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ROAD AND BRIDGE STANDARDS

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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 802.15 FOR CROWN TRANSITIONS, SHEET 802.16 FOR URBAN PROJECTS AND SHEET 802.17 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 802.16, 802.17 AND 802.18 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 802.15 FOR CROWN TRANSITIONS, SHEET 802.16 FOR URBAN PROJECTS OR AS GIVEN ON SHEET 802.17 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 802.16 AND 802.17.

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

THE DESIGNER SHOULD EXERCISE CAUTION IN THE USE OF COMPOUND AND REVERSE CURVES UNLESS TOPOGRAPHICAL OR RIGHT OF WAY RESTRICTIONS MAKE THEIR USE APPROPRIATE. THE USE OF BROKEN-BACK CURVES SHOULD BE AVOIDED EXCEPT WHERE VERY UNUSUAL TOPOGRAPHICAL OR RIGHT OF WAY CONDITIONS MAKE OTHER ALTERNATIVES IMPRACTICAL. THE USE OF BROKEN-BACK CURVES MAY REQUIRE A DESIGN EXCEPTION FROM THE STATE LOCATION AND DESIGN ENGINEER. SEE SHEETS 802.11 THRU 802.14 FOR GENERAL INFORMATION ON COMPOUND, REVERSE AND BROKEN-BACK CURVE INFORMATION. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR SPECIFIC COMPOUND AND REVERSE CURVE DESIGN INFORMATION.

A DESIGN EXCEPTION IS NOT REQUIRED WHEN USING VALUES FROM SHEETS 802.23 THRU 802.42 SINCE THESE TABLES WERE DERIVED WITHIN AASHTO GUIDELINES.

REFER TO CHAPTER 4 OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR INFORMATION ON THE USE OF 18' PAVEMENT WIDTHS (9' LANE WIDTHS).

ALL TANGENT RUNOUT SECTION (L_t) VALUES AND SUPERELEVATION RUNOFF LENGTHS (L_r) LISTED IN THE TABLES HAVE BEEN ROUNDED UP TO THE NEAREST FOOT. ALL L_t VALUES ARE BASED ON A 2% CROWN.

SPECIFICATION REFERENCE	<h3 style="margin: 0;">EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE GENERAL CONDITIONS</h3> <p style="margin: 0; font-size: small;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	ROAD AND BRIDGE STANDARDS				
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center; font-size: x-small;">REVISION DATE</td> <td style="width: 50%; text-align: center; font-size: x-small;">SHEET 1 OF 1</td> </tr> <tr> <td colspan="2" style="text-align: center; font-size: x-small;">802.01</td> </tr> </table>	REVISION DATE	SHEET 1 OF 1	802.01	
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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 ONLT TO URBAN LOW SPEED CONDITIONS.
- LrLENGTH OF TRANSITION CURVE MEASURED ALONG BASELINE. WHERE NO TRANSITION CURVE IS APPLIED Lr IS LENGTH OF SUPERELEVATION RUNOFF SECTION.
- W OR PWWIDTH OF STANDARD PAVEMENT.
- ZTDISTANCE FROM TRANSITIONED BASELINE TO EDGES OF TRANSITIONED PAVEMENT
- wMAXIMUM TOTAL PAVEMENT WIDENING.
- ERATE OF SUPERELEVATION.
- FSAFE SIDE FRICTION FACTOR.
- SAMOUNT OF SUPERELEVATION TO BE APPLIED TO THE BASELINE GRADE TO OBTAIN THE ELEVATIONS OF THE EDGES OF TRANSITIONED PAVEMENT.
- CDIFFERENCE IN ELEVATION BETWEEN BASELINE (CENTER) AND EDGE OF PAVEMENT FOR STANDARD PAVEMENT CROWN.
- LtSTANDARD PAVEMENT CROWN TRANSITION OR TANGENT RUNOUT SECTION.
- CPCHORD POINT (1/10 INCREMENTS OF TRANSITION CURVE).
- NPC.....NORMAL PAVEMENT CROWN.

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



ROAD AND BRIDGE STANDARDS

TRANSITION CURVES FOR RURAL AND URBAN HIGHWAYS AND STREET CONDITIONS

SPECIFICATION REFERENCE

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VIRGINIA DEPARTMENT OF TRANSPORTATION

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 THE MINIMUM ALLOWABLE SUPERELEVATION, TRANSITION LENGTHS, AND WIDENING CORRECTIONS FOR STANDARD RURAL PAVEMENT WIDTHS THROUGH A RANGE OF 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 802.02.

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR RURAL CONDITIONS SEE SHEETS 802.32 THRU 802.42.

ON CURVES WITH GREATER THAN 2865 FT RADIUS, THERE WILL BE NO PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THE TABLES. SEE SHEET 802.06 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

ON CURVES WITH PAVEMENT WIDTHS OF 24' OR WIDER AND A RADIUS OF 882 FT. OR GREATER, THERE WILL BE NO PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THESE TABLES.

WHEN USING COMPOUND OR REVERSE CURVES WITH RURAL CONDITIONS, SEE SHEETS 802.11, 802.13 AND 802.14 FOR POLICY ON THE USE OF SPIRAL TRANSITIONS.

FOR CURVE RADII NOT LISTED IN TABLES, REFER TO SHEET 802.21 TO CALCULATE SUPERELEVATION RUNOFF LENGTH (L_r) AND PAVEMENT WIDENING (w).

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

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR RURAL CONDITIONS SEE SHEET 802.19.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 802.01.

SEE SHEET 802.05 FOR A GRAPHICAL ILLUSTRATION OF SPIRAL TRANSITIONS.

SPECIFICATION REFERENCE	EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE	 ROAD AND BRIDGE STANDARDS	
RURAL CONDITION VIRGINIA DEPARTMENT OF TRANSPORTATION			

URBAN CONDITION

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

THESE TABLES CONTAIN THE MINIMUM SUPERELEVATION RATES AND TRANSITION LENGTHS FOR STANDARD URBAN PAVEMENT WIDTHS THROUGH A RANGE OF 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 802.02.

A TABLE FOR "LOW SPEED URBAN" DESIGNS IS ON SHEET 802.23 WITH A RANGE OF STANDARD PAVEMENT WIDTHS (W), TRANSITION LENGTHS (L_r), AND RADII 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 802.24 THRU 802.31

THE USE OF SPIRAL TRANSITIONS FOR COMPOUND AND REVERSE CURVES ON URBAN ROADWAYS SHOULD BE AVOIDED. HOWEVER, THE ENGINEER DOES HAVE LATITUDE IN THE USE OF SPIRAL TRANSITIONS IF THE GEOMETRICS ARE WARRANTED. SHOULD SPIRAL TRANSITIONS BE UTILIZED, SEE PAGE 802.13 AND 802.14 FOR DETAILS. WHEN URBAN CONDITIONS APPLY THERE WILL BE NO PAVEMENT WIDENING. THE LENGTH OF TRANSITION (L_r) DETERMINES THE LENGTH OF SUPERELEVATION TRANSITION THROUGH WHICH THE OUTER EDGE OF PAVEMENT IS RAISED ABOVE THE BASELINE GRADE TO A MAXIMUM OF $E(\frac{W}{2})$. SEE SHEET 802.07 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO SHEET 802.21 TO CALCULATE TRANSITION LENGTHS (L_r).

L_r 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 802.18.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 802.01.



ROAD AND BRIDGE STANDARDS

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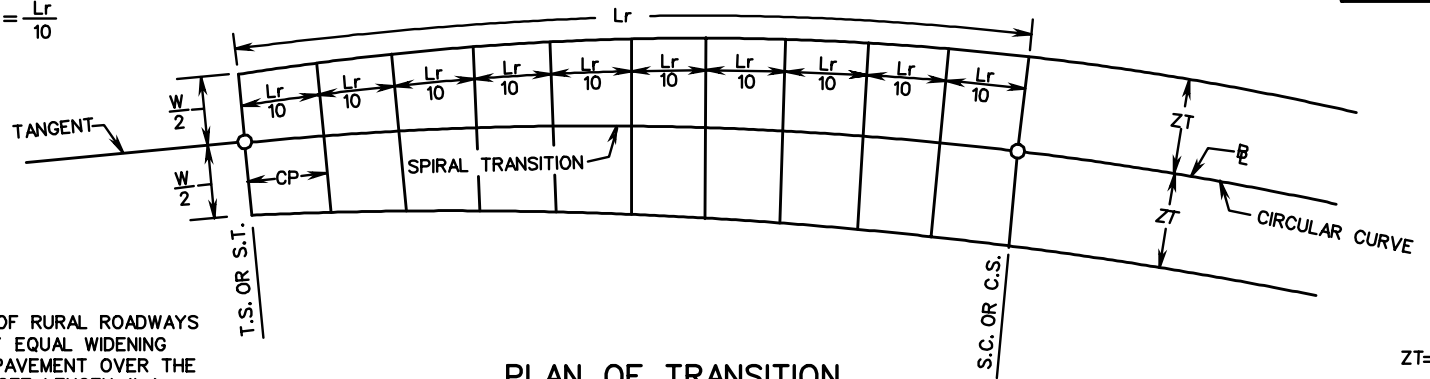
802.04

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE URBAN CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

CHORD POINTS (CP) = $\frac{Lr}{10}$

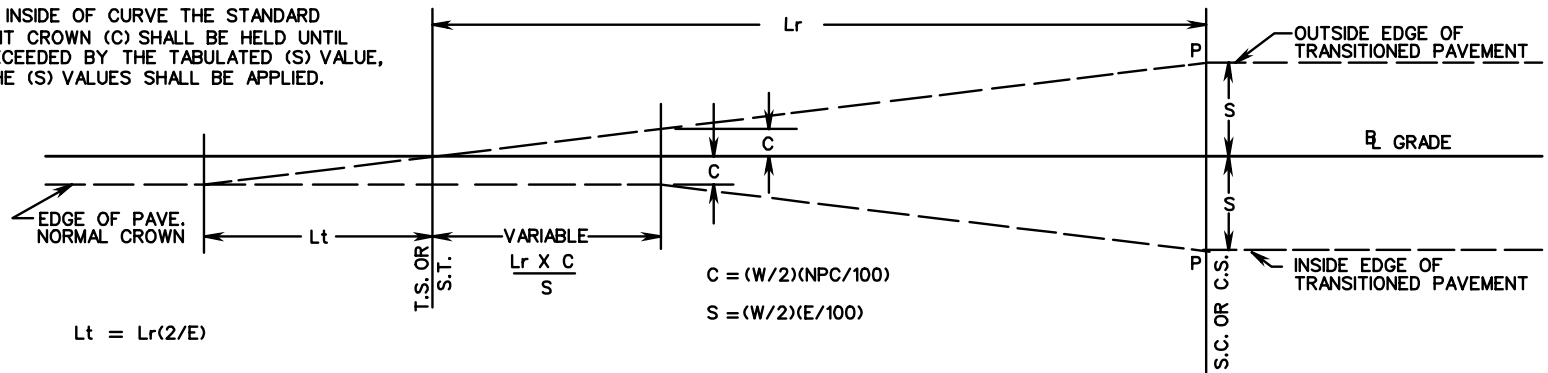


NOTE:
PAVEMENT WIDENING OF RURAL ROADWAYS WILL BE ACHIEVED BY EQUAL WIDENING OF BOTH EDGES OF PAVEMENT OVER THE SUPERELEVATION RUNOFF LENGTH (Lr).

PLAN OF TRANSITION

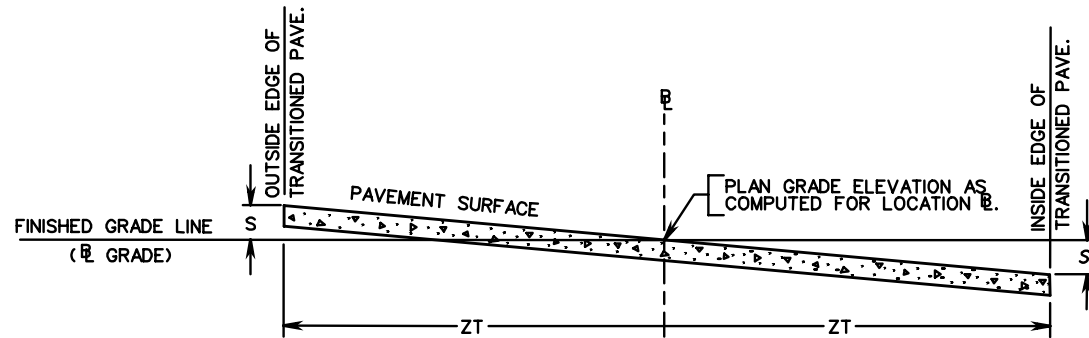
$ZT = \frac{W + w}{2}$

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.



PROFILE OF TRANSITION

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



CROSS SECTION THRU TRANSITION

SPECIFICATION REFERENCE

DETAIL FOR TRANSITIONED \mathbb{B}
RURAL CONDITION WITH PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

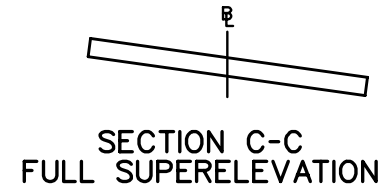
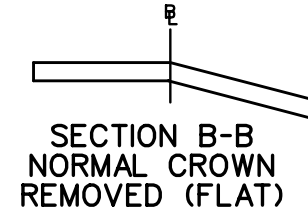
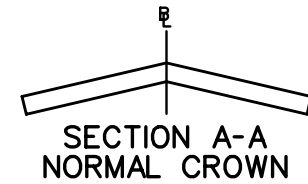
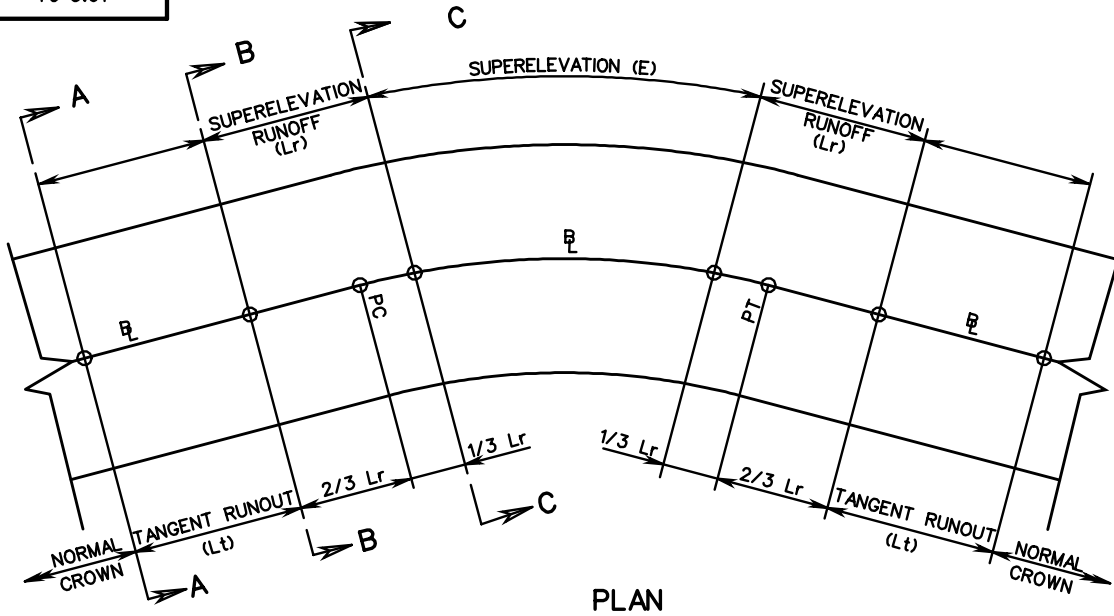
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ROAD AND BRIDGE STANDARDS

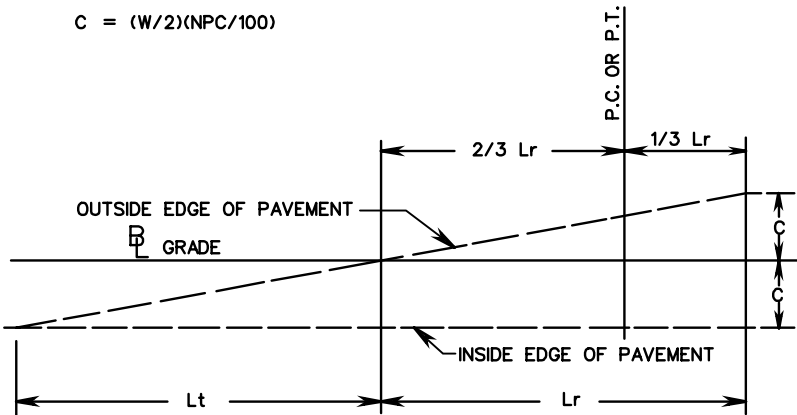
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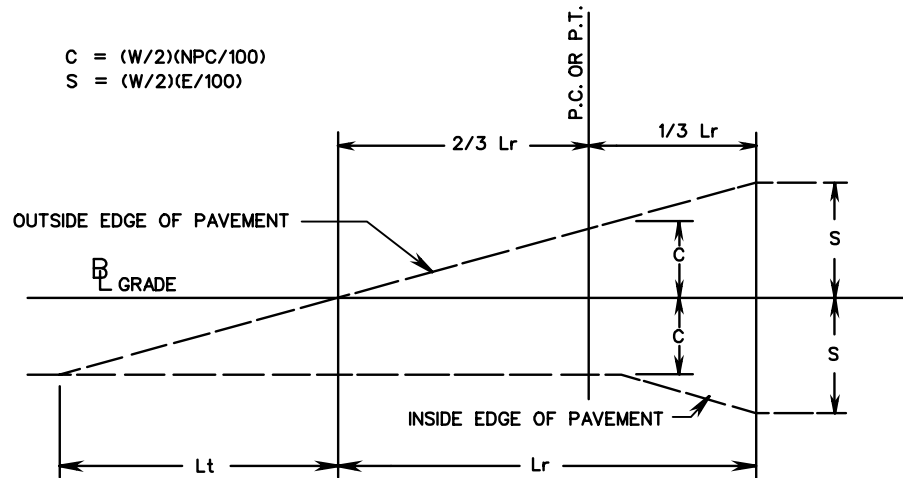


$C = (W/2)(NPC/100)$



SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN

$C = (W/2)(NPC/100)$
 $S = (W/2)(E/100)$



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



ROAD AND BRIDGE STANDARDS

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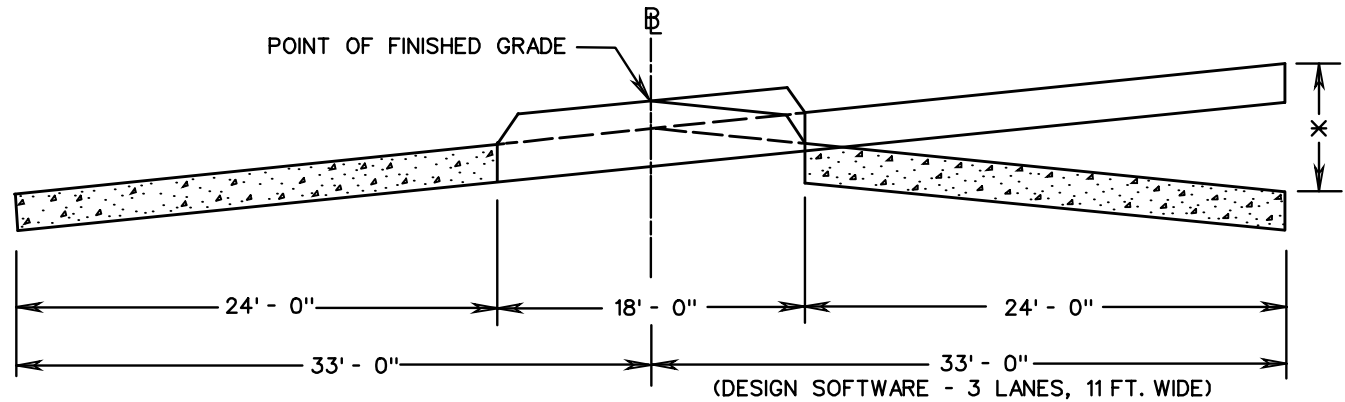
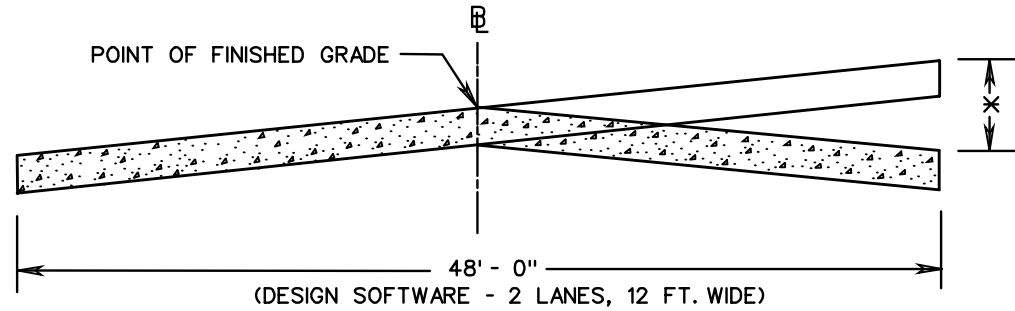
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DETAIL FOR NON-TRANSITION **B**
 URBAN & RURAL CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
 REFERENCE



× 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-5.04ULS, TC-5.01U , AND TC-5.01R (WITHOUT PAVEMENT WIDENING) SUPERELEVATED CURVES, POSITION THE SUPERELEVATION RUNOFF SECTION (L_r) 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 TS, SC, CS, ST AND EVERY 25' INCREMENT (i.e., 10+00, 10+25, 10+50, 10+75, etc...)

SPECIFICATION REFERENCE

DETAILS OF SUPERELEVATION ABOUT BASELINE

VIRGINIA DEPARTMENT OF TRANSPORTATION

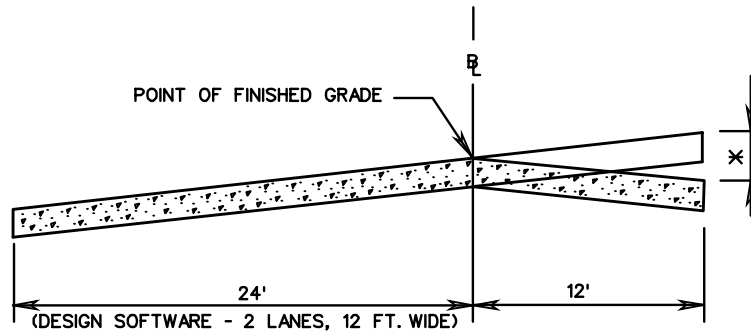
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ROAD AND BRIDGE STANDARDS

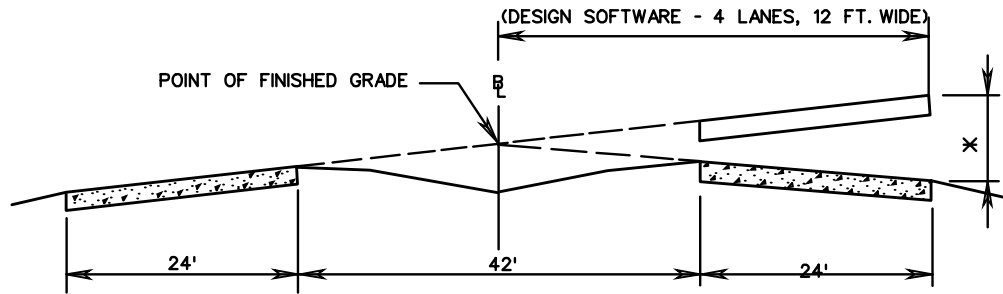
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802.07



THE PAVEMENT WIDTHS SHOWN IN THE STANDARD TC-5.01 TABLES ON SHEET 802.24 THROUGH 802.42 REPRESENT TWICE THE DISTANCE FROM THE CROWLINE 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.



