.0	125	440	0.0
1750	7.8	48	220	3.9	51	220	2.9	60	220	0.0	65	240	0.0	97	360	0.0	124	460	0.0
1500	8.0	48	220	4.1	55	240	3.1	58	240	2.1	63	240	0.0	95	360	0.0	126	480	0.0
⊕ 1488	8.0	48	220	4.1	55	240	3.1	58	240	2.1	63	240	0.0	95	360	0.0	126	480	0.0

NOTE:

CR, LS & w VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.

⊕ MINIMUM ALLOWABLE RADIUS

DESIGN FACTORS FOR A DESIGN SPEED OF 70 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=70		WIDTH-18 FT			WIDTH-20 FT			WIDTH-22 FT			WIDTH-24 FT			WIDTH-48 FT			WIDTH-72 FT		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																	
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'		
RADIUS (FT)	E(%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
20000	2.1	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0
15000	2.1	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0	220	220	0.0
10000	2.2	210	220	0.0	210	220	0.0	210	220	0.0	210	220	0.0	210	220	0.0	210	220	0.0
7000	3.0	154	220	0.0	154	220	0.0	154	220	0.0	154	220	0.0	154	220	0.0	154	220	0.0
5000	4.1	113	220	0.0	113	220	0.0	113	220	0.0	113	220	0.0	113	220	0.0	134	260	0.0
4000	5.0	93	220	0.0	93	220	0.0	93	220	0.0	93	220	0.0	101	240	0.0	126	300	0.0
3000	6.3	74	220	0.0	74	220	0.0	74	220	0.0	74	220	0.0	100	300	0.0	127	380	0.0
2500	7.2	49	220	3.6	52	220	2.6	65	220	0.0	65	220	0.0	100	340	0.0	129	440	0.0
2250	7.6	48	220	3.7	51	220	2.7	61	220	0.0	67	240	0.0	100	360	0.0	128	460	0.0
2000	8.0	48	220	3.9	56	240	2.9	58	220	0.0	63	240	0.0	95	360	0.0	126	480	0.0
⊗ 1821	8.0	45	220	4.0	55	240	3.0	58	240	2.0	63	240	0.0	95	360	0.0	126	480	0.0

NOTE:

CR, LS & w VALUES IN FEET.

⊗ MINIMUM ALLOWABLE RADIUS

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET
USE LS VALUES DEVELOPED BY IGRDS.