ROAD AND BRIDGE STANDARDS

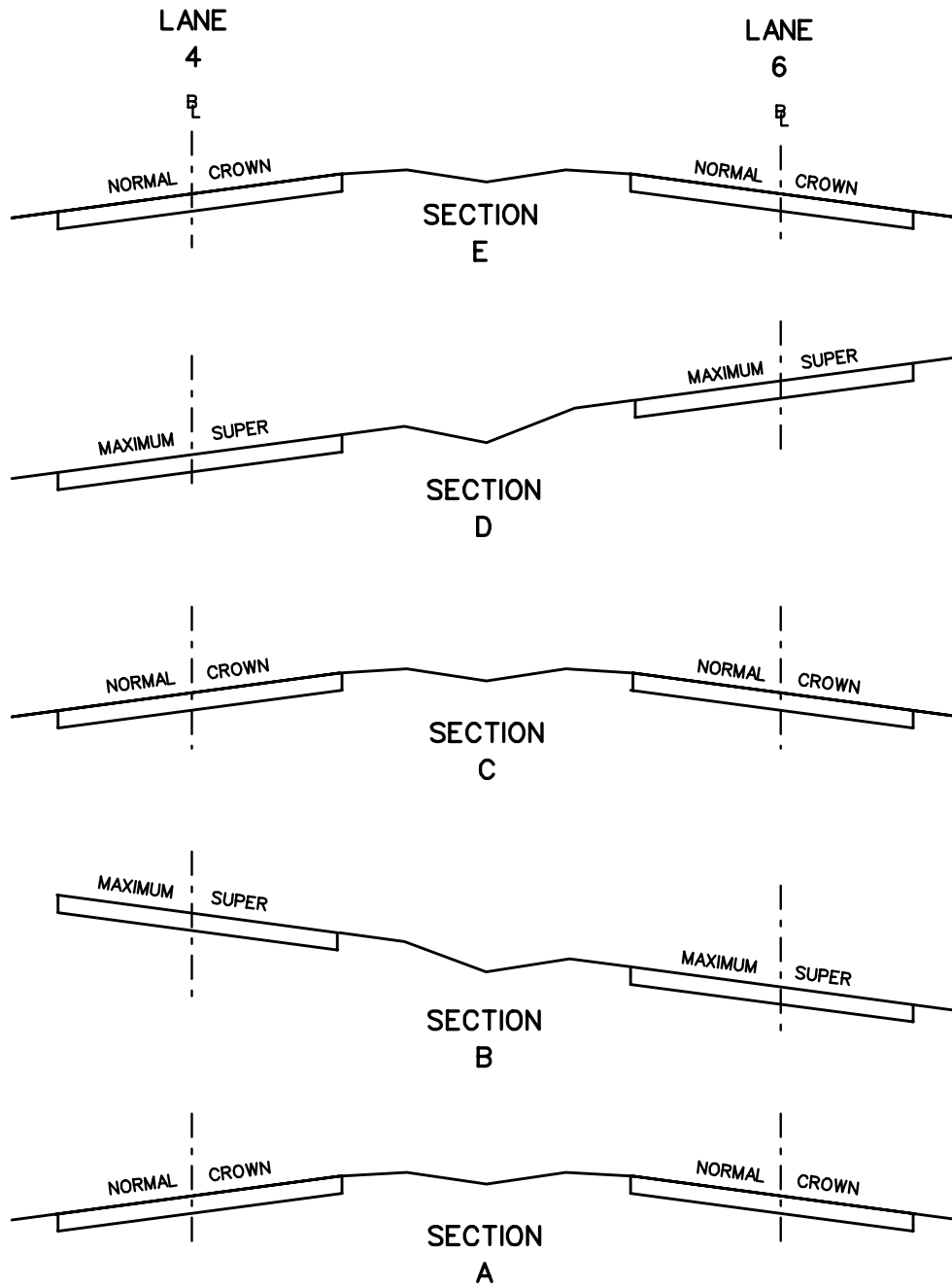
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DETAILS OF SUPERELEVATION ABOUT BASELINE

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ROAD AND BRIDGE STANDARDS

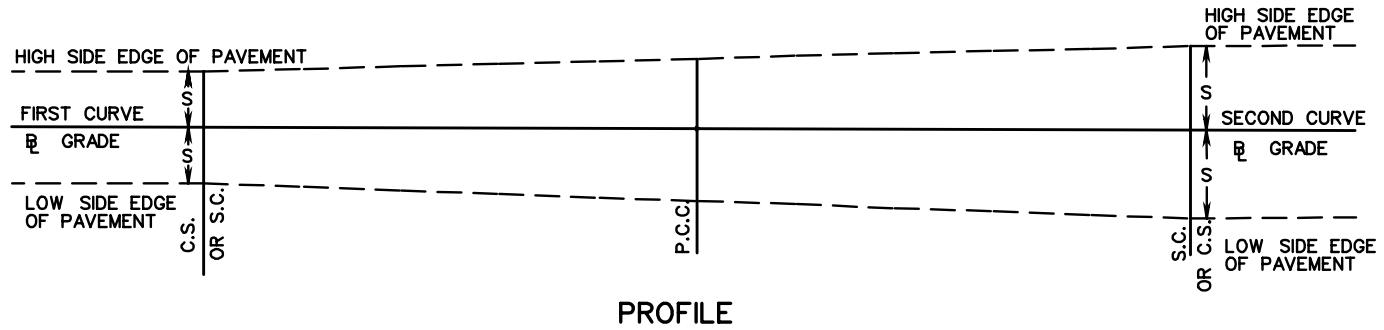
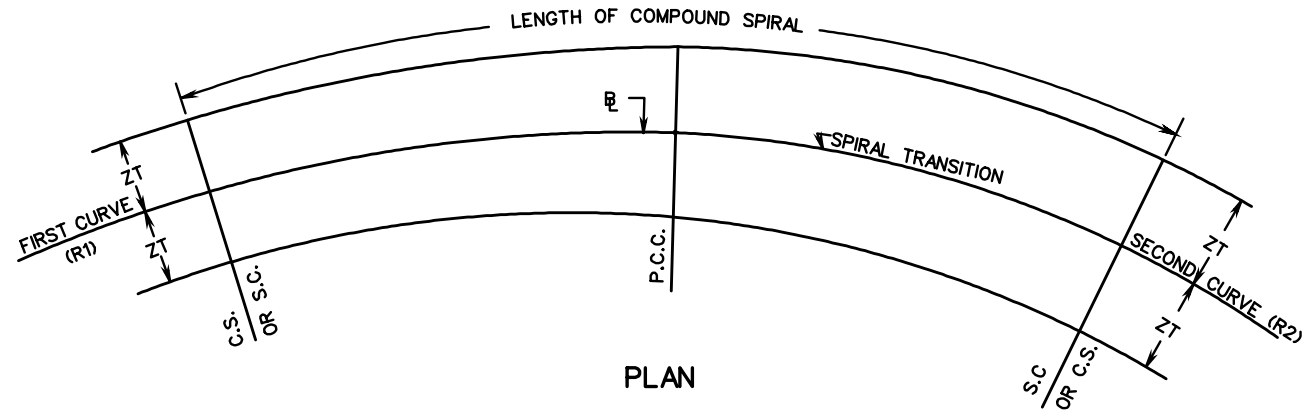
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CROSS SECTION - FOUR LANE ROADWAY

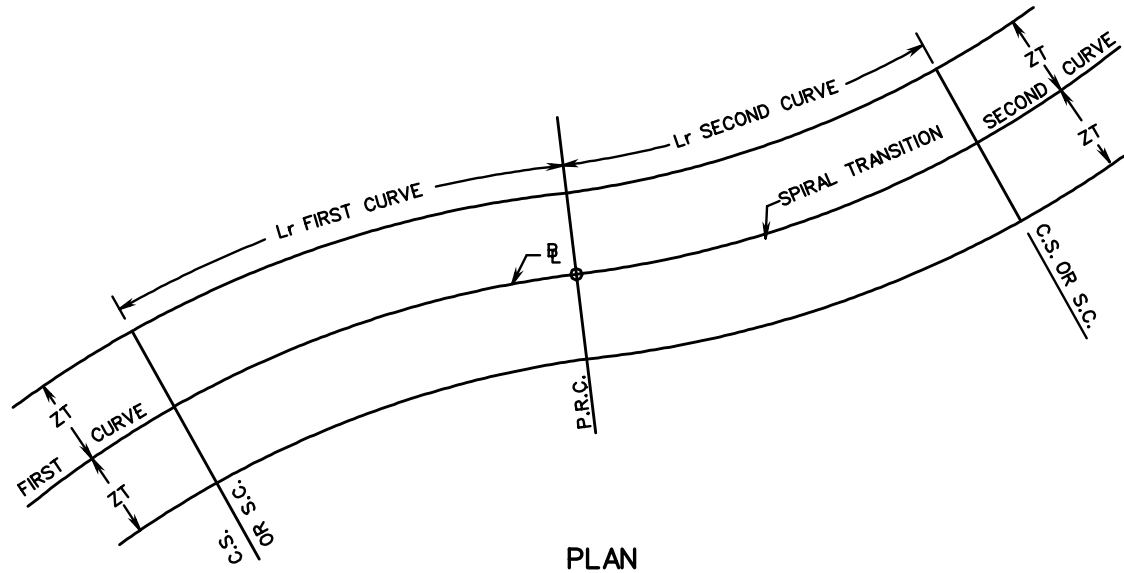
VIRGINIA DEPARTMENT OF TRANSPORTATION



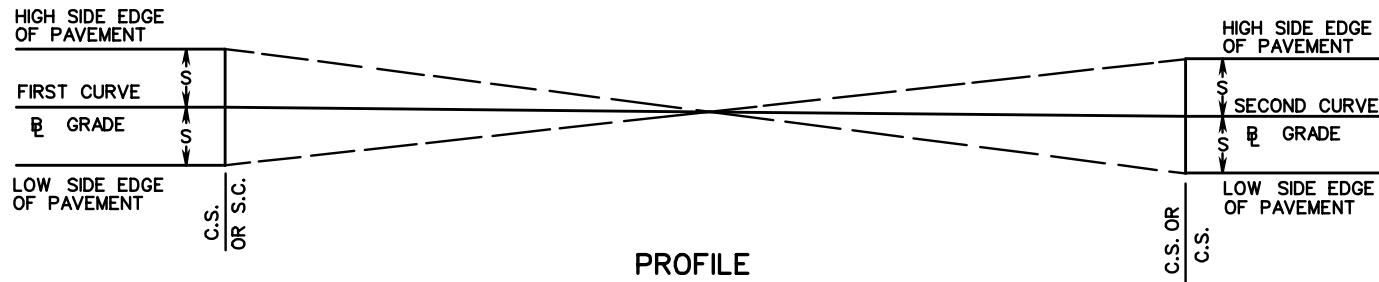
NOTE:

1. FOR COMPOUND CURVES ON OPEN ROADWAYS, THE RATIO OF FLATTER RADIUS (R_1) TO THE SHARPER RADIUS (R_2) SHALL NOT EXCEED 1.5:1. WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED.
2. FOR COMPOUND CURVES ON RAMPS AND AT INTERSECTIONS, THE RATIO OF THE FLATTER RADIUS (R_1) TO THE SHARPER RADIUS (R_2) SHALL NOT EXCEED 2:1.
3. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
4. REFER TO CHAPTER 3 OF THE AASHTO GREEN BOOK FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.

<p>SPECIFICATION REFERENCE</p>	<p>METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES RURAL CONDITIONS WITH PAVEMENT WIDENING</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>VDOT ROAD AND BRIDGE STANDARDS</p>				
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">REVISION DATE</td> <td style="width: 50%;">SHEET 1 OF 1</td> </tr> <tr> <td colspan="2" style="text-align: center;">802.11</td> </tr> </table>	REVISION DATE	SHEET 1 OF 1	802.11	
REVISION DATE	SHEET 1 OF 1					
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PLAN



PROFILE

NOTE:

1. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
2. REFER TO CHAPTER 3 OF THE AASHTO'S A POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.



ROAD AND BRIDGE STANDARDS

METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
RURAL CONDITION WITH PAVEMENT WIDENING

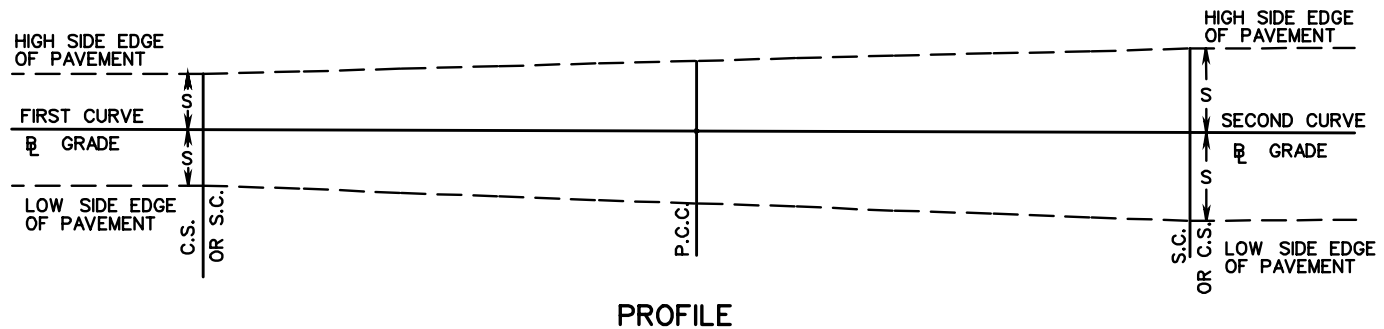
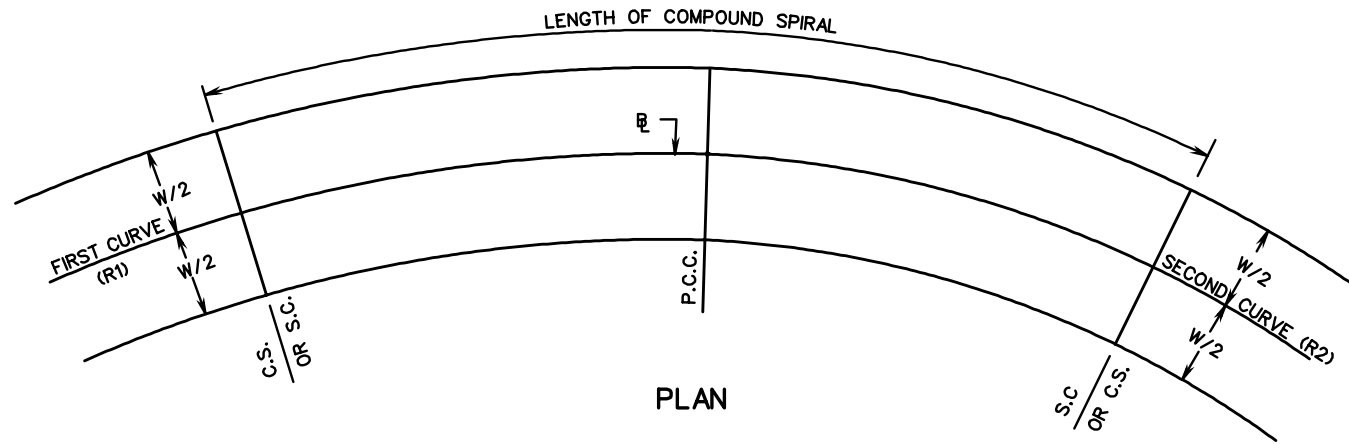
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VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:

1. FOR COMPOUND CURVES ON OPEN ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1 WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED.
2. FOR COMPOUND CURVES ON RAMPS AND AT INTERSECTIONS, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1.
3. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF COMPOUND SPIRAL COMPUTED PER PAGE 802.21.
4. REFER TO CHAPTER 3 OF THE AASHTO GREEN BOOK FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.
5. THE USE OF SPIRAL TRANSITIONS FOR COMPOUND AND REVERSE CURVES ON URBAN ROADWAYS SHOULD BE AVOIDED. HOWEVER, THE ENGINEER DOES HAVE LATITUDE IN THE USE OF SPIRAL TRANSITIONS IF THE GEOMETRICS ARE WARRANTED.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES
URBAN & RURAL CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

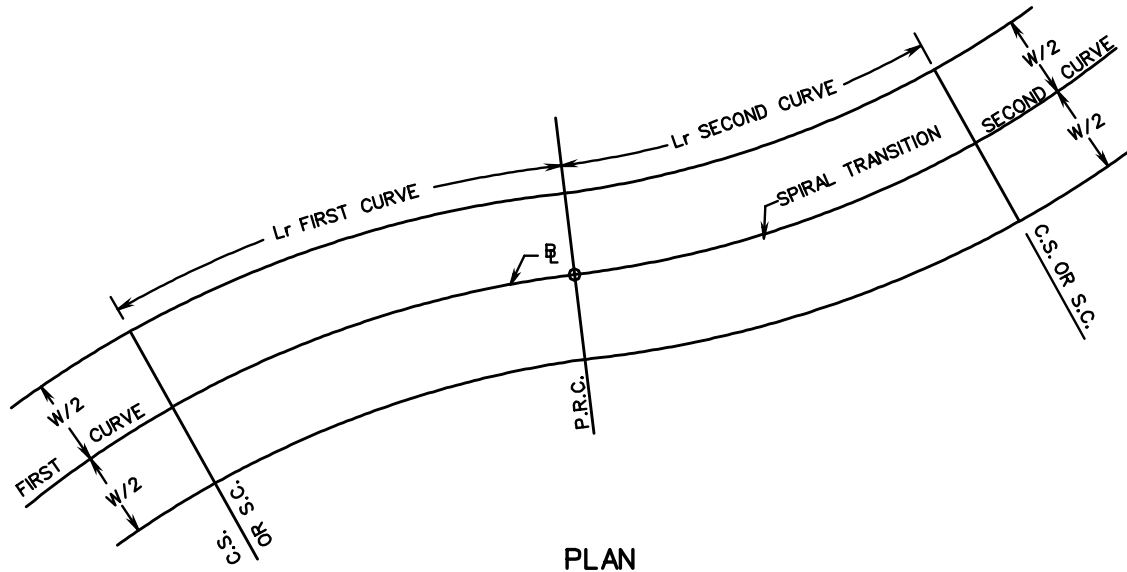
VDOT

ROAD AND BRIDGE STANDARDS

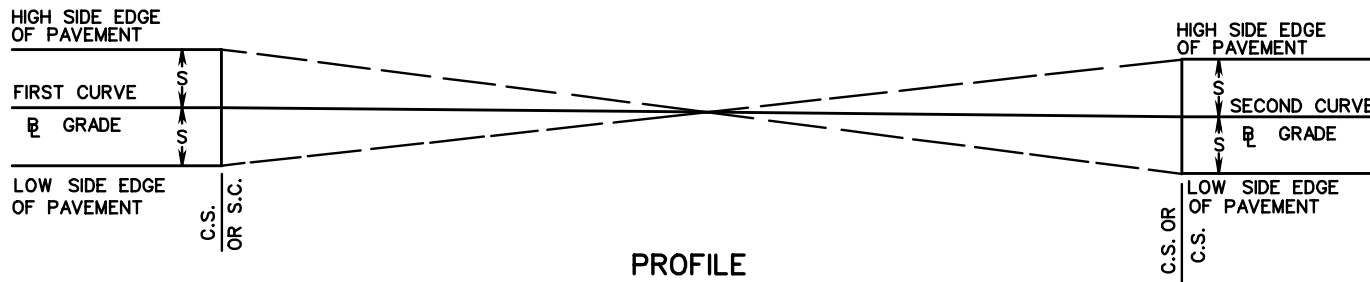
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PLAN



PROFILE

NOTE:

1. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF SUPERELEVATION RUNOFF (Lr) COMPUTED PER PAGE 802.21.
2. REFER TO CHAPTER 3 OF THE AASHTO'S A POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.
3. THE USE OF SPIRAL TRANSITIONS FOR COMPOUND AND REVERSE CURVES ON URBAN ROADWAYS SHOULD BE AVOIDED. HOWEVER, THE ENGINEER DOES HAVE LATITUDE IN THE USE OF SPIRAL TRANSITIONS IF THE GEOMETRICS ARE WARRANTED.



ROAD AND BRIDGE STANDARDS

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METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
URBAN & RURAL CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

TRANSITION TABLE

LENGTH OF TANGENT RUNOUT (Lt)	START/END OF SUPERELEVATION RUNOFF (Lr)	DISTANCE IN FEET FROM START/END OF SUPERELEVATION RUNOFF SECTION (Lr)				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 FORM STAKES SET (CONCRETE PAVEMENT ONLY).

URBAN CONDITIONS RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT
(Lr POSITIONED 2/3 ±ON TANGENT, 1/3 ±ON CURVE)

LENGTH OF SUPERELEVATION RUNOFF (Lr)	END/ BEGIN TANGENT RUNOUT (Lt)	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.



ROAD AND BRIDGE STANDARDS

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TABLE I

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

RURAL CONDITIONS WITH PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT

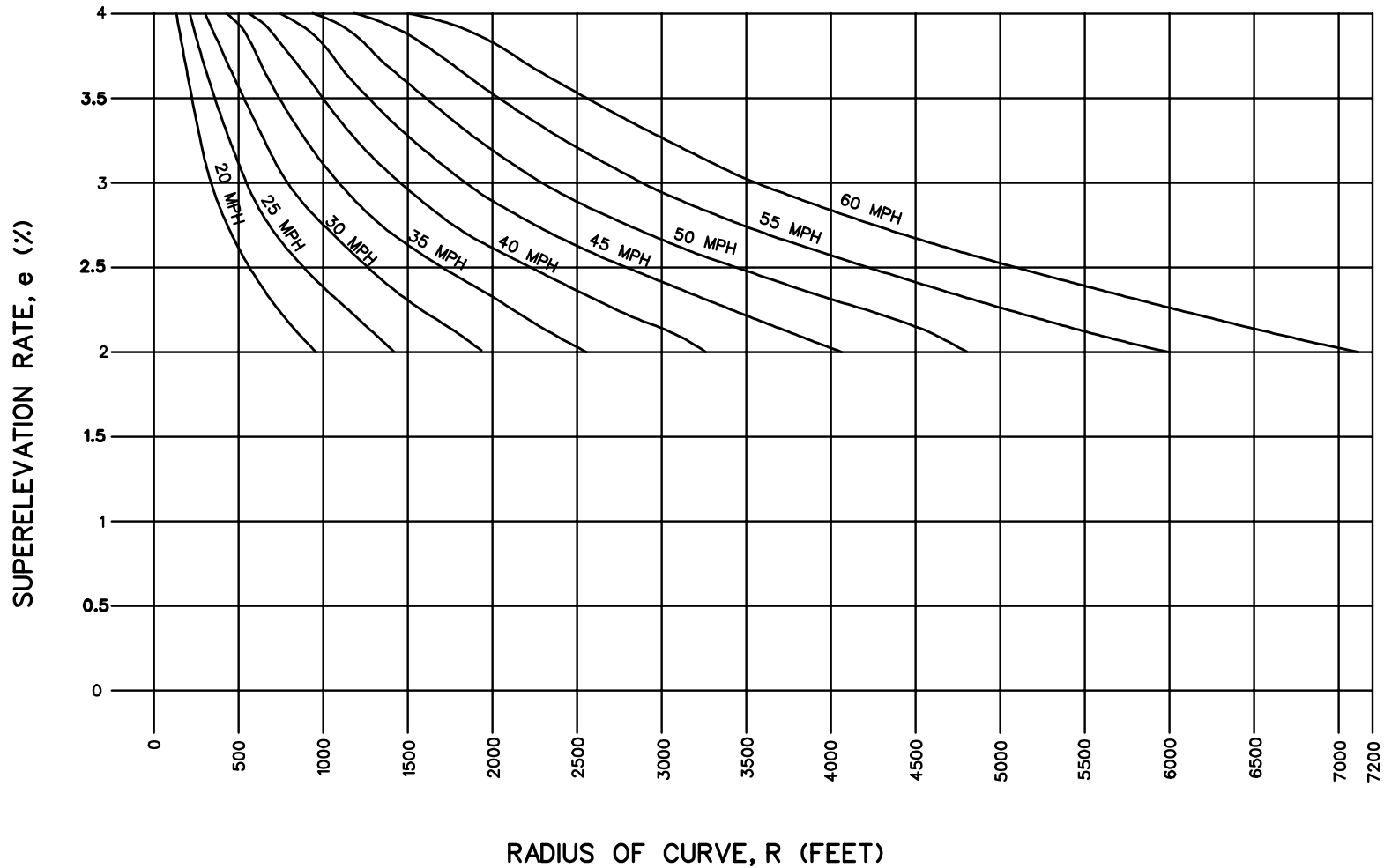
LENGTH OF SUPERELEVATION RUNOFF (Lr)	T.S. OR S.T.	DISTANCE IN FEET FROM T.S. OR S.T. ALONG SPIRAL TRANSITION									S.C. OR C.S.
		1	2	3	4	5	6	7	8	9	
		480	0	48	96	144	192	240	288	336	
460	0	46	92	138	184	230	276	322	368	414	460
440	0	44	88	132	176	220	264	308	352	396	440
420	0	42	84	126	168	210	252	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.

SPECIFICATION REFERENCE	<h2>TABLE 2</h2>	VDOT ROAD AND BRIDGE STANDARDS	
		REVISION DATE	SHEET 1 OF 1 802.17
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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.

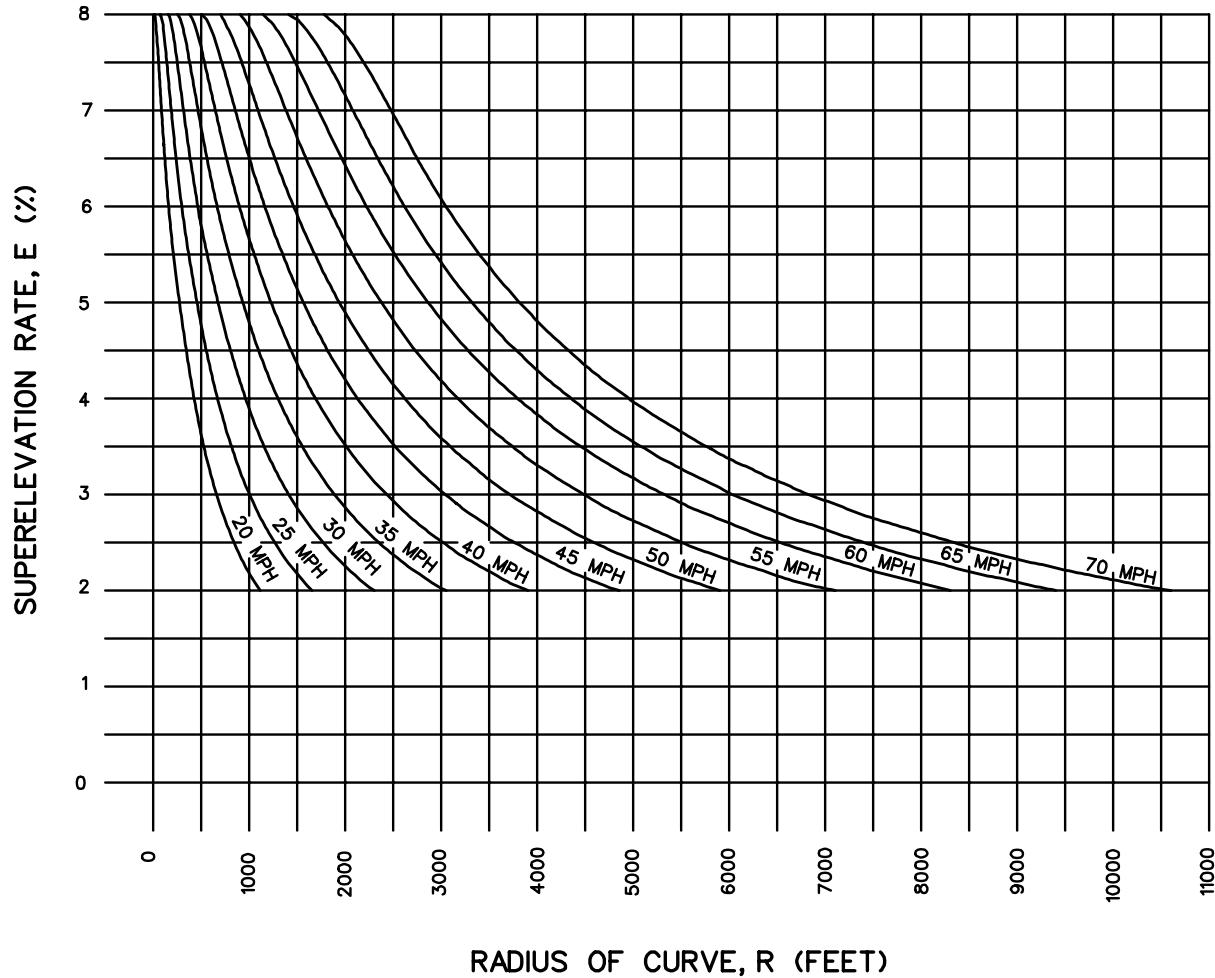
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ROAD AND BRIDGE STANDARDS	
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DESIGN SUPERELEVATION RATES URBAN CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

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REFERENCE

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SPECIFICATION
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DESIGN SUPERELEVATION RATES RURAL CONDITIONS

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CURVE WIDENING TABLES

SU DESIGN VEHICLE

COMPONENT	SIZE
OVERALL WIDTH (u)	8.0 ft
WHEELBASE (L)	20 ft
FRONT OVERHANG (A)	4 ft

LATERAL CLEARANCE

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

ADJUSTMENT FACTORS

NUMBER OF LANES ROTATED n_1	ADJUSTMENT FACTOR (b_w)
1	1.00
1.5	0.8333
2	0.75
2.5	0.70
3	0.6667
3.5	0.6425

RELATIVE GRADIENTS

DESIGN SPEED V_D MPH	MAXIMUM RELATIVE GRADIENT (rg)	MIN. TRANSITION LENGTH IN FEET RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE CURVES FOR ALL CONDITIONS (2 SECOND RULE)	MAXIMUM RELATIVE GRADIENT (rg) RAMP AND LOOPS	
			18' LANE	24' LANE
20	0.74	59	0.89	0.99
25	0.70	74	0.84	0.93
30	0.66	88	0.80	0.88
35	0.62	103	0.75	0.83
40	0.58	117	0.70	0.77
45	0.54	132	0.65	0.72
50	0.50	147	0.60	0.67
55	0.47	161	0.57	0.63
60	0.45	176	0.54	0.60
65	0.43	191	0.52	0.57
70	0.40	205	0.48	0.53

- A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- b_w - ADJUSTMENT FACTOR FROM TABLE.
- C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- E - SUPERELEVATION RATE FROM APPROPRIATE TABLE.
- F_A - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.
- L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- L_r - LENGTH OF SUPERELEVATION RUNOFF SECTION.

DEFINITIONS

- L_t - LENGTH OF TANGENT RUNOUT SECTION
- M - MULTIPLE LANE FACTOR.
- N - NUMBER OF LANES.
- n_1 - NUMBER OF LANES ROTATED (FROM TABLES).
- 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 - PAVEMENT WIDTH
- W_C - CALCULATED TOTAL CURVE WIDTH.
- W_n - WIDTH OF LANE.
- Z - CALCULATED EXTRA WIDTH ALLOWANCE.

GENERAL DESIGN CONSIDERATIONS

1. WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE SUPERELEVATION RUNOFF LENGTH (L_r).
2. THE COMPUTED SUPERELEVATION RUNOFF LENGTH (L_r) IS ROUNDED UP TO THE NEAREST FOOT.
3. WHEN THE SUPERELEVATION RUNOFF LENGTH (L_r) IS CALCULATED, IT MUST BE COMPARED WITH THE MINIMUM VALUE LISTED IN THE APPROPRIATE COLUMN ON THE RELATIVE GRADIENT TABLE.
4. TANGENT RUNOUT (L_t) IS ALWAYS ACHIEVED OUTSIDE OF THE SUPERELEVATION RUNOFF SECTION (L_r).
5. NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.
6. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH A CURVE RADIUS GREATER THAN 2865 FEET.
7. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH 12 FOOT WIDE LANES AND A CURVE RADIUS GREATER THAN 881 FEET.
8. PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (w) IS EQUAL TO OR GREATER THAN 2 FEET.
9. WHEN CALCULATING WIDENING (w) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "W".
10. AN ALTERNATE METHOD FOR MULTI-LANE UNDIVIDED PAVEMENTS (48'), THE L_r IS 1.5 TIMES (M-1.5) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS; AND FOR SIX LANE UNDIVIDED PAVEMENTS (72'), THE L_r IS TWO TIMES (M-2) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS.
11. CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 FOOT.
12. CURVES WITH SPIRAL CURVE TRANSITIONS MUST HAVE A MINIMUM SUPERELEVATION RUNOFF LENGTH (L_r) EQUAL TO 2 SECONDS OF TRAVEL TIME AT THE ROADWAY'S DESIGN SPEED AS NOTED IN THE RELATIVE GRADIENT TABLE.

NO WIDENING REQUIRED FORMULAS USED TO CALCULATE SUPERELEVATION RUNOFF (L_r) AND WIDENING (w)

$L_r = b_w (W_n n_1 E / rg)$
 $L_r = M(WE/rg)$ (ALT. MULTI-LANE)

WIDENING REQUIRED
 $L_r = b_w [E n_1 (W_n + w/N) / rg]$
 $L_r = m[E(W_n + w/N) / rg]$ (ALT. MULTI-LANE)

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

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

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

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

$w = W_C - 2W_n$

FOR SOLVED PROBLEMS USING THIS METHODOLOGY, SEE THE EXAMPLES ON PAGE 802.22

SPECIFICATION REFERENCE

METHODOLOGIES FOR CALCULATING TC-5.01 VALUES



ROAD AND BRIDGE STANDARDS

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RURAL EXAMPLE20 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 10 FT)

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

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

$$E = 7.6 \text{ (7.6\% PER 802.40)}$$

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

$$U = 8.0 + 1000 - \sqrt{(1000)^2 - (20)^2}$$

$$U = 8.20002$$

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

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

$$F_A = .087996$$

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

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

$$Z = 1.58$$

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

$$W_C = 2(8.20002 + 2) + 0.087996 + 1.58$$

$$W_C = 22.0680$$

$$w = W_C - 2W_n = 22.0680 - 2(10) = 2.1$$

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

$$L_r = [E n_s (W_n + w/2) / rg] b_w$$

$$L_r = [7.6(1)(10 + 2.1/2) / 0.50] 1$$

$$L_r = 7.6 (11.05) / 0.50$$

$$L_r = 167.96$$

RURAL EXAMPLE72 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 12 FT)

$$V_D = 40 \text{ MPH} \quad R = 500 \text{ FT}$$

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

$$E = 8.0 \text{ (8\% PER PAGE 802.38)}$$

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

$$U = 8.0 + 500 - \sqrt{(500)^2 - (20)^2}$$

$$U = 8.4002$$

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

$$F_A = \sqrt{(500)^2 + 4[2(20) + 4]} - 500$$

$$F_A = .1760$$

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

$$Z = (40 / \sqrt{500})$$

$$Z = 1.7885$$

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

$$W_C = 2(8.4002 + 3.0) + .1760 + 1.7885$$

$$W_C = 24.7651$$

$$w = W_C - 2W_n = 24.7651 - 2(12) = 0.7651(0.8)$$

FOR 72' PAVEMENT WIDTH

$$w = 3(0.8) = 2.4$$

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

$$L_r = [E n_s (W_n + w/3) / rg] b_w$$

$$L_r = [8 (3) (12 + 2.4/3) / 0.58] 0.6667$$

$$L_r = (307.2 / 0.58) 0.6667$$

$$L_r = 353.1211$$

OR

$$L_r = M[E(W_n + w/N) / rg]$$

$$L_r = 2 [8(12 + 4.5/3) / 0.58]$$

$$L_r = 2 (102.4 / 0.58)$$

$$L_r = 353.1034$$

URBAN EXAMPLES24 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 12 FT)

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

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

$$E = 4.0 \text{ (4\% PER PAGE 802.29)}$$

$$L_r = (W_n n_s E / rg) b_w$$

$$L_r = [12(1)(4) / 0.58] 1.00$$

$$L_r = (48 / 0.58)$$

$$L_r = 82.7586$$

66 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 11 FT)

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

$$W_n = 11 \text{ FT} \quad rg = 0.58$$

$$E = 4.0 \text{ (4\% PER PAGE 802.29)}$$

$$L_r = b_w (W_n n_s E / rg)$$

$$L_r = 0.6667 [11(3)(4) / 0.58]$$

$$L_r = 0.6667 (132 / 0.58)$$

$$L_r = 151.7317$$

OR

$$L_r = M (E W_n / rg)$$

$$L_r = 2 [4(11) / 0.58]$$

$$L_r = 2 (44 / 0.58)$$

$$L_r = 151.7241$$



ROAD AND BRIDGE STANDARDS

CALCULATED TC-5.01 EXAMPLESSPECIFICATION
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VIRGINIA DEPARTMENT OF TRANSPORTATION

MINIMUM RADII AND SUPERELEVATION RUNOFF SECTION LENGTHS (L_r) FOR +2% SUPERELEVATION

RADIUS (FEET)	E (%)	f	DV (MPH)	LENGTH OF SUPERELEVATION RUNOFF (L _r) IN FEET						
				PAVEMENT WIDTH (W)						W > 72'
				24' (1@12')	36' (1.5@12')	48' (2@12')	60' (3@10')	66' (3@11')	72' (3@12')	
> 795	2.0	0.150	45	45	56	67	75	82	90	*
593	2.0	0.160	40	42	52	63	70	77	84	*
408	2.0	0.180	35	39	49	59	65	72	78	*
273	2.0	0.200	30	37	46	55	61	67	74	*
167	2.0	0.230	25	35	43	52	58	64	69	*
92	2.0	0.270	20	33	41	49	55	60	66	*

* FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE L_r VALUES DEVELOPED BY THE DESIGN SOFTWARE.

**MINIMUM RADII FOR DESIGNS
UTILIZING -2% SUPERELEVATION NORMAL PAVEMENT CROWN**

RADIUS (FEET)	f	NC (MPH)
> 1039	.150	45
762	.160	40
510	.180	35
333	.200	30
198	.230	25
107	.270	20

SPECIFICATION
REFERENCE

**SUMMARY OF STD. TC-5.04 ULS
URBAN-LOW SPEED DESIGN FACTORS**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

802.23

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
1400	NC	0	0	0	0	0	0	0	0	0	0	0	0
961	2.0	33	33	41	41	49	49	55	55	60	60	65	65
884	2.1	33	35	41	43	49	52	55	57	60	63	65	69
810	2.2	33	36	41	45	49	54	55	60	60	66	65	72
735	2.3	33	38	41	47	49	56	55	63	60	69	65	75
653	2.4	33	39	41	49	49	59	55	65	60	72	65	78
578	2.5	33	41	41	51	49	61	55	68	60	75	65	82
516	2.6	33	43	41	53	49	64	55	71	60	78	65	85
464	2.7	33	44	41	55	49	66	55	73	60	81	65	88
421	2.8	33	46	41	57	49	69	55	76	60	84	65	91
383	2.9	33	48	41	59	49	71	55	79	60	87	65	95
351	3.0	33	49	41	61	49	73	55	82	60	90	65	98
322	3.1	33	51	41	63	49	76	55	84	60	93	65	101
296	3.2	33	52	41	65	49	78	55	87	60	96	65	104
273	3.3	33	54	41	67	49	81	55	90	60	99	65	108
252	3.4	33	56	41	69	49	83	55	92	60	102	65	111
232	3.5	33	57	41	71	49	86	55	95	60	105	65	114
214	3.6	33	59	41	73	49	88	55	98	60	108	65	117
196	3.7	33	60	41	75	49	90	55	100	60	110	65	120
179	3.8	33	62	41	77	49	93	55	103	60	113	65	124
160	3.9	33	64	41	79	49	95	55	106	60	116	65	127
127	4.0	33	65	41	81	49	98	55	109	60	119	65	130

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

802.24

**TRANSITION CURVES - URBAN
20 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
2500	NC	0	0	0	0	0	0	0	0	0	0	0	0
1407	2.0	35	35	43	43	52	52	58	58	63	63	69	69
1299	2.1	35	36	43	45	52	54	58	60	63	66	69	72
1195	2.2	35	38	43	48	52	57	58	63	63	70	69	76
1094	2.3	35	40	43	50	52	60	58	66	63	73	69	79
990	2.4	35	42	43	52	52	62	58	69	63	76	69	83
883	2.5	35	43	43	54	52	65	58	72	63	79	69	86
793	2.6	35	45	43	56	52	67	58	75	63	82	69	90
718	2.7	35	47	43	58	52	70	58	78	63	85	69	93
654	2.8	35	48	43	60	52	72	58	80	63	88	69	96
598	2.9	35	50	43	63	52	75	58	83	63	92	69	100
548	3.0	35	52	43	65	52	78	58	86	63	95	69	103
505	3.1	35	54	43	67	52	80	58	89	63	98	69	107
466	3.2	35	55	43	69	52	83	58	92	63	101	69	110
430	3.3	35	57	43	71	52	85	58	95	63	104	69	114
397	3.4	35	59	43	73	52	88	58	98	63	107	69	117
367	3.5	35	60	43	75	52	90	58	100	63	110	69	120
339	3.6	35	62	43	78	52	93	58	103	63	114	69	124
311	3.7	35	64	43	80	52	96	58	106	63	117	69	127
284	3.8	35	66	43	82	52	98	58	109	63	120	69	131
255	3.9	35	67	43	84	52	101	58	112	63	123	69	134
204	4.0	35	69	43	86	52	103	58	115	63	126	69	138

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION
REFERENCE

**TRANSITION CURVES - URBAN
25 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

802.25

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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
3000	NC	0	0	0	0	0	0	0	0	0	0	0	0
1940	2.0	37	37	46	46	55	55	61	61	67	67	73	73
1795	2.1	37	39	46	48	55	58	61	64	67	70	73	77
1658	2.2	37	40	46	50	55	60	61	67	67	74	73	80
1525	2.3	37	42	46	53	55	63	61	70	67	77	73	84
1393	2.4	37	44	46	55	55	66	61	73	67	80	73	88
1255	2.5	37	46	46	57	55	69	61	76	67	84	73	91
1134	2.6	37	48	46	60	55	71	61	79	67	87	73	95
1030	2.7	37	50	46	62	55	74	61	82	67	90	73	99
941	2.8	37	51	46	64	55	77	61	85	67	94	73	102
863	2.9	37	53	46	66	55	80	61	88	67	97	73	106
794	3.0	37	55	46	69	55	82	61	91	67	100	73	110
732	3.1	37	57	46	71	55	85	61	94	67	104	73	113
677	3.2	37	59	46	73	55	88	61	97	67	107	73	117
627	3.3	37	60	46	75	55	90	61	100	67	110	73	120
580	3.4	37	62	46	78	55	93	61	104	67	114	73	124
537	3.5	37	64	46	80	55	96	61	107	67	117	73	128
496	3.6	37	66	46	82	55	99	61	110	67	120	73	131
457	3.7	37	68	46	85	55	101	61	113	67	124	73	135
417	3.8	37	70	46	87	55	104	61	116	67	127	73	139
375	3.9	37	71	46	89	55	107	61	119	67	130	73	142
300	4.0	37	73	46	91	55	110	61	122	67	134	73	146

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



TRANSITION CURVES - URBAN
30 MPH DESIGN SPEED

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	CR	Lr		
4000	NC	0	0	0	0	0	0	0	0	0	0	0	0
2561	2.0	39	39	49	49	59	59	65	65	71	71	78	78
2374	2.1	39	41	49	51	59	61	65	68	71	75	78	82
2199	2.2	39	43	49	54	59	64	65	71	71	79	78	86
2031	2.3	39	45	49	56	59	67	65	75	71	82	78	90
1866	2.4	39	47	49	59	59	70	65	78	71	86	78	93
1697	2.5	39	49	49	61	59	73	65	81	71	89	78	97
1538	2.6	39	51	49	63	59	76	65	84	71	93	78	101
1403	2.7	39	53	49	66	59	79	65	88	71	96	78	105
1285	2.8	39	55	49	68	59	82	65	91	71	100	78	109
1182	2.9	39	57	49	71	59	85	65	94	71	103	78	113
1090	3.0	39	59	49	73	59	88	65	97	71	107	78	117
1008	3.1	39	60	49	75	59	90	65	100	71	110	78	120
933	3.2	39	62	49	78	59	93	65	104	71	114	78	124
865	3.3	39	64	49	80	59	96	65	107	71	118	78	128
802	3.4	39	66	49	83	59	99	65	110	71	121	78	132
743	3.5	39	68	49	85	59	102	65	113	71	125	78	136
688	3.6	39	70	49	88	59	105	65	117	71	128	78	140
634	3.7	39	72	49	90	59	108	65	120	71	132	78	144
580	3.8	39	74	49	92	59	111	65	123	71	135	78	148
522	3.9	39	76	49	95	59	114	65	126	71	139	78	151
420	4.0	39	78	49	97	59	117	65	130	71	142	78	155

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION REFERENCE

**TRANSITION CURVES - URBAN
35 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

802.27

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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
5000	NC	0	0	0	0	0	0	0	0	0	0	0	0
3273	2.0	42	42	52	52	63	63	69	69	76	76	83	83
3039	2.1	42	44	52	55	63	66	69	73	76	80	83	87
2820	2.2	42	46	52	57	63	69	69	76	76	84	83	92
2612	2.3	42	48	52	60	63	72	69	80	76	88	83	96
2411	2.4	42	50	52	63	63	75	69	83	76	92	83	100
2209	2.5	42	52	52	65	63	78	69	87	76	95	83	104
2010	2.6	42	54	52	68	63	81	69	90	76	99	83	108
1839	2.7	42	56	52	70	63	84	69	94	76	103	83	112
1689	2.8	42	58	52	73	63	87	69	97	76	107	83	116
1557	2.9	42	60	52	75	63	90	69	100	76	110	83	120
1439	3.0	42	63	52	78	63	94	69	104	76	114	83	125
1332	3.1	42	65	52	81	63	97	69	107	76	118	83	129
1236	3.2	42	67	52	83	63	100	69	111	76	122	83	133
1148	3.3	42	69	52	86	63	103	69	114	76	126	83	137
1066	3.4	42	71	52	88	63	106	69	118	76	129	83	141
989	3.5	42	73	52	91	63	109	69	121	76	133	83	145
916	3.6	42	75	52	94	63	112	69	125	76	137	83	149
845	3.7	42	77	52	96	63	115	69	128	76	141	83	154
774	3.8	42	79	52	99	63	118	69	132	76	145	83	158
698	3.9	42	81	52	101	63	122	69	135	76	148	83	162
563	4.0	42	83	52	104	63	125	69	138	76	152	83	166

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

802.28

TRANSITION CURVES - URBAN 40 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
6000	NC	0	0	0	0	0	0	0	0	0	0	0	0
4076	2.0	45	45	56	56	67	67	75	75	82	82	89	89
3790	2.1	45	47	56	59	67	70	75	78	82	86	89	94
3523	2.2	45	49	56	62	67	74	75	82	82	90	89	98
3271	2.3	45	52	56	64	67	77	75	86	82	94	89	103
3029	2.4	45	54	56	67	67	80	75	89	82	98	89	107
2790	2.5	45	56	56	70	67	84	75	93	82	102	89	112
2552	2.6	45	58	56	73	67	87	75	97	82	106	89	116
2341	2.7	45	60	56	75	67	90	75	100	82	110	89	120
2155	2.8	45	63	56	78	67	94	75	104	82	115	89	125
1990	2.9	45	65	56	81	67	97	75	108	82	119	89	129
1843	3.0	45	67	56	84	67	100	75	112	82	123	89	134
1710	3.1	45	69	56	87	67	104	75	115	82	127	89	138
1589	3.2	45	72	56	89	67	107	75	119	82	131	89	143
1477	3.3	45	74	56	92	67	110	75	123	82	135	89	147
1374	3.4	45	76	56	95	67	114	75	126	82	139	89	152
1276	3.5	45	78	56	98	67	117	75	130	82	143	89	156
1184	3.6	45	80	56	100	67	120	75	134	82	147	89	160
1093	3.7	45	83	56	103	67	124	75	138	82	151	89	165
1003	3.8	45	85	56	106	67	127	75	141	82	155	89	169
905	3.9	45	87	56	109	67	130	75	145	82	159	89	174
730	4.0	45	89	56	112	67	134	75	149	82	163	89	178

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION REFERENCE

**TRANSITION CURVES - URBAN
45 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

802.29

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 e 12'		1.5 e 12'		2 e 12'		3 e 10'		3 e 11'		3 e 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr		
8000	NC	0	0	0	0	0	0	0	0	0	0	0	
4792	2.0	48	48	60	60	72	72	80	80	88	88	96	96
4629	2.1	48	51	60	63	72	76	80	84	88	93	96	101
4310	2.2	48	53	60	66	72	80	80	88	88	97	96	106
4010	2.3	48	56	60	69	72	83	80	92	88	102	96	111
3723	2.4	48	58	60	72	72	87	80	96	88	106	96	116
3444	2.5	48	60	60	75	72	90	80	100	88	110	96	120
3166	2.6	48	63	60	78	72	94	80	104	88	115	96	125
2911	2.7	48	65	60	81	72	98	80	108	88	119	96	130
2686	2.8	48	68	60	84	72	101	80	112	88	124	96	135
2486	2.9	48	70	60	87	72	105	80	116	88	128	96	140
2306	3.0	48	72	60	90	72	108	80	120	88	132	96	144
2143	3.1	48	75	60	93	72	112	80	124	88	137	96	149
1994	3.2	48	77	60	96	72	116	80	128	88	141	96	154
1857	3.3	48	80	60	99	72	119	80	132	88	146	96	159
1729	3.4	48	82	60	102	72	123	80	136	88	150	96	164
1608	3.5	48	84	60	105	72	126	80	140	88	154	96	168
1493	3.6	48	87	60	108	72	130	80	144	88	159	96	173
1381	3.7	48	89	60	111	72	134	80	148	88	163	96	178
1268	3.8	48	92	60	114	72	137	80	152	88	168	96	183
1146	3.9	48	94	60	117	72	141	80	156	88	172	96	188
929	4.0	48	96	60	120	72	144	80	160	88	176	96	192

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt AND Lr VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

802.30

**TRANSITION CURVES - URBAN
50 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
10000	NC	0	0	0	0	0	0	0	0	0	0	0	0
5995	2.0	52	52	64	64	77	77	86	86	94	94	103	103
5592	2.1	52	54	64	68	77	81	86	90	94	99	103	108
5218	2.2	52	57	64	71	77	85	86	94	94	103	103	113
4869	2.3	52	59	64	74	77	89	86	98	94	108	103	118
4538	2.4	52	62	64	77	77	92	86	103	94	113	103	123
4220	2.5	52	64	64	80	77	96	86	107	94	118	103	128
3909	2.6	52	67	64	83	77	100	86	111	94	122	103	133
3610	2.7	52	69	64	87	77	104	86	115	94	127	103	138
3343	2.8	52	72	64	90	77	108	86	120	94	132	103	143
3104	2.9	52	75	64	93	77	112	86	124	94	136	103	149
2888	3.0	52	77	64	96	77	115	86	128	94	141	103	154
2691	3.1	52	80	64	99	77	119	86	132	94	146	103	159
2510	3.2	52	82	64	103	77	123	86	137	94	150	103	164
2343	3.3	52	85	64	106	77	127	86	141	94	155	103	169
2186	3.4	52	87	64	109	77	131	86	145	94	160	103	174
2037	3.5	52	90	64	112	77	135	86	149	94	164	103	179
1895	3.6	52	92	64	115	77	138	86	154	94	169	103	184
1756	3.7	52	95	64	119	77	142	86	158	94	174	103	189
1615	3.8	52	98	64	122	77	146	86	162	94	178	103	195
1462	3.9	52	100	64	125	77	150	86	166	94	183	103	200
1190	4.0	52	103	64	128	77	154	86	171	94	188	103	205

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION REFERENCE

**TRANSITION CURVES - URBAN
55 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

802.31

DESIGN FACTORS FOR A DESIGN SPEED OF 20 MPH (RURAL) USING E= 8% MAX.

Table with columns: DESIGN VELOCITY +20, RADIUS(FT), DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH), WIDTH+18 FT, WIDTH+20 FT, WIDTH+22 FT, WIDTH+24 FT, WIDTH+48 FT, INTERCHANGE RAMPS. Sub-columns for each width include Lt, Lr, w.

NOTE: Lt, Lr & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, Lr, AND w VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

802.32

TRANSITION CURVES - RURAL
20 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

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

Table with columns for Design Velocity (E=8%), Radius (ft), and design software equivalents for various lane widths (18ft, 20ft, 22ft, 24ft, 48ft). The table provides values for Lr, Lt, w, and Lr/Lt for each lane width configuration.

NOTE: Lt, Lr & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, Lr, AND w VALUES.

VDOT ROAD AND BRIDGE STANDARDS SHEET 1 OF 1 REVISION DATE 802.34

TRANSITION CURVES - RURAL 30 MPH DESIGN SPEED

SPECIFICATION REFERENCE

NOTE: L_t, L_r & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, L_t, L_r, AND w VALUES.

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

Table with columns: DESIGN VELOCITY +60, RADIUS(FT), E(%), and DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH). The table is organized into three main sections based on lane width: 1 @ 9', 1 @ 10', and 1 @ 11', each with sub-columns for width increments of 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20 feet. The 1 @ 12' section also includes columns for 3 @ 12' and INTERCHANGE RAMPS. The table lists design factors (L_t, L_r, w) for various radius values from 12000 FT to 1204 FT.



ROAD AND BRIDGE STANDARDS

TRANSITION CURVES - RURAL
60 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

TC-5.01

NOTE: L_t, L_r & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, L_t, L_r, AND w VALUES.

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

Table with columns for Radius (ft), Velocity (mph), and three sets of lane widths (10', 11', 12'). Each set includes L_t, L_r, and w values for interchanges and ramps. The table lists design factors for various radius and velocity combinations from 17000 to 1821 feet.



ROAD AND BRIDGE STANDARDS

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802.42

TRANSITION CURVES - RURAL
70 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

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 803.15 FOR CROWN TRANSITIONS, SHEET 803.16 FOR URBAN PROJECTS AND SHEET 803.17 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 803.15, 803.16 AND 803.17 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 803.15 FOR CROWN TRANSITIONS, SHEET 803.16 FOR URBAN PROJECTS OR AS GIVEN ON SHEET 803.17 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 803.16 AND 803.17.

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

THE DESIGNER SHOULD EXERCISE CAUTION IN THE USE OF COMPOUND AND REVERSE CURVES UNLESS TOPOGRAPHICAL OR RIGHT OF WAY RESTRICTIONS MAKE THEIR USE APPROPRIATE. THE USE OF BROKEN-BACK CURVES SHOULD BE AVOIDED EXCEPT WHERE VERY UNUSUAL TOPOGRAPHICAL OR RIGHT OF WAY CONDITIONS MAKE OTHER ALTERNATIVES IMPRACTICAL. THE USE OF BROKEN-BACK CURVES MAY REQUIRE A DESIGN EXCEPTION FROM THE STATE LOCATION AND DESIGN ENGINEER. SEE SHEETS 803.11 THRU 803.14 FOR GENERAL INFORMATION ON COMPOUND, REVERSE AND BROKEN-BACK CURVE INFORMATION.

A DESIGN EXCEPTION IS NOT REQUIRED WHEN USING VALUES FROM SHEETS 803.23 THRU 803.44 SINCE THESE TABLES WERE DERIVED WITHIN AASHTO GUIDELINES.

REFER TO CHAPTER 4 OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR INFORMATION ON THE USE OF 18' PAVEMENT WIDTHS (9' LANE WIDTHS).

ALL TANGENT RUNOUT SECTION (L_t) VALUES AND SUPERELEVATION RUNOFF LENGTHS (L_r) LISTED IN THE TABLES HAVE BEEN ROUNDED UP TO THE NEAREST FOOT. ALL L_t VALUES ARE BASED ON A 2% CROWN.

SPECIFICATION REFERENCE	<h3 style="margin: 0;">EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE</h3> <h3 style="margin: 0;">GENERAL CONDITIONS</h3> <p style="margin: 0; font-size: small;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	ROAD AND BRIDGE STANDARDS				
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">REVISION DATE</td> <td style="width: 50%; text-align: center;">SHEET 1 OF 1</td> </tr> <tr> <td colspan="2" style="text-align: center;">803.01</td> </tr> </table>	REVISION DATE	SHEET 1 OF 1	803.01	
REVISION DATE	SHEET 1 OF 1					
803.01						

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.
- LrLENGTH OF TRANSITION CURVE MEASURED ALONG BASELINE. WHERE NO TRANSITION CURVE IS APPLIED Lr IS LENGTH OF SUPERELEVATION RUNOFF SECTION.
- W OR PWWIDTH OF STANDARD PAVEMENT.
- ZTDISTANCE FROM TRANSITIONED BASELINE TO EDGES OF TRANSITIONED PAVEMENT
- wMAXIMUM TOTAL PAVEMENT WIDENING.
- ERATE OF SUPERELEVATION.
- FSAFE SIDE FRICTION FACTOR.
- SAMOUNT OF SUPERELEVATION TO BE APPLIED TO THE BASELINE GRADE TO OBTAIN THE ELEVATIONS OF THE EDGES OF TRANSITIONED PAVEMENT.
- CDIFFERENCE IN ELEVATION BETWEEN BASELINE (CENTER) AND EDGE OF PAVEMENT FOR STANDARD PAVEMENT CROWN.
- LtSTANDARD PAVEMENT CROWN TRANSITION OR TANGENT RUNOUT SECTION.
- CPCHORD POINT (1/10 INCREMENTS OF TRANSITION CURVE).
- NPC.....NORMAL PAVEMENT CROWN.

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



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

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803.02

TRANSITION CURVES FOR RURAL AND URBAN HIGHWAYS AND STREET CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

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 THE MINIMUM ALLOWABLE SUPERELEVATION, TRANSITION LENGTHS, AND WIDENING CORRECTIONS FOR STANDARD RURAL PAVEMENT WIDTHS THROUGH A RANGE OF 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 803.02.

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR RURAL CONDITIONS SEE SHEETS 803.32 THRU 803.44.

ON CURVES WITH NO PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THE TABLES. SEE SHEET 803.06 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

ON CURVES WITH PAVEMENT WIDENING, WIDENING WILL BE ACHEIVED BY EQUAL WIDENING OF BOTH EDGES OF PAVEMENT OVER THE SUPERELEVATION RUNOFF LENGTH. SEE PAGE 803.05 FOR DETAILS.

WHEN USING COMPOUND OR REVERSE CURVES WITH RURAL CONDITIONS, SEE SHEETS 803.11, 803.12, 803.13, AND 803.14 FOR DETAILS OF TRANSITIONS.

FOR CURVE RADII NOT LISTED IN TABLES, REFER TO SHEET 803.20 TO CALCULATE SUPERELEVATION RUNOFF LENGTH (L_r) AND PAVEMENT WIDENING (w).

L_r AND E SHALL BE SHOWN ON THE PLANS FOR ALL CURVES.

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 803.01.

<p>SPECIFICATION REFERENCE</p>	<p>EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE</p>	<p>VDOT ROAD AND BRIDGE STANDARDS</p>	
		<p>REVISION DATE</p>	<p>SHEET 1 OF 1</p>

URBAN CONDITION

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

THESE TABLES CONTAIN THE MINIMUM SUPERELEVATION RATES AND TRANSITION LENGTHS FOR STANDARD URBAN PAVEMENT WIDTHS THROUGH A RANGE OF 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 803.02.

A TABLE FOR "LOW SPEED URBAN" DESIGNS IS ON SHEET 803.23 WITH A RANGE OF STANDARD PAVEMENT WIDTHS (W), TRANSITION LENGTHS (L_r), AND RADII 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 803.24 THRU 803.31

THE USE OF SPIRAL TRANSITIONS FOR COMPOUND AND REVERSE CURVES ON URBAN ROADWAYS SHOULD BE AVOIDED. HOWEVER, THE ENGINEER DOES HAVE LATITUDE IN THE USE OF SPIRAL TRANSITIONS IF THE GEOMETRICS ARE WARRANTED. SHOULD SPIRAL TRANSITIONS BE UTILIZED, SEE PAGE 803.13 AND 803.14 FOR DETAILS. WHEN URBAN CONDITIONS APPLY THERE WILL BE NO PAVEMENT WIDENING. THE LENGTH OF TRANSITION (L_r) DETERMINES THE LENGTH OF SUPERELEVATION TRANSITION THROUGH WHICH THE OUTER EDGE OF PAVEMENT IS RAISED ABOVE THE BASELINE GRADE TO A MAXIMUM OF $E(\frac{W}{2})$. SEE SHEET 803.07 FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO SHEET 803.20 TO CALCULATE TRANSITION LENGTHS (L_r).

L_r SHALL BE SHOWN ON THE PLANS FOR ALL CURVES.

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

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE SHEET 803.01.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

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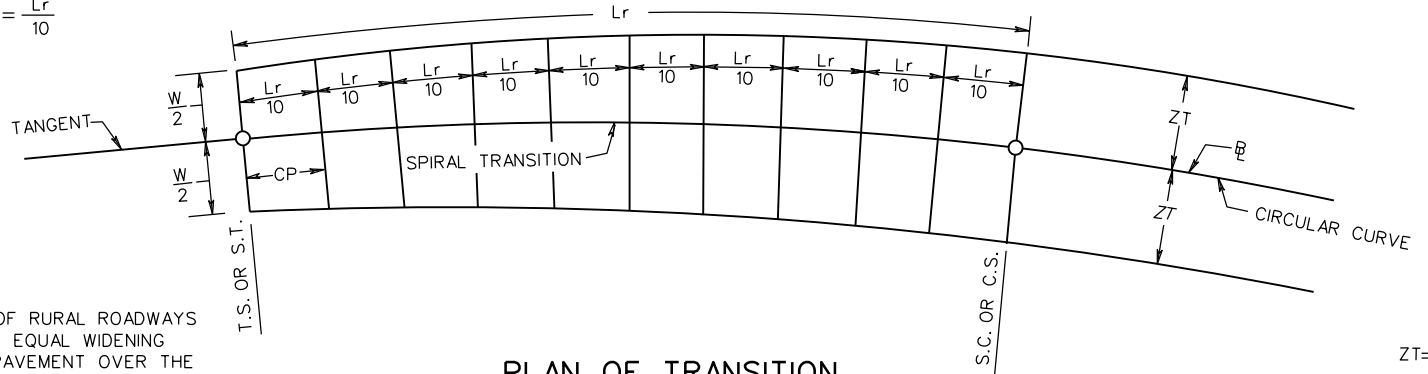
803.04

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE URBAN CONDITION

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

CHORD POINTS (CP) = $\frac{Lr}{10}$



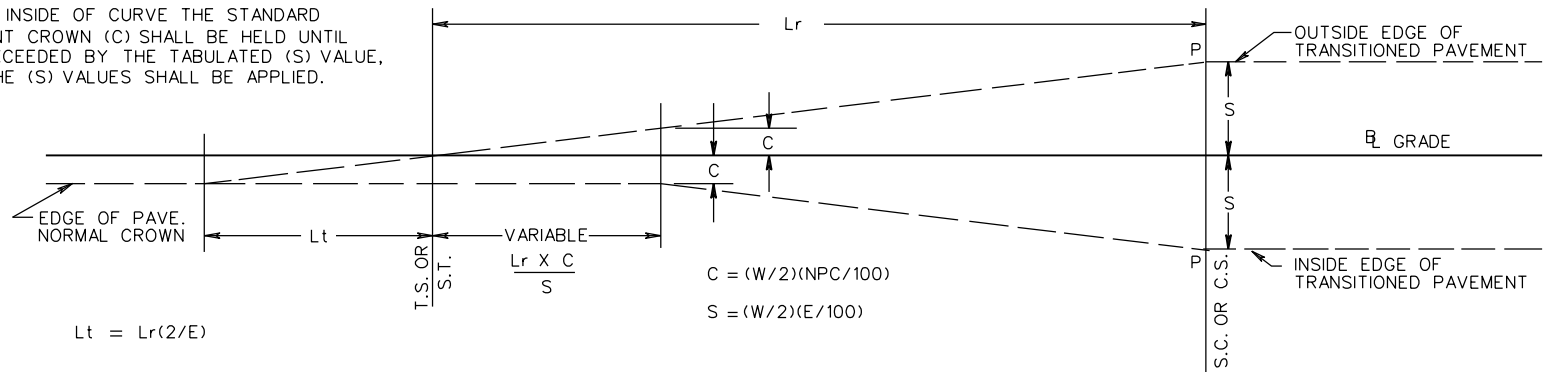
NOTE:

PAVEMENT WIDENING OF RURAL ROADWAYS WILL BE ACHIEVED BY EQUAL WIDENING OF BOTH EDGES OF PAVEMENT OVER THE SUPERELEVATION RUNOFF LENGTH (L_r).

PLAN OF TRANSITION

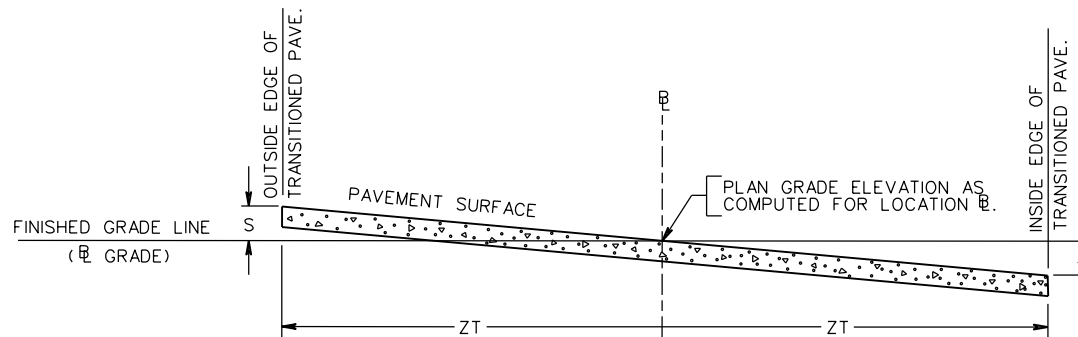
NOTE:

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.



PROFILE OF TRANSITION

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



CROSS SECTION THRU TRANSITION

SPECIFICATION REFERENCE

DETAIL FOR TRANSITIONED $\frac{B}{2}$ RURAL CONDITION WITH PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

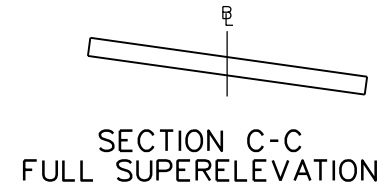
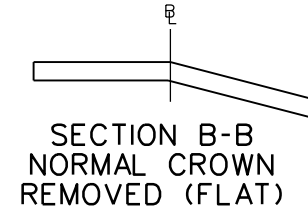
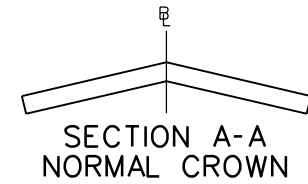
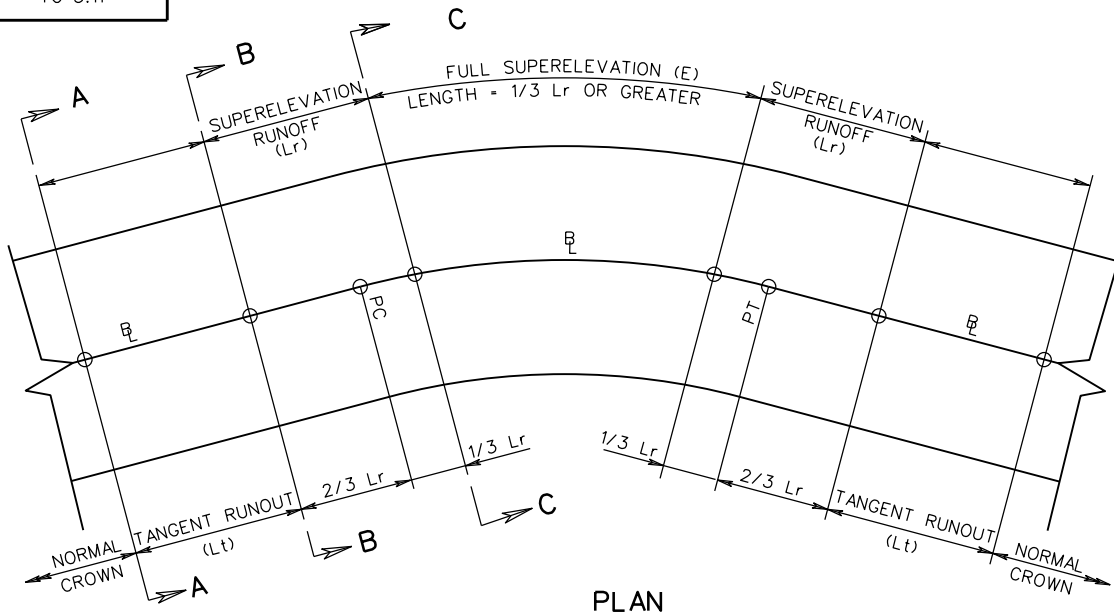
VDOT

ROAD AND BRIDGE STANDARDS

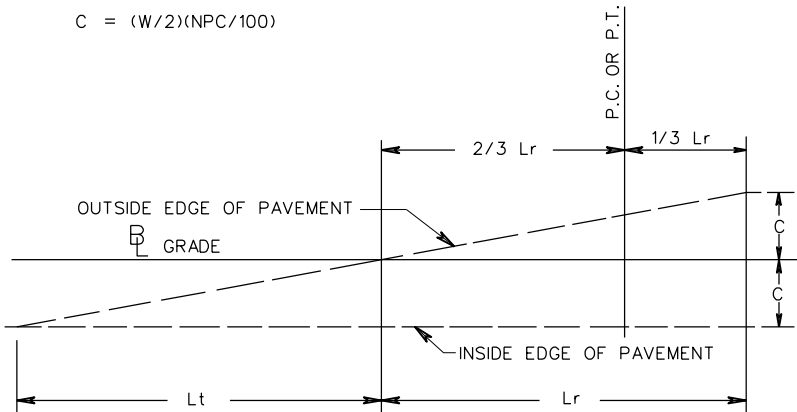
REVISION DATE

SHEET 1 OF 1

803.05



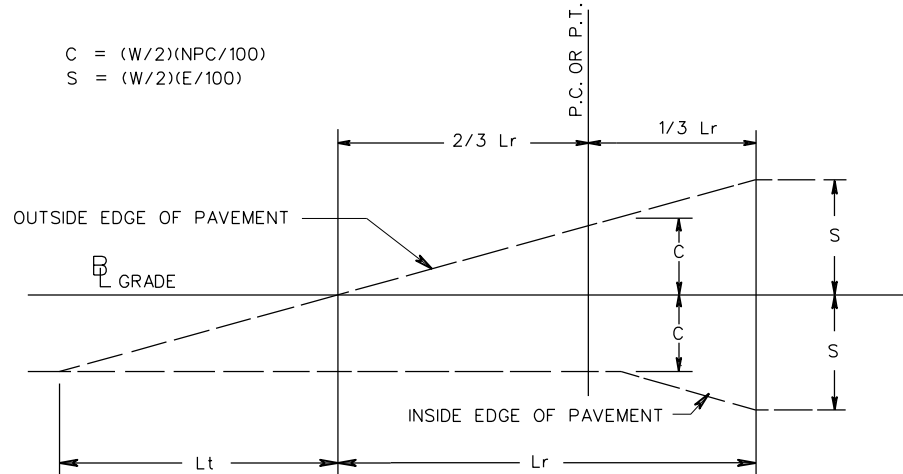
$$C = (W/2)(NPC/100)$$



SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN

$$C = (W/2)(NPC/100)$$

$$S = (W/2)(E/100)$$



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



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

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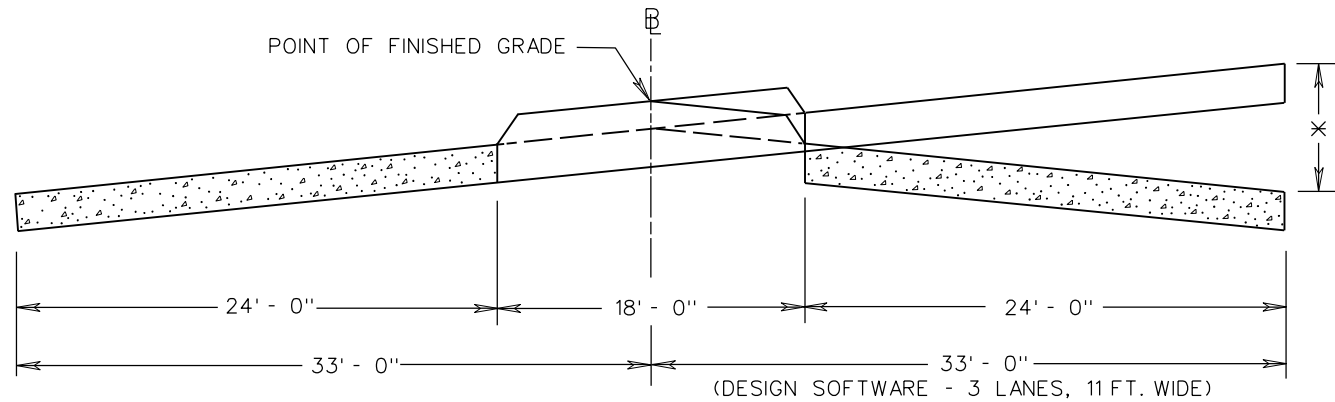
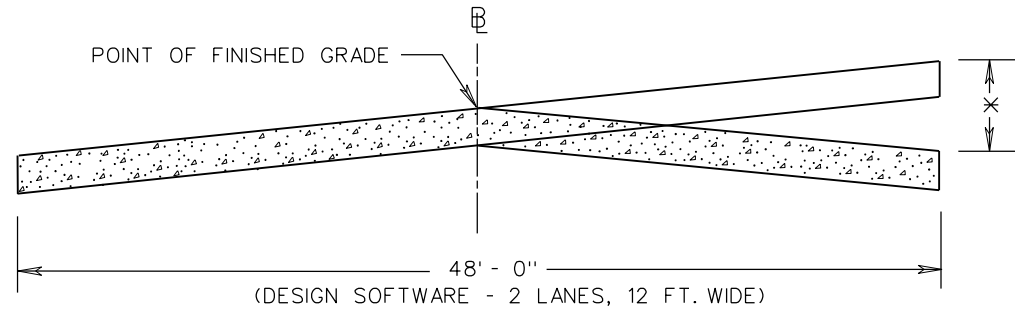
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01/13

DETAIL FOR NON-TRANSITION β URBAN & RURAL
CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE



× 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-5.11ULS, TC-5.11U , AND TC-5.11R (WITHOUT PAVEMENT WIDENING) SUPERELEVATED CURVES, POSITION THE SUPERELEVATION RUNOFF SECTION (L_r) 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 TS, SC, CS, ST AND EVERY 25' INCREMENT (i.e., 10+00, 10+25, 10+50, 10+75, etc...)

SPECIFICATION REFERENCE

DETAILS OF SUPERELEVATION ABOUT BASELINE

VIRGINIA DEPARTMENT OF TRANSPORTATION

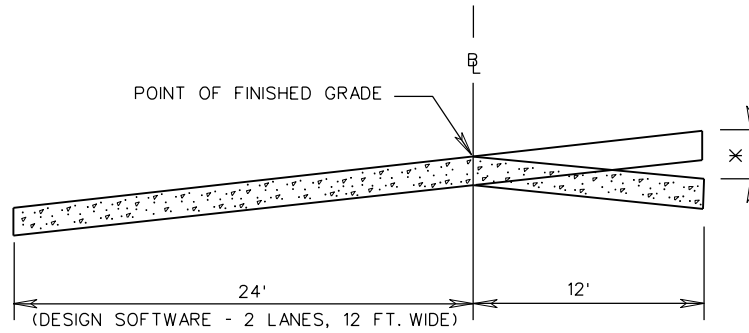
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ROAD AND BRIDGE STANDARDS

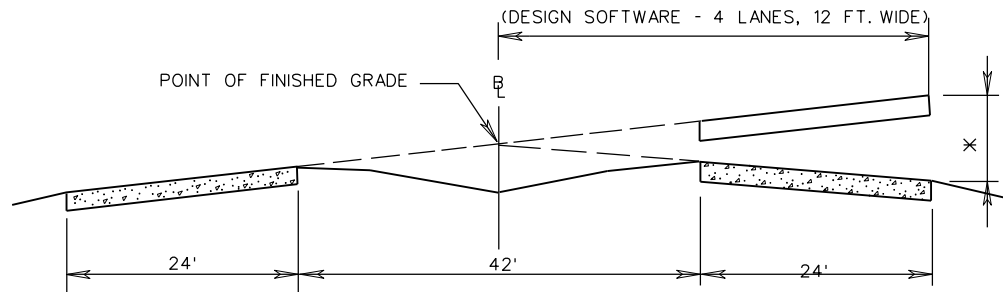
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THE PAVEMENT WIDTHS SHOWN IN THE STANDARD TC-5.11 TABLES ON SHEET 803.24 THROUGH 803.44 REPRESENT TWICE THE DISTANCE FROM THE CROWNLINE TO THE EDGE OF PAVEMENT ON THE HIGH SIDE.



* 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.



ROAD AND BRIDGE STANDARDS

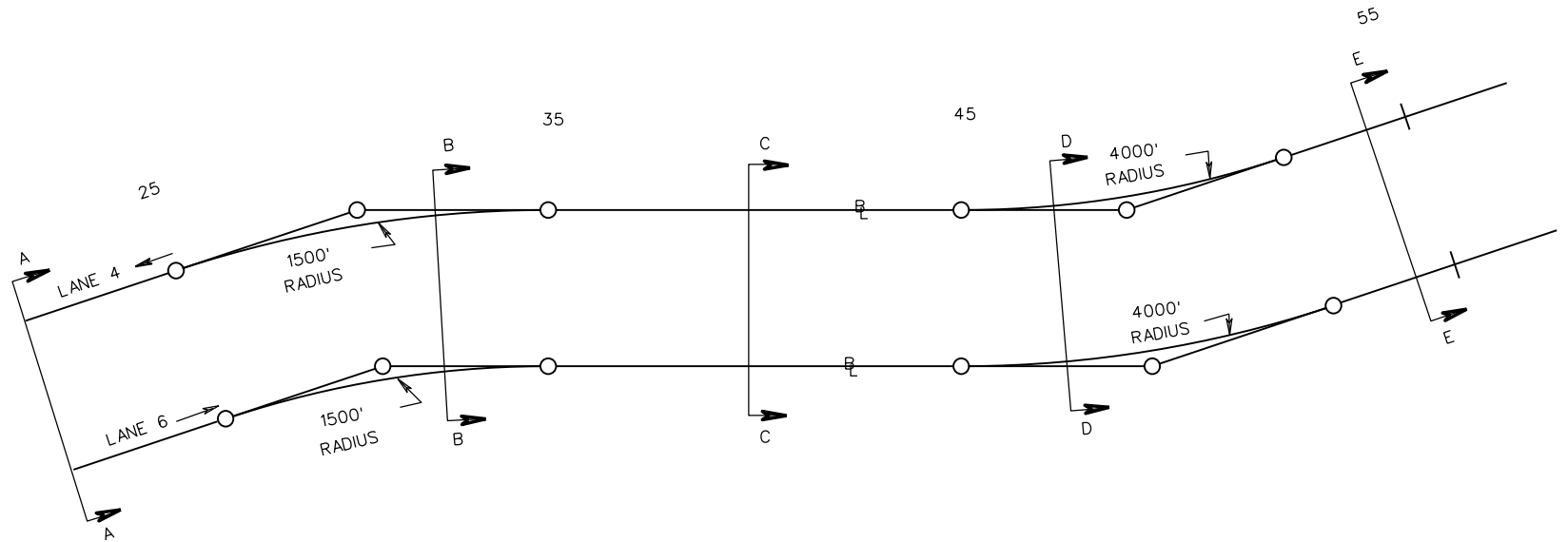
SHEET 1 OF 1

REVISION DATE

803.08

DETAILS OF SUPERELEVATION ABOUT BASELINE

VIRGINIA DEPARTMENT OF TRANSPORTATION



SPECIFICATION
REFERENCE

EXAMPLE FOR FOUR LANE ROADWAYS

VIRGINIA DEPARTMENT OF TRANSPORTATION

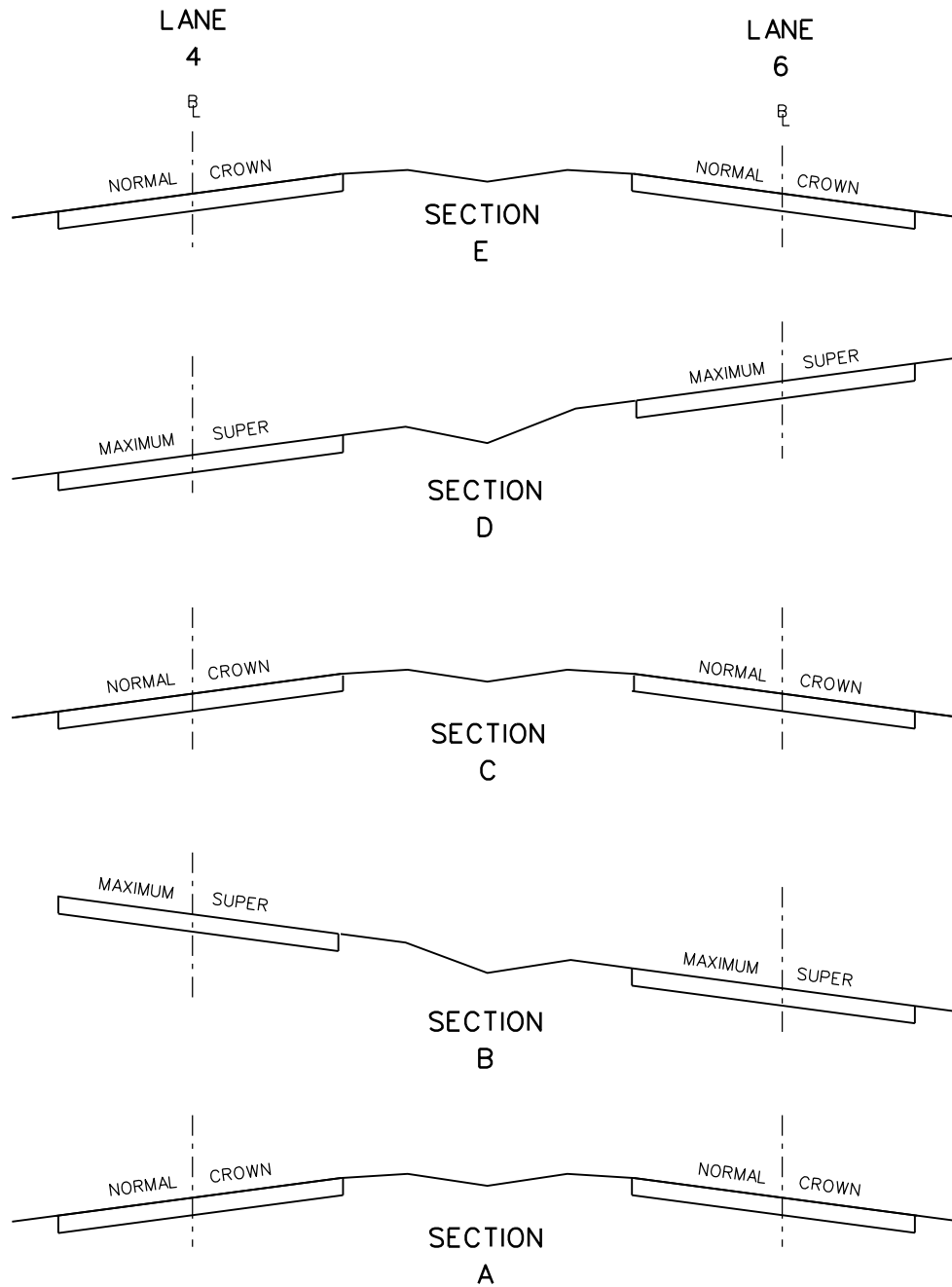
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ROAD AND BRIDGE STANDARDS

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ROAD AND BRIDGE STANDARDS

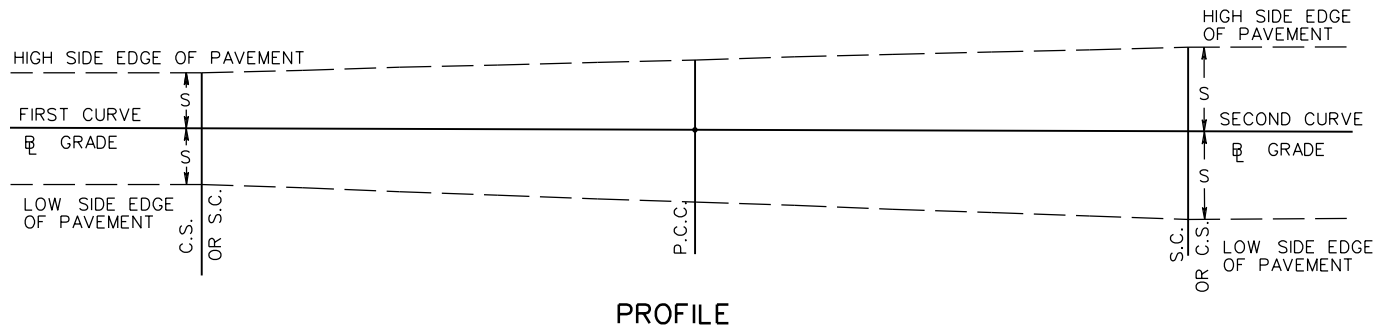
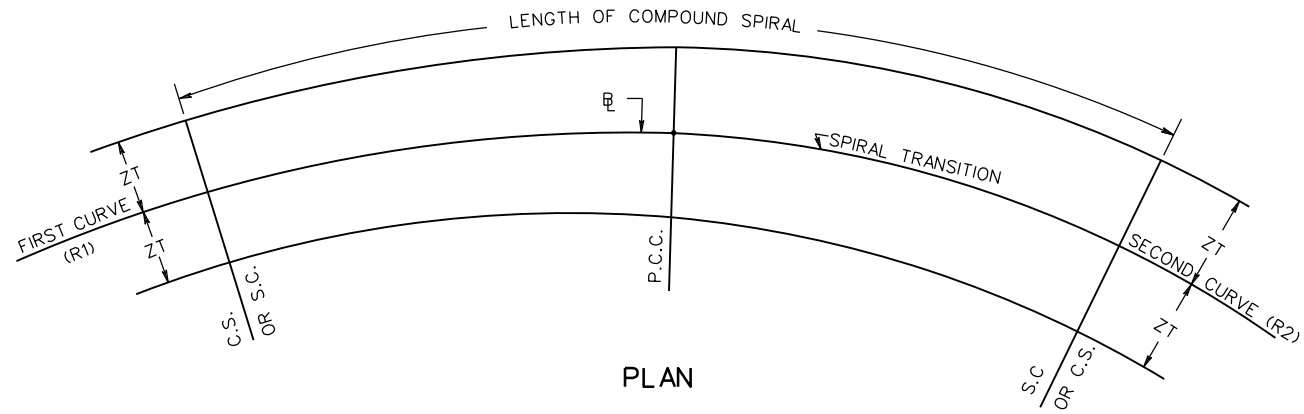
SHEET 1 OF 1

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803.10

CROSS SECTION - FOUR LANE ROADWAY

VIRGINIA DEPARTMENT OF TRANSPORTATION



NOTE:

1. FOR COMPOUND CURVES ON OPEN ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1.
2. FOR COMPOUND CURVES ON RAMPS AND AT INTERSECTIONS, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1. WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED.
3. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
4. REFER TO CHAPTER 3 OF THE AASHTO GREEN BOOK FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.
5. THE SEPARATE CURVES THAT ARE COMBINED TO CREATE THE COMPOUND CURVE, SHOULD BE OF SUFFICIENT LENGTH TO ALLOW ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATION ON EACH CURVE.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.11 ON COMPOUND CURVES
RURAL CONDITIONS WITH PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

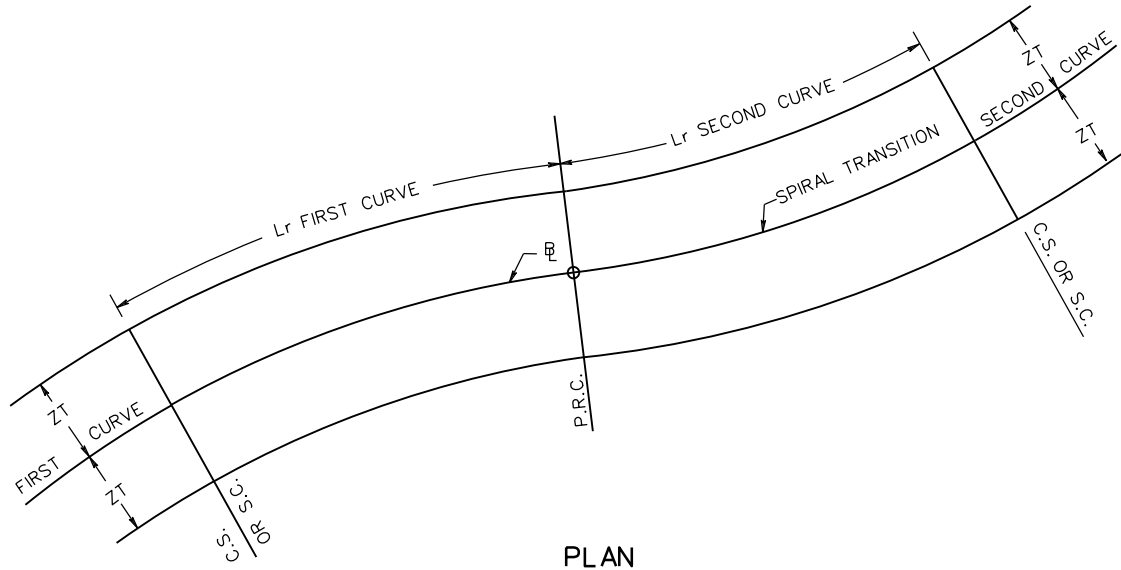
VDOT

ROAD AND BRIDGE STANDARDS

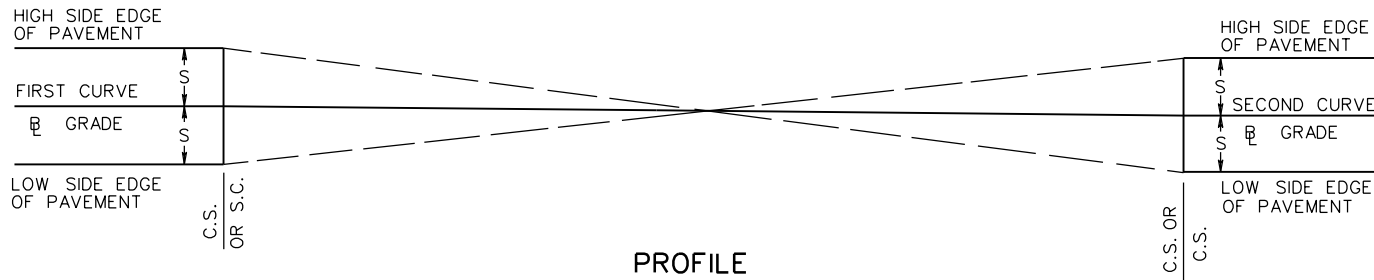
REVISION DATE

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PLAN



PROFILE

NOTE:

1. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
2. REFER TO CHAPTER 3 OF THE AASHTO'S A POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.
3. REVERSE CURVES SHOULD HAVE A CURVE LENGTH THAT ALLOWS ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATED SECTION OF PAVEMENT FOR EACH CURVE.



ROAD AND BRIDGE STANDARDS

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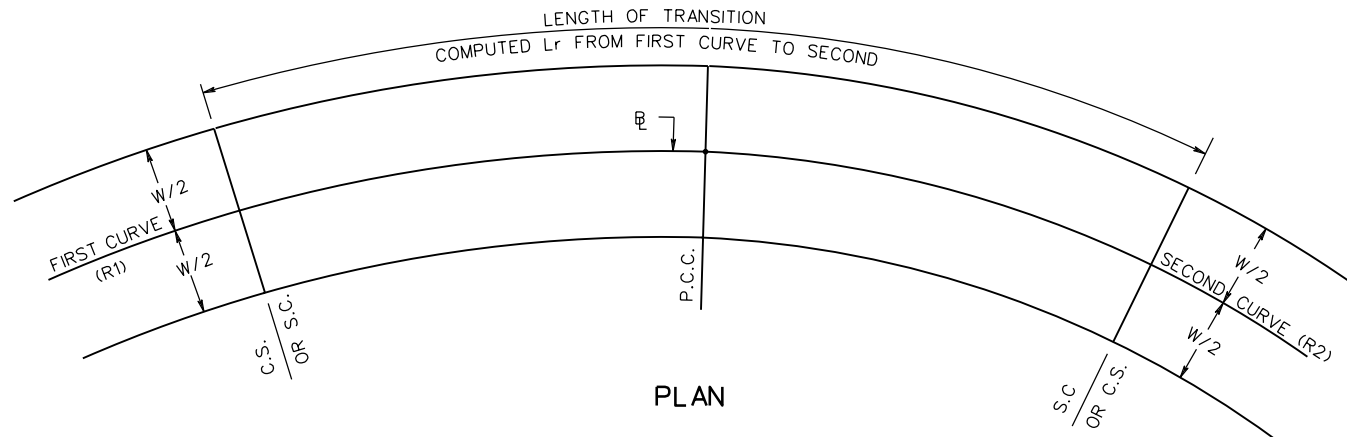
REVISION DATE

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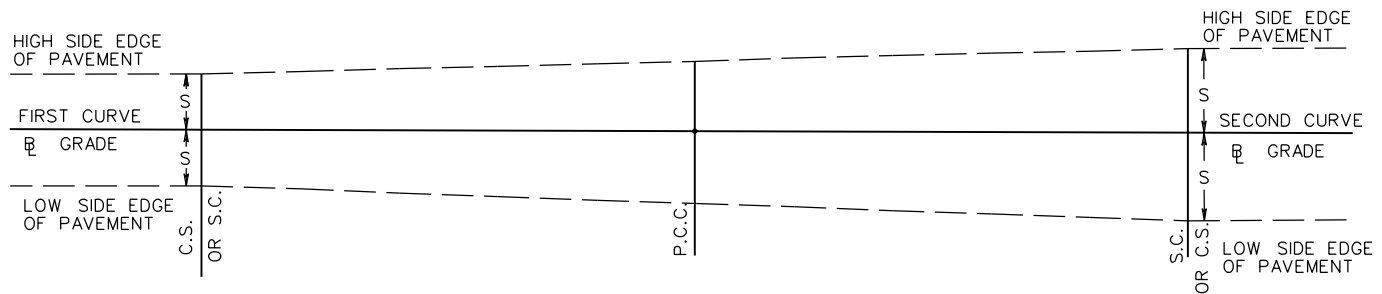
METHOD OF APPLYING TC-5.11 ON REVERSE CURVES RURAL CONDITION WITH PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE



PLAN



PROFILE

NOTE:

1. FOR COMPOUND CURVES ON OPEN ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1.
2. FOR COMPOUND CURVES ON RAMP AND AT INTERSECTIONS, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1. WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED.
3. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF COMPOUND SPIRAL COMPUTED PER PAGE 803.20.
4. REFER TO CHAPTER 3 OF THE AASHTO GREEN BOOK FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.
5. THE SEPARATE CURVES THAT ARE COMBINED TO CREATE THE COMPOUND CURVE, SHOULD BE OF SUFFICIENT LENGTH TO ALLOW ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATION ON EACH CURVE.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.11 ON COMPOUND CURVES
URBAN & RURAL CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

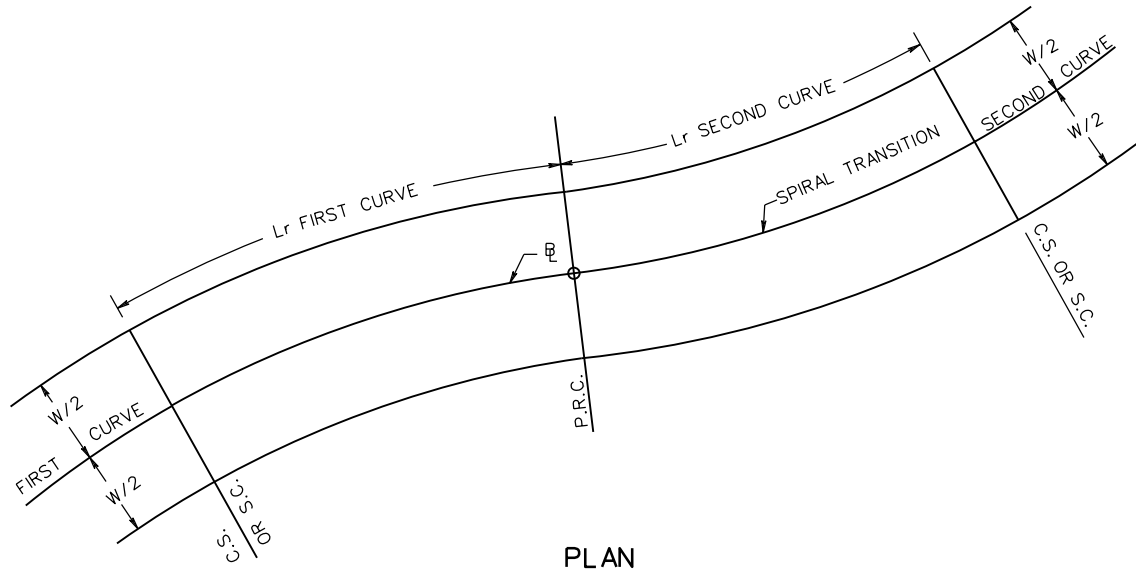
VDOT

ROAD AND BRIDGE STANDARDS

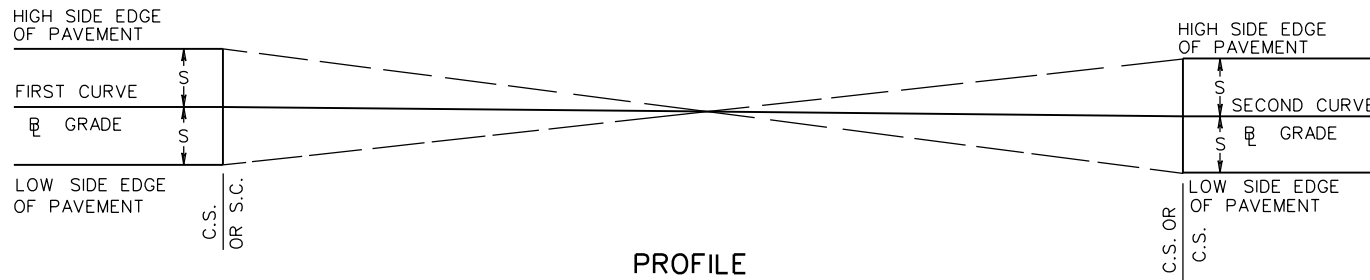
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PLAN



PROFILE

NOTES:

1. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF SUPERELEVATION RUNOFF (L_r) COMPUTED PER PAGE 803.20.
2. REFER TO CHAPTER 3 OF THE AASHTO'S A POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.
3. THE USE OF SPIRAL TRANSITIONS FOR COMPOUND AND REVERSE CURVES ON URBAN ROADWAYS SHOULD BE AVOIDED. HOWEVER, THE ENGINEER DOES HAVE LATITUDE IN THE USE OF SPIRAL TRANSITIONS IF THE GEOMETRICS ARE WARRANTED.
4. REVERSE CURVES SHOULD HAVE A CURVE LENGTH THAT ALLOWS ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATED SECTION OF PAVEMENT FOR EACH CURVE.



ROAD AND BRIDGE STANDARDS

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METHOD OF APPLYING TC-5.11 ON REVERSE CURVES
URBAN & RURAL CONDITIONS W/OUT PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

TRANSITION TABLE

LENGTH OF TANGENT RUNOUT (Lt)	START/END OF SUPERELEVATION RUNOFF (Lr)	DISTANCE IN FEET FROM START/END OF SUPERELEVATION RUNOFF SECTION (Lr)				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 FORM STAKES SET (CONCRETE PAVEMENT ONLY).

URBAN CONDITIONS RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT
(Lr POSITIONED 2/3 ±ON TANGENT, 1/3 ±ON CURVE)

LENGTH OF SUPERELEVATION RUNOFF (Lr)	END/ BEGIN TANGENT RUNOUT (Lt)	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.



ROAD AND BRIDGE STANDARDS

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TABLE I

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

RURAL CONDITIONS WITH PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT

LENGTH OF SUPERELEVATION RUNOFF (Lr)	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.

SPECIFICATION REFERENCE

TABLE 2

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

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GENERAL DESIGN CONSIDERATIONS

1. WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE SUPERELEVATION RUNOFF LENGTH (L_r).
2. THE COMPUTED SUPERELEVATION RUNOFF LENGTH (L_r) IS ROUNDED UP TO THE NEAREST FOOT.
3. WHEN THE SUPERELEVATION RUNOFF LENGTH (L_r) IS CALCULATED, IT MUST BE COMPARED WITH THE MINIMUM VALUE LISTED IN THE APPROPRIATE COLUMN ON THE RELATIVE GRADIENT TABLE.
4. TANGENT RUNOUT (L_t) IS ALWAYS ACHIEVED OUTSIDE OF THE SUPERELEVATION RUNOFF SECTION (L_r).
5. NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.
6. PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (w) IS EQUAL TO OR GREATER THAN 2 FEET. SEE PAGE 803.05 FOR DETAIL.
7. WHEN CALCULATING WIDENING (w) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "W".
9. CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 FOOT.
10. CURVES WITH SPIRAL CURVE TRANSITIONS MUST HAVE A MINIMUM SUPERELEVATION RUNOFF LENGTH (L_r) EQUAL TO 2 SECONDS OF TRAVEL TIME AT THE ROADWAY'S DESIGN SPEED AS NOTED IN THE RELATIVE GRADIENT TABLE.
11. THE MINIMUM LENGTH OF CURVE SHOULD EQUAL THE LENGTH OF SUPERELEVATION TRANSITION OR L_r . THIS IS TO ALLOW SUFFICIENT DEVELOPMENT OF THE FULL SUPERELEVATED SECTION OF PAVEMENT WHICH SHOULD BE A MINIMUM LENGTH OF $\frac{1}{3}$ THE TRANSITION L_r .
12. REVERSE CURVES SHOULD BE SEPARATED BY A TANGENT OF SUFFICIENT LENGTH TO ALLOW THE FULL L_r AND L_t FOR EACH CURVE. IF THIS IS NOT POSSIBLE A MINIMUM LENGTH OF TANGENT SHOULD ALLOW FOR THE FULL L_r FOR EACH CURVE.
13. REVERSE CURVES THAT MEET AT A PRC SHOULD HAVE A CURVE LENGTH THAT ALLOWS ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATED SECTION OF PAVEMENT FOR EACH CURVE.
14. THE SEPARATE CURVES THAT ARE COMBINED TO CREATE THE COMPOUND CURVE, SHOULD BE OF SUFFICIENT LENGTH TO ALLOW ADEQUATE DEVELOPMENT OF THE FULL SUPERELEVATION ON EACH CURVE.

MAXIMUM RADIUS FOR USE OF A SPIRAL CURVE TRANSITION

DESIGN SPEED (mph)	MAXIMUM RADIUS (ft)
20	203
25	317
30	456
35	620
40	810
45	1025
50	1265
55	1531
60	1822
65	2138
70	2479
75	2846
80	3238

MAXIMUM LENGTH OF SPIRAL

$$L_{s,max} = \sqrt{24 (p_{max}) R}$$

$L_{s,max}$ = MAXIMUM LENGTH OF SPIRAL, ft

p_{max} = MAXIMUM LATERAL OFFSET BETWEEN THE TANGENT AND CIRCULAR CURVE (3.3 ft)

R = RADIUS OF CIRCULAR CURVE, ft

SPECIFICATION REFERENCE

METHODOLOGIES FOR CALCULATING TC-5.11 VALUES

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

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RELATIVE GRADIENTS

ADJUSTMENT FACTORS

NUMBER OF LANES ROTATED n_1	ADJUSTMENT FACTOR (b_w)
1	1.00
1.5	0.8333
2	0.75
2.5	0.70
3	0.6667
3.5	0.6425

DESIGN SPEED V_D MPH	MAXIMUM RELATIVE GRADIENT (rg) 12' LANE	MIN. TRANSITION LENGTH IN FEET RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE CURVES FOR ALL CONDITIONS (2 SECOND RULE)	MAXIMUM RELATIVE GRADIENT (rg) RAMPS AND LOOPS		
			16' LANE	18' LANE	24' LANE
			20	0.74	59
25	0.70	74	0.80	0.84	0.93
30	0.66	88	0.75	0.80	0.88
35	0.62	103	0.71	0.75	0.83
40	0.58	117	0.66	0.70	0.77
45	0.54	132	0.61	0.65	0.72
50	0.50	147	0.57	0.60	0.67
55	0.47	161	0.54	0.57	0.63
60	0.45	176	0.51	0.54	0.60
65	0.43	191	0.49	0.52	0.57
70	0.40	205	0.45	0.48	0.53
75	0.38	220	0.43	0.46	0.51
80	0.35	235	0.39	0.42	0.47

DEFINITIONS

- A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- b_w - ADJUSTMENT FACTOR FROM TABLE.
- C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- E - SUPERELEVATION RATE FROM APPROPRIATE TABLE.
- e_d - DESIGN SUPERELEVATION RATE, PERCENT
- e_{nc} - NORMAL CROSS SLOPE RATE, PERCENT
- F_A - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.
- L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.
- L_r - LENGTH OF SUPERELEVATION RUNOFF SECTION.
- L_t - LENGTH OF TANGENT RUNOUT SECTION
- M - MULTIPLE LANE FACTOR.
- N - NUMBER OF LANES.
- n_1 - NUMBER OF LANES ROTATED (FROM TABLES).
- 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 - PAVEMENT WIDTH
- W_c - CALCULATED TOTAL CURVE WIDTH.
- W_n - WIDTH OF LANE.
- Z - CALCULATED EXTRA WIDTH ALLOWANCE.

FORMULAS USED TO CALCULATE SUPERELEVATION RUNOFF (L_r) AND CROWN RUNOUT (L_t)

NO WIDENING REQUIRED

$$L_r = b_w (W_n n_1 E / rg)$$

$$L_r = M(W_n E / rg) \quad (\text{ALT. MULTI-LANE})$$

WIDENING REQUIRED

$$L_r = b_w [E n_1 (W_n + w/N) / rg]$$

$$L_r = MEE(W_n + w/N) / rg \quad (\text{ALT. MULTI-LANE})$$

$$L_t = \left(\frac{e_{nc}}{e_d} \right) L_r$$

FOR SOLVED PROBLEMS USING THIS METHODOLOGY FOR L_r , SEE THE EXAMPLES ON PAGE 803.22

NOTE: AN ALTERNATE METHOD FOR MULTI-LANE ROADWAYS. FOR FOUR LANE UNDIVIDED PAVEMENTS (48') THE L_r IS 1.5 TIMES (M=1.5) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS; AND FOR SIX LANE UNDIVIDED PAVEMENTS (72'), THE L_r IS TWO TIMES (M=2) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS.



ROAD AND BRIDGE STANDARDS

METHODOLOGIES FOR CALCULATING TC-5.11 VALUES

SPECIFICATION REFERENCE

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DESIGN VEHICLE DIMENSIONS

DESIGN VEHICLE TYPE	u WIDTH	A FRONT OVERHANG	L	
			WB *1	WB *2
P	7	3	11	0
SU-30	8	4	20	0
SU-40	8	4	25	0
S-BUS-36	8	2.5	21.3	0
WB-40	8	3	12.5	27.5
WB-62	8.5	4	19.5	4.3

NOTE: THE "L" VALUE USED IN CALCULATING "U" WILL BE THE GREATER OF THE VALUES LISTED UNDER WB*1 OR WB*2 IN THE TABLE. THE "L" VALUE USED IN CALCULATING F_A WILL ALWAYS BE THE VALUE FROM THE WB*1 COLUMN UNDER "L".

LATERAL CLEARANCE

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

FORMULAS USED TO CALCULATE WIDENING (w)

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

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

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

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

$$w = W_C - 2W_n$$

FOR OTHER DESIGN VEHICLE DIMENSIONS REFER TO THE AASHTO GREEN BOOK.

DESIGN VEHICLE SU-40
24 FT PAVEMENT WIDTH

V_D = 20 MPH R = 200 FT
W_n = 12 FT rg = 0.74
E = 6.1 (6.1% PER 803.32)

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

$$U = 8.0 + 200 - \sqrt{(200)^2 - (25)^2}$$

$$U = 9.56865$$

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

$$F_A = \sqrt{(200)^2 + 4[2(25) + 4]} - 200$$

$$F_A = .53927$$

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

$$Z = (20 / \sqrt{200})$$

$$Z = 1.41$$

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

$$W_C = 2(9.56865 + 3) + 0.53927 + 1.41$$

$$W_C = 27.08657$$

$$w = W_C - 2W_n = 27.08657 - 2(12) = 3.0865 \text{ or } 3.1$$

DESIGN VEHICLE SU-40
20 FT PAVEMENT WIDTH

V_D = 35 MPH R = 500 FT
W_n = 10 FT rg = 0.62
E = 3.1 (3.1% PER 803.38)

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

$$U = 8.0 + 500 - \sqrt{(500)^2 - (25)^2}$$

$$U = 8.62539$$

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

$$F_A = \sqrt{(500)^2 + 4[2(25) + 4]} - 500$$

$$F_A = .21595$$

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

$$Z = (35 / \sqrt{500})$$

$$Z = 1.57$$

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

$$W_C = 2(8.62539 + 2) + 0.21595 + 1.57$$

$$W_C = 23.0367$$

$$w = W_C - 2W_n = 23.0367 - 2(10) = 3.0367 \text{ or } 3.0$$

DESIGN VEHICLE WB-62
20 FT PAVEMENT WIDTH

V_D = 50 MPH R = 1000 FT
W_n = 10 FT rg = 0.50
E = 7.6 (7.6% PER 803.38)

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

$$U = 8.5 + 1000 - \sqrt{(1000)^2 - (4.3)^2}$$

$$U = 9.42492$$

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

$$F_A = \sqrt{(1000)^2 + 4[2(19.5) + 4]} - 1000$$

$$F_A = .085996$$

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

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

$$Z = 1.58$$

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

$$W_C = 2(9.42492 + 2) + 0.085996 + 1.58$$

$$W_C = 24.5158$$

$$w = W_C - 2W_n = 24.5158 - 2(10) = 4.5158 \text{ or } 4.5$$

SPECIFICATION REFERENCE

METHODOLOGIES FOR CALCULATING TC-5.11 VALUES



ROAD AND BRIDGE STANDARDS

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RURAL EXAMPLE

20 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 10 FT)

$$\begin{aligned} V_D &= 50 \text{ MPH} & R &= 1000 \text{ FT} \\ W_n &= 10 \text{ FT} & r_g &= 0.50 \\ E &= 7.6 \text{ (7.6\% PER 803.38)} \end{aligned}$$

$$\begin{aligned} U &= u + R - \sqrt{R^2 - L^2} \\ U &= 8.5 + 1000 - \sqrt{(1000)^2 - (43)^2} \\ U &= 9.42492 \end{aligned}$$

$$\begin{aligned} F_A &= \sqrt{R^2 + A(2L + A)} - R \\ F_A &= \sqrt{(1000)^2 + 4[2(19.5) + 4]} - 1000 \\ F_A &= .085996 \end{aligned}$$

$$\begin{aligned} Z &= (V_D / \sqrt{R}) \\ Z &= (50 / \sqrt{1000}) \\ Z &= 1.58 \end{aligned}$$

$$\begin{aligned} W_C &= N(U + C) + F_A + Z \\ W_C &= 2(9.42492 + 2) + 0.085996 + 1.58 \\ W_C &= 24.5158 \end{aligned}$$

$$w = W_C - 2W_n = 24.5158 - 2(10) = 4.5158 \text{ or } 4.5$$

(w>2 THEREFORE WIDENING IS REQUIRED)

$$\begin{aligned} L_r &= [E n_s (W_n + w/2) / r_g] b_w \\ L_r &= [7.6(1)(10 + 4.5/2) / 0.50] 1 \\ L_r &= 7.6 (12.25) / 0.50 \\ L_r &= 186.20 \end{aligned}$$

RURAL EXAMPLE

72 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 12 FT)

$$\begin{aligned} V_D &= 40 \text{ MPH} & R &= 500 \text{ FT} \\ W_n &= 12 \text{ FT} & r_g &= 0.58 \\ E &= 8.0 \text{ (8\% PER PAGE 803.36)} \end{aligned}$$

$$\begin{aligned} U &= u + R - \sqrt{R^2 - L^2} \\ U &= 8.5 + 500 - \sqrt{(500)^2 - (43)^2} \\ U &= 10.35243 \end{aligned}$$

$$\begin{aligned} F_A &= \sqrt{R^2 + A(2L + A)} - R \\ F_A &= \sqrt{(500)^2 + 4[2(19.5) + 4]} - 500 \\ F_A &= .1719 \end{aligned}$$

$$\begin{aligned} Z &= (V_D / \sqrt{R}) \\ Z &= (40 / \sqrt{500}) \\ Z &= 1.7885 \end{aligned}$$

$$\begin{aligned} W_C &= 2(U + C) + F_A + Z \\ W_C &= 2(10.35243 + 3) + 0.1719 + 1.7885 \\ W_C &= 28.6652 \\ w &= W_C - 2W_n = 28.6652 - 2(12) = 4.6652 \end{aligned}$$

FOR 72' PAVEMENT WIDTH
w = 3(4.6652) = 13.9956

(w>2 THEREFORE WIDENING IS REQUIRED)

$$\begin{aligned} L_r &= [E n_s (W_n + w/6) / r_g] b_w \\ L_r &= [8 (3) (12 + 13.9956/6) / 0.58] 0.6667 \\ L_r &= (343.9824 / 0.58) 0.6667 \\ L_r &= 395.4018 \end{aligned}$$

OR

$$\begin{aligned} L_r &= M[E(W_n + w/N) / r_g] \\ L_r &= 2 [8(12 + 13.9956/6) / 0.58] \\ L_r &= 2 (114.6608 / 0.58) \\ L_r &= 395.3820 \end{aligned}$$

URBAN EXAMPLES

24 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 12 FT)

$$\begin{aligned} V_D &= 40 \text{ MPH} & R &= 600 \text{ FT} \\ W_n &= 12 \text{ FT} & r_g &= 0.58 \\ E &= 4.0 \text{ (4\% PER PAGE 803.28)} \end{aligned}$$

$$\begin{aligned} L_r &= (W_n n_s E / r_g) b_w \\ L_r &= [12(1)(4) / 0.58] 1.00 \\ L_r &= (48 / 0.58) \\ L_r &= 82.7586 \end{aligned}$$

66 FT PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 11 FT)

$$\begin{aligned} V_D &= 40 \text{ MPH} & R &= 600 \text{ FT} \\ W_n &= 11 \text{ FT} & r_g &= 0.58 \\ E &= 4.0 \text{ (4\% PER PAGE 803.28)} \end{aligned}$$

$$\begin{aligned} L_r &= b_w (W_n n_s E / r_g) \\ L_r &= 0.6667 [11(3)(4) / 0.58] \\ L_r &= 0.6667 (132 / 0.58) \\ L_r &= 151.7317 \end{aligned}$$

OR

$$\begin{aligned} L_r &= M (E W_n / r_g) \\ L_r &= 2 [4(11) / 0.58] \\ L_r &= 2 (44 / 0.58) \\ L_r &= 151.7241 \end{aligned}$$



ROAD AND BRIDGE STANDARDS

CALCULATED TC-5.11 EXAMPLES

SPECIFICATION
REFERENCE

SHEET 1 OF 1

REVISION DATE

803.22

01/13

VIRGINIA DEPARTMENT OF TRANSPORTATION

MINIMUM RADII AND SUPERELEVATION RUNOFF SECTION LENGTHS (L_r) FOR +2% SUPERELEVATION

RADIUS (FEET)	E (%)	f	DV (MPH)	LENGTH OF SUPERELEVATION RUNOFF (L _r) IN FEET						
				PAVEMENT WIDTH (W)						W > 72'
				24' (1@12')	36' (1.5@12')	48' (2@12')	60' (3@10')	66' (3@11')	72' (3@12')	
> 795	2.0	0.150	45	45	56	67	75	82	90	*
593	2.0	0.160	40	42	52	63	70	77	84	*
408	2.0	0.180	35	39	49	59	65	72	78	*
273	2.0	0.200	30	37	46	55	61	67	74	*
167	2.0	0.230	25	35	43	52	58	64	69	*
92	2.0	0.270	20	33	41	49	55	60	66	*

* FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE L_r VALUES DEVELOPED BY THE DESIGN SOFTWARE.

MINIMUM RADII FOR DESIGNS
UTILIZING -2% SUPERELEVATION NORMAL PAVEMENT CROWN

RADIUS (FEET)	f	NC (MPH)
> 1039	.150	45
762	.160	40
510	.180	35
333	.200	30
198	.230	25
107	.270	20

SPECIFICATION
REFERENCE

SUMMARY OF STD. TC-5.11 ULS
URBAN-LOW SPEED DESIGN FACTORS

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

803.23

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr		
1410	NC	0	0	0	0	0	0	0	0	0	0	0	
960	2	33	33	41	41	49	49	55	55	60	60	65	65
868	2.1	33	35	41	43	49	52	55	57	60	63	65	69
756	2.2	33	36	41	45	49	54	55	60	60	66	65	72
684	2.3	33	38	41	47	49	56	55	63	60	69	65	75
565	2.4	33	39	41	49	49	59	55	65	60	72	65	78
504	2.5	33	41	41	51	49	61	55	68	60	75	65	82
408	2.6	33	43	41	53	49	64	55	71	60	78	65	85
376	2.7	33	44	41	55	49	66	55	73	60	81	65	88
348	2.8	33	46	41	57	49	69	55	76	60	84	65	91
300	2.9	33	48	41	59	49	71	55	79	60	87	65	95
264	3	33	49	41	61	49	73	55	82	60	90	65	98
254	3.1	33	51	41	63	49	76	55	84	60	93	65	101
229	3.2	33	52	41	65	49	78	55	87	60	96	65	104
197	3.3	33	54	41	67	49	81	55	90	60	99	65	108
188	3.4	33	56	41	69	49	83	55	92	60	102	65	111
167	3.5	33	57	41	71	49	86	55	95	60	105	65	114
156	3.6	33	59	41	73	49	88	55	98	60	108	65	117
147	3.7	33	60	41	75	49	90	55	100	60	110	65	120
124	3.8	33	62	41	77	49	93	55	103	60	113	65	124
116	3.9	33	64	41	79	49	95	55	106	60	116	65	127
87	4	33	65	41	81	49	98	55	109	60	119	65	130

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

803.24

**TRANSITION CURVES - URBAN
20 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
2050	NC	0	0	0	0	0	0	0	0	0	0	0	0
1350	2	35	35	43	43	52	52	58	58	63	63	69	69
1234	2.1	35	36	43	45	52	54	58	60	63	66	69	72
1119	2.2	35	38	43	48	52	57	58	63	63	70	69	76
994	2.3	35	40	43	50	52	60	58	66	63	73	69	79
858	2.4	35	42	43	52	52	62	58	69	63	76	69	83
750	2.5	35	43	43	54	52	65	58	72	63	79	69	86
664	2.6	35	45	43	56	52	67	58	75	63	82	69	90
593	2.7	35	47	43	58	52	70	58	78	63	85	69	93
534	2.8	35	48	43	60	52	72	58	80	63	88	69	96
483	2.9	35	50	43	63	52	75	58	83	63	92	69	100
440	3	35	52	43	65	52	78	58	86	63	95	69	103
402	3.1	35	54	43	67	52	80	58	89	63	98	69	107
369	3.2	35	55	43	69	52	83	58	92	63	101	69	110
339	3.3	35	57	43	71	52	85	58	95	63	104	69	114
311	3.4	35	59	43	73	52	88	58	98	63	107	69	117
286	3.5	35	60	43	75	52	90	58	100	63	110	69	120
263	3.6	35	62	43	78	52	93	58	103	63	114	69	124
241	3.7	35	64	43	80	52	96	58	106	63	117	69	127
218	3.8	35	66	43	82	52	98	58	109	63	120	69	131
195	3.9	35	67	43	84	52	101	58	112	63	123	69	134
155	4	35	69	43	86	52	103	58	115	63	126	69	138

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION REFERENCE

**TRANSITION CURVES - URBAN
25 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

803.25

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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
2830	NC	0	0	0	0	0	0	0	0	0	0	0	0
1885	2.0	37	37	46	46	55	55	61	61	67	67	73	73
1734	2.1	37	39	46	48	55	58	61	64	67	70	73	77
1588	2.2	37	40	46	50	55	60	61	67	67	74	73	80
1442	2.3	37	42	46	53	55	63	61	70	67	77	73	84
1282	2.4	37	44	46	55	55	66	61	73	67	80	73	88
1134	2.5	37	46	46	57	55	69	61	76	67	84	73	91
1013	2.6	37	48	46	60	55	71	61	79	67	87	73	95
913	2.7	37	50	46	62	55	74	61	82	67	90	73	99
827	2.8	37	51	46	64	55	77	61	85	67	94	73	102
754	2.9	37	53	46	66	55	80	61	88	67	97	73	106
689	3.0	37	55	46	69	55	82	61	91	67	100	73	110
633	3.1	37	57	46	71	55	85	61	94	67	104	73	113
582	3.2	37	59	46	73	55	88	61	97	67	107	73	117
536	3.3	37	60	46	75	55	90	61	100	67	110	73	120
495	3.4	37	62	46	78	55	93	61	104	67	114	73	124
456	3.5	37	64	46	80	55	96	61	107	67	117	73	128
420	3.6	37	66	46	82	55	99	61	110	67	120	73	131
385	3.7	37	68	46	85	55	101	61	113	67	124	73	135
351	3.8	37	70	46	87	55	104	61	116	67	127	73	139
314	3.9	37	71	46	89	55	107	61	119	67	130	73	142
251	4.0	37	73	46	91	55	110	61	122	67	134	73	146

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



TRANSITION CURVES - URBAN 30 MPH DESIGN SPEED

**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		
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'		
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	CR	Lr	
3730	NC	0	0	0	0	0	0	0	0	0	0	0	0	0
2511	2.0	39	39	49	49	59	59	65	65	71	71	78	78	
2320	2.1	39	41	49	51	59	61	65	68	71	75	78	82	
2138	2.2	39	43	49	54	59	64	65	71	71	79	78	86	
1961	2.3	39	45	49	56	59	67	65	75	71	82	78	90	
1781	2.4	39	47	49	59	59	70	65	78	71	86	78	93	
1593	2.5	39	49	49	61	59	73	65	81	71	89	78	97	
1434	2.6	39	51	49	63	59	76	65	84	71	93	78	101	
1299	2.7	39	53	49	66	59	79	65	88	71	96	78	105	
1184	2.8	39	55	49	68	59	82	65	91	71	100	78	109	
1084	2.9	39	57	49	71	59	85	65	94	71	103	78	113	
995	3.0	39	59	49	73	59	88	65	97	71	107	78	117	
916	3.1	39	60	49	75	59	90	65	100	71	110	78	120	
846	3.2	39	62	49	78	59	93	65	104	71	114	78	124	
782	3.3	39	64	49	80	59	96	65	107	71	118	78	128	
723	3.4	39	66	49	83	59	99	65	110	71	121	78	132	
668	3.5	39	68	49	85	59	102	65	113	71	125	78	136	
617	3.6	39	70	49	88	59	105	65	117	71	128	78	140	
567	3.7	39	72	49	90	59	108	65	120	71	132	78	144	
518	3.8	39	74	49	92	59	111	65	123	71	135	78	148	
465	3.9	39	76	49	95	59	114	65	126	71	139	78	151	
373	4.0	39	78	49	97	59	117	65	130	71	142	78	155	

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION
REFERENCE

**TRANSITION CURVES - URBAN
35 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

803.27

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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
4770	NC	0	0	0	0	0	0	0	0	0	0	0	0
3245	2.0	42	42	52	52	63	63	69	69	76	76	83	83
3009	2.1	42	44	52	55	63	66	69	73	76	80	83	87
2787	2.2	42	46	52	57	63	69	69	76	76	84	83	92
2575	2.3	42	48	52	60	63	72	69	80	76	88	83	96
2367	2.4	42	50	52	63	63	75	69	83	76	92	83	100
2155	2.5	42	52	52	65	63	78	69	87	76	95	83	104
1954	2.6	42	54	52	68	63	81	69	90	76	99	83	108
1782	2.7	42	56	52	70	63	84	69	94	76	103	83	112
1633	2.8	42	58	52	73	63	87	69	97	76	107	83	116
1502	2.9	42	60	52	75	63	90	69	100	76	110	83	120
1385	3.0	42	63	52	78	63	94	69	104	76	114	83	125
1281	3.1	42	65	52	81	63	97	69	107	76	118	83	129
1187	3.2	42	67	52	83	63	100	69	111	76	122	83	133
1100	3.3	42	69	52	86	63	103	69	114	76	126	83	137
1020	3.4	42	71	52	88	63	106	69	118	76	129	83	141
946	3.5	42	73	52	91	63	109	69	121	76	133	83	145
875	3.6	42	75	52	94	63	112	69	125	76	137	83	149
806	3.7	42	77	52	96	63	115	69	128	76	141	83	154
738	3.8	42	79	52	99	63	118	69	132	76	145	83	158
664	3.9	42	81	52	101	63	122	69	135	76	148	83	162
536	4.0	42	83	52	104	63	125	69	138	76	152	83	166

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

803.28

TRANSITION CURVES - URBAN 40 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr		
5930	NC	0	0	0	0	0	0	0	0	0	0	0	
4058	2.0	45	45	56	56	67	67	75	75	82	82	89	89
3771	2.1	45	47	56	59	67	70	75	78	82	86	89	94
3502	2.2	45	49	56	62	67	74	75	82	82	90	89	98
3248	2.3	45	52	56	64	67	77	75	86	82	94	89	103
3002	2.4	45	54	56	67	67	80	75	89	82	98	89	107
2758	2.5	45	56	56	70	67	84	75	93	82	102	89	112
2516	2.6	45	58	56	73	67	87	75	97	82	106	89	116
2304	2.7	45	60	56	75	67	90	75	100	82	110	89	120
2119	2.8	45	63	56	78	67	94	75	104	82	115	89	125
1955	2.9	45	65	56	81	67	97	75	108	82	119	89	129
1808	3.0	45	67	56	84	67	100	75	112	82	123	89	134
1676	3.1	45	69	56	87	67	104	75	115	82	127	89	138
1556	3.2	45	72	56	89	67	107	75	119	82	131	89	143
1446	3.3	45	74	56	92	67	110	75	123	82	135	89	147
1343	3.4	45	76	56	95	67	114	75	126	82	139	89	152
1247	3.5	45	78	56	98	67	117	75	130	82	143	89	156
1156	3.6	45	80	56	100	67	120	75	134	82	147	89	160
1067	3.7	45	83	56	103	67	124	75	138	82	151	89	165
978	3.8	45	85	56	106	67	127	75	141	82	155	89	169
883	3.9	45	87	56	109	67	130	75	145	82	159	89	174
713	4.0	45	89	56	112	67	134	75	149	82	163	89	178

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION
REFERENCE

**TRANSITION CURVES - URBAN
45 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

803.29

**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr		
7220	NC	0	0	0	0	0	0	0	0	0	0	0	
4972	2.0	48	48	60	60	72	72	80	80	88	88	96	96
4629	2.1	48	51	60	63	72	76	80	84	88	93	96	101
4310	2.2	48	53	60	66	72	80	80	88	88	97	96	106
4010	2.3	48	56	60	69	72	83	80	92	88	102	96	111
3723	2.4	48	58	60	72	72	87	80	96	88	106	96	116
3444	2.5	48	60	60	75	72	90	80	100	88	110	96	120
3166	2.6	48	63	60	78	72	94	80	104	88	115	96	125
2911	2.7	48	65	60	81	72	98	80	108	88	119	96	130
2686	2.8	48	68	60	84	72	101	80	112	88	124	96	135
2486	2.9	48	70	60	87	72	105	80	116	88	128	96	140
2306	3.0	48	72	60	90	72	108	80	120	88	132	96	144
2143	3.1	48	75	60	93	72	112	80	124	88	137	96	149
1994	3.2	48	77	60	96	72	116	80	128	88	141	96	154
1857	3.3	48	80	60	99	72	119	80	132	88	146	96	159
1729	3.4	48	82	60	102	72	123	80	136	88	150	96	164
1608	3.5	48	84	60	105	72	126	80	140	88	154	96	168
1493	3.6	48	87	60	108	72	130	80	144	88	159	96	173
1381	3.7	48	89	60	111	72	134	80	148	88	163	96	178
1268	3.8	48	92	60	114	72	137	80	152	88	168	96	183
1146	3.9	48	94	60	117	72	141	80	156	88	172	96	188
929	4.0	48	96	60	120	72	144	80	160	88	176	96	192

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt AND Lr VALUES.



**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	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 12'		1.5 @ 12'		2 @ 12'		3 @ 10'		3 @ 11'		3 @ 12'	
		Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr	Lt	Lr
8650	NC	0	0	0	0	0	0	0	0	0	0	0	0
5995	2.0	52	52	64	64	77	77	86	86	94	94	103	103
5592	2.1	52	54	64	68	77	81	86	90	94	99	103	108
5218	2.2	52	57	64	71	77	85	86	94	94	103	103	113
4869	2.3	52	59	64	74	77	89	86	98	94	108	103	118
4538	2.4	52	62	64	77	77	92	86	103	94	113	103	123
4220	2.5	52	64	64	80	77	96	86	107	94	118	103	128
3909	2.6	52	67	64	83	77	100	86	111	94	122	103	133
3610	2.7	52	69	64	87	77	104	86	115	94	127	103	138
3343	2.8	52	72	64	90	77	108	86	120	94	132	103	143
3104	2.9	52	75	64	93	77	112	86	124	94	136	103	149
2888	3.0	52	77	64	96	77	115	86	128	94	141	103	154
2691	3.1	52	80	64	99	77	119	86	132	94	146	103	159
2510	3.2	52	82	64	103	77	123	86	137	94	150	103	164
2343	3.3	52	85	64	106	77	127	86	141	94	155	103	169
2186	3.4	52	87	64	109	77	131	86	145	94	160	103	174
2037	3.5	52	90	64	112	77	135	86	149	94	164	103	179
1895	3.6	52	92	64	115	77	138	86	154	94	169	103	184
1756	3.7	52	95	64	119	77	142	86	158	94	174	103	189
1615	3.8	52	98	64	122	77	146	86	162	94	178	103	195
1462	3.9	52	100	64	125	77	150	86	166	94	183	103	200
1191	4.0	52	103	64	128	77	154	86	171	94	188	103	205

NOTE:

Lt AND Lr VALUES IN FEET.

FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE Lr VALUES DEVELOPED BY THE DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, AND Lr VALUES.

SPECIFICATION REFERENCE

**TRANSITION CURVES - URBAN
55 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION



ROAD AND BRIDGE STANDARDS

REVISION DATE

SHEET 1 OF 1

803.31

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

DESIGN VELOCITY =30	WIDTH+ 18 FT			WIDTH+20 FT			WIDTH+22 FT			WIDTH+24 FT			WIDTH+48 FT			INTERCHANGE RAMPS						
	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)									WIDTH												
	1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			16 FT			18 FT			
RADIUS(FT)	E(%)	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	Lt	Lr	Lt	Lr
3240	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2400	2	31	31	2	31	31	0	34	34	0	37	37	0	55	55	0	43	43	43	43	45	45
2360	2.1	31	32	2	31	32	0	34	35	0	37	39	0	55	58	0	43	45	45	45	48	48
2200	2.2	31	34	2	31	34	0	34	37	0	37	40	0	55	60	0	43	47	45	45	50	50
2040	2.3	31	36	2.1	31	35	0	34	39	0	37	42	0	55	63	0	43	50	45	45	52	52
2000	2.4	31	37	2.1	31	37	0	34	40	0	37	44	0	55	66	0	43	52	45	45	54	54
1920	2.5	32	39	2.1	31	38	0	34	42	0	37	46	0	55	69	0	43	54	45	45	57	57
1840	2.6	31	40	2.1	31	40	0	34	44	0	37	48	0	55	71	0	43	56	45	45	59	59
1760	2.7	32	42	2.2	31	41	0	34	45	0	37	50	0	55	74	0	43	58	45	45	61	61
1680	2.8	31	43	2.2	31	43	0	34	47	0	37	51	0	55	77	0	43	60	45	45	63	63
1600	2.9	32	45	2.3	31	44	0	34	49	0	37	53	0	55	80	0	43	62	45	45	66	66
1520	3	32	47	2.3	31	46	0	34	50	0	37	55	0	55	82	0	43	64	45	45	68	68
1440	3.1	31	48	2.3	31	47	0	34	52	0	37	57	0	55	85	0	43	67	45	45	70	70
1430	3.2	32	50	2.4	31	49	0	34	54	0	37	59	0	55	88	0	43	69	45	45	72	72
1352	3.3	31	51	2.4	31	50	0	34	55	0	37	60	0	55	90	0	43	71	45	45	75	75
1288	3.4	32	53	2.5	31	52	0	34	57	0	37	62	0	55	93	0	43	73	45	45	77	77
1259	3.5	32	55	2.5	31	54	0	34	59	0	37	64	0	55	96	0	43	75	45	45	79	79
1203	3.6	32	56	2.5	31	55	0	34	60	0	37	66	0	55	99	0	43	77	45	45	81	81
1182	3.7	32	58	2.5	31	57	0	34	62	0	37	68	0	55	101	0	43	79	45	45	84	84
1120	3.8	32	60	2.6	31	58	0	34	64	0	37	70	0	55	104	0	43	82	45	45	86	86
1090	3.9	32	61	2.6	31	60	0	34	65	0	37	71	0	55	107	0	43	84	45	45	88	88
1038	4	32	63	2.7	31	61	0	34	67	0	37	73	0	55	110	0	43	86	45	45	90	90
1010	4.1	32	65	2.7	31	63	0	34	69	0	37	75	0	55	112	0	43	88	45	45	93	93
980	4.2	32	67	2.8	31	64	0	34	70	0	37	77	0	55	115	0	43	90	45	45	95	95
941	4.3	32	68	2.8	31	66	0	34	72	0	37	79	0	55	118	0	43	92	45	45	97	97
910	4.4	32	70	2.9	31	67	0	34	74	0	37	80	0	55	120	0	43	94	45	45	99	99
878	4.5	32	72	2.9	31	69	0	34	75	0	37	82	0	55	123	0	43	96	45	45	102	102
863	4.6	32	73	2.9	31	70	0	34	77	0	37	84	0	55	126	0	43	99	45	45	104	104
824	4.7	32	75	3	34	79	2	34	79	2	37	86	0	55	129	0	43	101	45	45	106	106
807	4.8	33	77	3	34	80	2	34	80	2	37	88	0	55	131	0	43	103	45	45	108	108
781	4.9	33	79	3.1	34	83	2.1	34	82	0	37	90	0	55	134	0	43	105	45	45	111	111
742	5	32	80	3.1	34	84	2.1	34	84	0	37	91	0	55	137	0	43	107	45	45	113	113
731	5.1	33	82	3.2	34	86	2.2	34	85	0	37	93	0	55	140	0	43	109	45	45	115	115
698	5.2	33	84	3.2	34	88	2.2	34	87	0	37	95	0	55	142	0	43	111	45	45	117	117
675	5.3	33	86	3.3	34	90	2.3	34	89	0	37	97	0	55	145	0	43	114	45	45	120	120
647	5.4	33	88	3.4	34	92	2.4	34	90	0	37	99	0	55	148	0	43	116	45	45	122	122
626	5.5	33	90	3.4	35	94	2.4	34	92	0	37	100	0	55	150	0	43	118	45	45	124	124
604	5.6	33	92	3.5	35	96	2.5	34	94	0	37	102	0	55	153	0	43	120	45	45	126	126
573	5.7	33	94	3.6	35	98	2.6	34	95	0	37	104	0	55	156	0	43	122	45	45	129	129
565	5.8	33	95	3.6	35	100	2.6	34	97	0	37	106	0	55	159	0	43	124	45	45	131	131
543	5.9	33	97	3.7	35	102	2.7	34	99	0	37	108	0	55	161	0	43	126	45	45	133	133
522	6	34	100	3.8	35	104	2.8	34	100	0	37	110	0	55	164	0	43	128	45	45	135	135
510	6.1	34	101	3.8	35	106	2.8	34	102	0	37	111	0	55	167	0	43	131	45	45	138	138
486	6.2	34	103	3.9	35	108	2.9	34	104	0	37	113	0	55	170	0	43	133	45	45	140	140
464	6.3	34	105	4	35	110	3	37	115	2	37	115	0	55	172	0	43	135	45	45	142	142
450	6.4	34	108	4.1	35	112	3.1	37	117	2.1	37	117	0	55	175	0	43	137	45	45	144	144
440	6.5	34	109	4.1	36	114	3.1	37	119	2.1	37	119	0	55	178	0	43	139	45	45	147	147
430	6.6	34	111	4.2	36	116	3.2	37	121	2.2	37	120	0	55	180	0	43	141	45	45	149	149
410	6.7	35	114	4.3	36	119	3.3	37	124	2.3	37	122	0	55	183	0	43	143	45	45	151	151
400	6.8	35	116	4.4	36	121	3.4	37	126	2.4	37	124	0	55	186	0	43	146	45	45	153	153
390	6.9	35	118	4.5	36	123	3.5	38	129	2.5	37	126	0	55	189	0	43	148	45	45	156	156
371	7	35	120	4.6	36	126	3.6	38	131	2.6	37	128	0	55	191	0	43	150	45	45	158	158
360	7.1	35	123	4.7	37	128	3.7	38	133	2.7	37	130	0	55	194	0	43	152	45	45	160	160
343	7.2	35	125	4.8	37	130	3.8	38	136	2.8	37	131	0	55	197	0	43	154	45	45	162	162
332	7.3	35	127	4.9	37	133	3.9	38	138	2.9	37	133	0	55	200	0	43	156	45	45	165	165
320	7.4	35	129	5	37	135	4	39	141	3	40	146	2	60	219	4	43	158	45	45	167	167
309	7.5	36	132	5.1	37	137	4.1	39	143	3.1	40	149	2.1	60	223	4.2	43	160	45	45	169	169
298	7.6	36	135	5.3	37	140	4.3	39	146	3.3	40	152	2.3	60	228	4.6	43	163	45	45	171	171
280	7.7	36	138	5.5	38	143	4.5	39	149	3.5	41	155	2.5	61	232	5	43	165	45	45	174	174
271	7.8	36	140	5.6	38	146	4.6	39	152	3.6	41	158	2.6	61	236	5.2	43	167	45	45	176	176
259	7.9	37	143	5.8	38	149	4.8	40	155	3.8	41	161	2.8	62	241	5.6	43	169	45	45	178	178
215	8	38	149	6.5	39	155	5.5	41	161	4.5	42	167	3.5	63	250	7	43	171	45	45	180	180

NOTE:
Lt, Lr & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, Lr, AND w VALUES.
WIDENING SHOWN IS BASED ON A SU-40 DESIGN VEHICLE.



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

803.34

01/13

TRANSITION CURVES - RURAL

30 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

DESIGN VELOCITY +35		DESIGN FACTORS FOR A DESIGN SPEED OF 35 MPH (RURAL) USING E = 8% MAX.																																									
		WIDTH= 18 FT						WIDTH=20 FT						WIDTH=22 FT						WIDTH=24 FT						WIDTH=48 FT						WIDTH=72 FT						INTERCHANGE RAMPS					
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																																									
		1 @ 9'			1 @ 10'			1 @ 11'			1 @ 12'			2 @ 12'			3 @ 12'			16 FT			18 FT																				
RADIUS(FT)	E(%)	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w									
4260	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
3160	2	30	30	0	33	33	0	36	36	0	39	39	0	39	39	0	59	59	0	59	59	0	78	78	0	78	78	0	46	46	48	48	48	48	48								
3040	2.1	30	31	0	33	34	0	36	38	0	39	41	0	39	41	0	59	61	0	59	61	0	78	82	0	78	82	0	46	48	48	51											
2940	2.2	30	32	0	33	36	0	36	40	0	39	43	0	39	43	0	59	64	0	59	64	0	78	86	0	78	86	0	46	50	48	53											
2700	2.3	33	38	2	33	38	0	36	41	0	39	45	0	39	45	0	59	67	0	59	67	0	78	90	0	78	90	0	46	52	48	56											
2580	2.4	33	39	2	33	39	0	36	43	0	39	47	0	39	47	0	59	70	0	59	70	0	78	93	0	78	93	0	46	55	48	58											
2520	2.5	33	41	2	33	41	0	36	45	0	39	49	0	39	49	0	59	73	0	59	73	0	78	97	0	78	97	0	46	57	48	60											
2412	2.6	34	43	2.1	33	42	0	36	47	0	39	51	0	39	51	0	59	76	0	59	76	0	78	101	0	78	101	0	46	59	48	63											
2303	2.7	33	44	2.1	33	44	0	36	48	0	39	53	0	39	53	0	59	79	0	59	79	0	78	105	0	78	105	0	46	61	48	65											
2220	2.8	33	46	2.1	33	46	0	36	50	0	39	55	0	39	55	0	59	82	0	59	82	0	78	109	0	78	109	0	46	64	48	68											
2085	2.9	34	48	2.2	33	47	0	36	52	0	39	57	0	39	57	0	59	85	0	59	85	0	78	113	0	78	113	0	46	66	48	70											
1994	3	33	49	2.2	33	49	0	36	54	0	39	59	0	39	59	0	59	88	0	59	88	0	78	117	0	78	117	0	46	68	48	72											
1915	3.1	33	51	2.2	33	50	0	36	55	0	39	60	0	39	60	0	59	90	0	59	90	0	78	120	0	78	120	0	46	70	48	75											
1865	3.2	34	53	2.3	33	52	0	36	57	0	39	62	0	39	62	0	59	93	0	59	93	0	78	124	0	78	124	0	46	73	48	77											
1822	3.3	34	55	2.3	33	54	0	36	59	0	39	64	0	39	64	0	59	96	0	59	96	0	78	128	0	78	128	0	46	75	48	80											
1706	3.4	33	56	2.3	33	55	0	36	61	0	39	66	0	39	66	0	59	99	0	59	99	0	78	132	0	78	132	0	46	77	48	82											
1648	3.5	34	58	2.4	33	57	0	36	63	0	39	68	0	39	68	0	59	102	0	59	102	0	78	136	0	78	136	0	46	79	48	84											
1590	3.6	34	60	2.4	33	59	0	36	64	0	39	70	0	39	70	0	59	105	0	59	105	0	78	140	0	78	140	0	46	82	48	87											
1533	3.7	33	61	2.4	33	60	0	36	66	0	39	72	0	39	72	0	59	108	0	59	108	0	78	144	0	78	144	0	46	84	48	89											
1476	3.8	34	63	2.5	33	62	0	36	68	0	39	74	0	39	74	0	59	111	0	59	111	0	78	148	0	78	148	0	46	86	48	92											
1467	3.9	34	65	2.5	33	63	0	36	70	0	39	76	0	39	76	0	59	114	0	59	114	0	78	151	0	78	151	0	46	88	48	94											
1410	4	34	67	2.5	33	65	0	36	71	0	39	78	0	39	78	0	59	117	0	59	117	0	78	155	0	78	155	0	46	91	48	96											
1355	4.1	34	68	2.5	33	67	0	36	73	0	39	80	0	39	80	0	59	120	0	59	120	0	78	159	0	78	159	0	46	93	48	99											
1300	4.2	34	70	2.6	33	68	0	36	75	0	39	82	0	39	82	0	59	122	0	59	122	0	78	163	0	78	163	0	46	95	48	101											
1275	4.3	34	72	2.6	33	70	0	36	77	0	39	84	0	39	84	0	59	125	0	59	125	0	78	167	0	78	167	0	46	97	48	104											
1220	4.4	34	74	2.7	33	71	0	36	79	0	39	86	0	39	86	0	59	128	0	59	128	0	78	171	0	78	171	0	46	100	48	106											
1200	4.5	34	76	2.7	33	73	0	36	80	0	39	88	0	39	88	0	59	131	0	59	131	0	78	175	0	78	175	0	46	102	48	108											
1140	4.6	34	77	2.7	33	75	0	36	82	0	39	90	0	39	90	0	59	134	0	59	134	0	78	179	0	78	179	0	46	104	48	111											
1110	4.7	34	79	2.8	33	76	0	36	84	0	39	91	0	39	91	0	59	137	0	59	137	0	78	182	0	78	182	0	46	106	48	113											
1080	4.8	34	81	2.8	33	78	0	36	86	0	39	93	0	39	93	0	59	140	0	59	140	0	78	186	0	78	186	0	46	109	48	116											
1050	4.9	34	83	2.8	33	80	0	36	87	0	39	95	0	39	95	0	59	143	0	59	143	0	78	190	0	78	190	0	46	111	48	118											
1020	5	34	85	2.9	33	81	0	36	89	0	39	97	0	39	97	0	59	146	0	59	146	0	78	194	0	78	194	0	46	113	48	120											
990	5.1	34	86	2.9	33	83	0	36	91	0	39	99	0	39	99	0	59	149	0	59	149	0	78	198	0	78	198	0	46	115	48	123											
960	5.2	34	88	2.9	33	84	0	36	93	0	39	101	0	39	101	0	59	151	0	59	151	0	78	202	0	78	202	0	46	118	48	125											
930	5.3	34	90	3	36	95	2	36	95	0	39	103	0	39	103	0	59	154	0	59	154	0	78	206	0	78	206	0	46	120	48	128											
889	5.4	35	92	3	36	96	2	36	96	0	39	105	0	39	105	0	59	157	0	59	157	0	78	210	0	78	210	0	46	122	48	130											
873	5.5	35	94	3.1	36	99	2.1	36	98	0	39	107	0	39	107	0	59	160	0	59	160	0	78	213	0	78	213	0	46	124	48	132											
847	5.6	35	96	3.1	36	100	2.1	36	100	0	39	109	0	39	109	0	59	163	0	59	163	0	78	217	0	78	217	0	46	127	48	135											
806	5.7	35	98	3.2	36	103	2.2	36	102	0	39	111	0	39	111	0	59	166	0	59	166	0	78	225	0	78	225	0	46	131	48	140											
790	5.8	35	100	3.2	36	104	2.2	36	103	0	39	113	0	39	113	0	59	169	0	59	169	0	78	229	0	78	229	0	46	134	48	142											
752	5.9	35	102	3.3	36	107	2.3	36	105	0	39	115	0	39	115	0	59	172	0	59	172	0	78	233	0	78	233	0	46	136	48	144											
730	6	35	104	3.4	37	109	2.4	36	107	0	39	117	0	39	117	0	59	175	0	59	175	0	78	237	0	78	237	0	46	138	48	147											
709	6.1	35	106	3.4	37	111	2.4	36	109	0	39	119	0	39	119	0	59	178	0	59	178	0	78	240	0	78	240	0	46	140	48	149											
689	6.2	35	107	3.4	37	112	2.4	36	110	0	39	120	0	39	120	0	59	180	0	59	180	0	78	244	0	78	244	0	46	142	48	152											
666	6.3	35	110	3.5	37	115	2.5	36	112	0	39	122	0	39	122	0	59	183	0	59	183	0	78	248	0	78	248	0	46	145	48	154											
654	6.4	35	111	3.5	37	117	2.5	36	114	0	39	124	0	39	124	0	59	186	0	59	186	0	78	252	0	78	252	0	46	147	48	156											
629	6.5	36	114	3.6	37	119	2.6	36	116	0	39	126	0	39	126	0	59	189	0	59	189	0	78	256	0	78	256	0	46	149	48	159											
607	6.6	36	116	3.7	37	121	2.7	36	118	0	39	12																															

NOTE: L_t, L_r & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, L_t, L_r, AND w VALUES. WIDENING SHOWN IS BASED ON A WB-62 DESIGN VEHICLE.

TC-5.11

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

DESIGN VELOCITY -50	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)										INTERCHANGE RAMPS									
	WIDTH-20 FT		WIDTH-22 FT		WIDTH-24 FT		WIDTH-48 FT		WIDTH-72 FT		16 FT		18 FT							
	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	L _t	L _r						
8150	NC	0	0	0	0	0	0	0	0	0	0	0	0	0						
6013	2	44	44	2	44	44	0	48	48	0	72	72	0	96	96	0	57	57	60	60
5703	2.1	45	47	2.1	44	47	0	48	51	0	72	76	0	96	101	0	57	59	60	63
5420	2.2	45	49	2.1	44	49	0	48	53	0	72	80	0	96	106	0	57	62	60	66
5162	2.3	45	51	2.1	44	51	0	48	56	0	72	83	0	96	111	0	57	65	60	69
4926	2.4	45	54	2.2	44	53	0	48	58	0	72	87	0	96	116	0	57	68	60	72
4708	2.5	45	56	2.2	44	55	0	48	60	0	72	90	0	96	120	0	57	71	60	75
4507	2.6	45	58	2.2	44	58	0	48	63	0	72	94	0	96	125	0	57	73	60	78
4320	2.7	45	61	2.3	44	60	0	48	65	0	72	98	0	96	130	0	57	76	60	81
4146	2.8	45	63	2.3	44	62	0	48	68	0	72	101	0	96	135	0	57	79	60	84
3985	2.9	45	65	2.3	44	64	0	48	70	0	72	105	0	96	140	0	57	82	60	87
3834	3	45	68	2.4	44	66	0	48	72	0	72	108	0	96	144	0	57	85	60	90
3692	3.1	45	70	2.4	44	69	0	48	75	0	72	112	0	96	149	0	57	88	60	93
3560	3.2	45	72	2.4	44	71	0	48	77	0	72	116	0	96	154	0	57	90	60	96
3434	3.3	45	75	2.5	44	73	0	48	80	0	72	119	0	96	159	0	57	93	60	99
3316	3.4	45	77	2.5	44	75	0	48	82	0	72	123	0	96	164	0	57	96	60	102
3205	3.5	45	79	2.5	44	77	0	48	84	0	72	126	0	96	168	0	57	99	60	105
3099	3.6	46	82	2.6	44	80	0	48	87	0	72	130	0	96	173	0	57	102	60	108
2999	3.7	46	84	2.6	44	82	0	48	89	0	72	134	0	96	178	0	57	104	60	111
2904	3.8	46	86	2.6	44	84	0	48	92	0	72	137	0	96	183	0	57	107	60	114
2814	3.9	46	89	2.7	44	86	0	48	94	0	72	141	0	96	188	0	57	110	60	117
2728	4	46	91	2.7	44	88	0	48	96	0	72	144	0	96	192	0	57	113	60	120
2646	4.1	46	94	2.8	44	91	0	48	99	0	72	148	0	96	197	0	57	116	60	123
2568	4.2	46	96	2.8	44	93	0	48	101	0	72	152	0	96	202	0	57	118	60	126
2493	4.3	46	99	2.8	44	95	0	48	104	0	72	155	0	96	207	0	57	121	60	129
2422	4.4	46	101	2.9	44	97	0	48	106	0	72	159	0	96	212	0	57	124	60	132
2353	4.5	46	104	2.9	44	99	0	48	108	0	72	162	0	96	216	0	57	127	60	135
2287	4.6	46	106	2.9	44	102	0	48	111	0	72	166	0	96	221	0	57	130	60	138
2224	4.7	46	109	3	48	113	2	48	113	0	72	170	0	96	226	0	57	132	60	141
2163	4.8	46	111	3	48	116	2	48	116	0	72	173	0	96	231	0	57	135	60	144
2104	4.9	47	114	3.1	49	119	2.1	48	118	0	72	177	0	96	236	0	57	138	60	147
2047	5	47	116	3.1	49	121	2.1	48	120	0	72	180	0	96	240	0	57	141	60	150
1992	5.1	47	118	3.1	49	123	2.1	48	123	0	72	184	0	96	245	0	57	144	60	153
1939	5.2	47	121	3.2	49	126	2.2	48	125	0	72	188	0	96	250	0	57	146	60	156
1888	5.3	47	123	3.2	49	129	2.2	48	128	0	72	191	0	96	255	0	57	149	60	159
1838	5.4	47	126	3.3	49	132	2.3	48	130	0	72	195	0	96	260	0	57	152	60	162
1790	5.5	47	129	3.3	49	134	2.3	48	132	0	72	198	0	96	264	0	57	155	60	165
1743	5.6	47	132	3.4	49	137	2.4	48	135	0	72	202	0	96	269	0	57	158	60	168
1698	5.7	47	134	3.4	49	140	2.4	48	137	0	72	206	0	96	274	0	57	160	60	171
1653	5.8	47	137	3.5	49	143	2.5	48	140	0	72	209	0	96	279	0	57	163	60	174
1610	5.9	47	139	3.5	49	145	2.5	48	142	0	72	213	0	96	284	0	57	166	60	177
1568	6	47	141	3.5	49	147	2.5	48	144	0	72	216	0	96	288	0	57	169	60	180
1527	6.1	48	144	3.6	50	151	2.6	48	147	0	72	220	0	96	293	0	57	172	60	183
1487	6.2	48	147	3.6	50	153	2.6	48	149	0	72	224	0	96	298	0	57	175	60	186
1448	6.3	48	150	3.7	50	156	2.7	48	152	0	72	227	0	96	303	0	57	177	60	189
1410	6.4	48	153	3.8	50	159	2.8	48	154	0	72	231	0	96	308	0	57	180	60	192
1372	6.5	48	155	3.8	50	162	2.8	48	156	0	72	234	0	96	312	0	57	183	60	195
1336	6.6	48	158	3.9	50	165	2.9	48	159	0	72	238	0	96	317	0	57	186	60	198
1300	6.7	48	161	3.9	50	167	2.9	48	161	0	72	242	0	96	322	0	57	189	60	201
1265	6.8	48	164	4	50	170	3	52	177	2	78	266	4	104	354	6	57	191	60	204
1230	6.9	48	166	4	50	173	3	52	180	2	78	270	4	104	359	6	57	194	60	207
1196	7	49	169	4.1	51	176	3.1	53	183	2.1	79	275	4.2	105	366	6.3	57	197	60	210
1162	7.1	49	172	4.2	51	179	3.2	53	187	2.2	79	280	4.4	105	373	6.6	57	200	60	213
1128	7.2	49	175	4.3	51	183	3.3	53	190	2.3	79	285	4.6	106	379	6.9	57	203	60	216
1094	7.3	49	178	4.3	51	185	3.3	53	192	2.3	79	288	4.6	106	384	6.9	57	205	60	219
1059	7.4	49	181	4.4	51	188	3.4	53	196	2.4	80	294	4.8	106	391	7.2	57	208	60	222
1024	7.5	50	184	4.5	51	192	3.5	53	199	2.5	80	299	5	106	398	7.5	57	211	60	225
988	7.6	50	187	4.6	52	195	3.6	54	203	2.6	80	304	5.2	107	405	7.8	57	214	60	228
950	7.7	50	191	4.7	52	198	3.7	54	206	2.7	81	309	5.4	107	412	8.1	57	217	60	231
908	7.8	50	194	4.8	52	202	3.8	54	210	2.8	81	314	5.6	108	419	8.4	57	219	60	234
860	7.9	51	198	5	52	206	4	54	214	3	81	320	6	108	427	9	57	222	60	237
760	8	51	204	5.4	53	212	4.4	55	220	3.4	83	329	6.8	110	439	10.2	57	225	60	240

VDOT
ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1
803.38

REVISION DATE
01/13

TRANSITION CURVES - RURAL
50 MPH DESIGN SPEED
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

NOTE: L_t, L_r & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, L_t, L_r, AND w VALUES. WIDENING SHOWN IS BASED ON A WB-62 DESIGN VEHICLE.

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

DESIGN VELOCITY +60	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS							
	WIDTH=22 FT				WIDTH=24 FT				WIDTH=48 FT				WIDTH=72 FT				WIDTH			
	1 @ 11'		1 @ 12'		1 @ 12'		2 @ 12'		2 @ 12'		3 @ 12'		16 FT		18 FT					
RADIUS(FT)	E(%)	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	L _t	L _r	w	
11500	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8480	2	49	49	0	54	54	0	80	80	0	80	80	0	107	107	0	63	63	67	67
8048	2.1	49	52	0	54	56	0	80	84	0	80	84	0	107	112	0	63	66	67	70
7654	2.2	49	54	0	54	59	0	80	88	0	80	88	0	107	118	0	63	70	67	74
7294	2.3	49	57	0	54	62	0	80	92	0	80	92	0	107	123	0	63	73	67	77
6965	2.4	49	59	0	54	64	0	80	96	0	80	96	0	107	128	0	63	76	67	80
6661	2.5	49	62	0	54	67	0	80	100	0	80	100	0	107	134	0	63	79	67	84
6381	2.6	49	64	0	54	70	0	80	104	0	80	104	0	107	139	0	63	82	67	87
6121	2.7	49	66	0	54	72	0	80	108	0	80	108	0	107	144	0	63	85	67	90
5879	2.8	49	69	0	54	75	0	80	112	0	80	112	0	107	150	0	63	88	67	94
5654	2.9	49	71	0	54	78	0	80	116	0	80	116	0	107	155	0	63	91	67	97
5444	3	49	74	0	54	80	0	80	120	0	80	120	0	107	160	0	63	95	67	100
5247	3.1	49	76	0	54	83	0	80	124	0	80	124	0	107	166	0	63	98	67	104
5063	3.2	49	79	0	54	86	0	80	128	0	80	128	0	107	171	0	63	101	67	107
4889	3.3	49	81	0	54	88	0	80	132	0	80	132	0	107	176	0	63	104	67	110
4725	3.4	49	84	0	54	91	0	80	136	0	80	136	0	107	182	0	63	107	67	114
4571	3.5	49	86	0	54	94	0	80	140	0	80	140	0	107	187	0	63	110	67	117
4424	3.6	49	88	0	54	96	0	80	144	0	80	144	0	107	192	0	63	113	67	120
4286	3.7	49	91	0	54	99	0	80	148	0	80	148	0	107	198	0	63	117	67	124
3587	4.3	49	106	0	54	115	0	80	172	0	80	172	0	107	230	0	63	135	67	144
3488	4.4	49	108	0	54	118	0	80	176	0	80	176	0	107	235	0	63	139	67	147
3394	4.5	49	110	0	54	120	0	80	180	0	80	180	0	107	240	0	63	142	67	150
3303	4.6	49	113	0	54	123	0	80	184	0	80	184	0	107	246	0	63	145	67	154
3216	4.7	49	115	0	54	126	0	80	188	0	80	188	0	107	251	0	63	148	67	157
3133	4.8	49	118	0	54	128	0	80	192	0	80	192	0	107	256	0	63	151	67	160
3053	4.9	49	120	0	54	131	0	80	196	0	80	196	0	107	262	0	63	154	67	164
2975	5	49	123	0	54	136	0	80	200	0	80	200	0	107	267	0	63	157	67	167
2901	5.1	49	125	0	54	139	0	80	204	0	80	204	0	107	272	0	63	160	67	170
2829	5.2	49	128	0	54	142	0	80	208	0	80	208	0	107	278	0	63	164	67	174
2759	5.3	49	130	0	54	144	0	80	212	0	80	212	0	107	283	0	63	167	67	177
2692	5.4	49	132	0	54	147	0	80	216	0	80	216	0	107	288	0	63	170	67	180
2627	5.5	54	147	2	54	150	0	80	220	0	80	220	0	107	294	0	63	173	67	184
2565	5.6	54	150	2	54	152	0	80	224	0	80	224	0	107	299	0	63	176	67	187
2504	5.7	54	152	2	54	155	0	80	228	0	80	228	0	107	304	0	63	179	67	190
2445	5.8	54	156	2.1	54	158	0	80	232	0	80	232	0	107	310	0	63	182	67	194
2387	5.9	54	158	2.1	54	160	0	80	236	0	80	236	0	107	315	0	63	186	67	197
2332	6	54	161	2.1	54	163	0	80	240	0	80	240	0	107	320	0	63	189	67	200
2277	6.1	54	165	2.2	54	166	0	80	244	0	80	244	0	107	326	0	63	192	67	204
2225	6.2	54	167	2.2	54	168	0	80	248	0	80	248	0	107	331	0	63	195	67	207
2173	6.3	54	170	2.2	54	168	0	80	252	0	80	252	0	107	336	0	63	198	67	210
2122	6.4	54	173	2.3	54	171	0	80	256	0	80	256	0	107	342	0	63	201	67	214
2072	6.5	54	176	2.3	54	174	0	80	260	0	80	260	0	107	347	0	63	204	67	217
2022	6.6	54	179	2.3	54	176	0	80	264	0	80	264	0	107	352	0	63	208	67	220
1974	6.7	55	182	2.4	54	179	0	80	268	0	80	268	0	107	358	0	63	211	67	224
1925	6.8	55	185	2.4	54	182	0	80	272	0	80	272	0	107	363	0	63	214	67	227
1877	6.9	55	188	2.5	54	184	0	80	276	0	80	276	0	107	368	0	63	217	67	230
1830	7	55	191	2.5	54	187	0	80	280	0	80	280	0	107	374	0	63	220	67	234
1782	7.1	55	195	2.6	54	190	0	80	284	0	80	284	0	107	379	0	63	223	67	237
1735	7.2	55	197	2.6	54	192	0	80	288	0	80	288	0	107	384	0	63	226	67	240
1687	7.3	55	201	2.7	54	195	0	80	292	0	80	292	0	107	390	0	63	230	67	244
1638	7.4	55	204	2.7	54	198	0	80	296	0	80	296	0	107	395	0	63	233	67	247
1588	7.5	56	207	2.8	54	200	0	80	300	0	80	300	0	107	400	0	63	236	67	250
1537	7.6	56	210	2.8	54	203	0	80	304	0	80	304	0	107	406	0	63	239	67	254
1482	7.7	56	214	2.9	54	206	0	80	308	0	80	308	0	107	411	0	63	242	67	257
1422	7.8	56	217	3	58	226	2	87	338	4	116	451	6	63	245	6	63	245	67	260
1350	7.9	56	221	3.1	58	230	2.1	87	344	4.2	116	459	6.3	63	248	6.3	63	248	67	264
1204	8	57	226	3.4	59	235	2.4	88	352	4.8	118	470	7.2	63	251	7.2	63	251	67	267



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

803.40

01/13

**TRANSITION CURVES - RURAL
60 MPH DESIGN SPEED**

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

NOTE: Lt, Lr & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, Lt, Lr, AND w VALUES. WIDENING SHOWN IS BASED ON A WB-62 DESIGN VEHICLE.

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

DESIGN VELOCITY V=70	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS											
	1 @ 11'				1 @ 12'				2 @ 12'				3 @ 12'			16 FT			18 FT					
	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w	Lt	Lr	w
14500	NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10731	2	55	58	0	60	63	0	90	95	0	120	126	0	120	126	0	120	126	0	120	126	0	120	126
10194	2.1	55	58	0	60	66	0	90	99	0	120	132	0	120	132	0	120	132	0	120	132	0	120	132
9706	2.2	55	61	0	60	69	0	90	104	0	120	138	0	120	138	0	120	138	0	120	138	0	120	138
9260	2.3	55	64	0	60	72	0	90	108	0	120	144	0	120	144	0	120	144	0	120	144	0	120	144
8851	2.4	55	66	0	60	75	0	90	113	0	120	150	0	120	150	0	120	150	0	120	150	0	120	150
8474	2.5	55	69	0	60	78	0	90	117	0	120	156	0	120	156	0	120	156	0	120	156	0	120	156
8127	2.6	55	72	0	60	81	0	90	122	0	120	162	0	120	162	0	120	162	0	120	162	0	120	162
7805	2.7	55	75	0	60	84	0	90	126	0	120	168	0	120	168	0	120	168	0	120	168	0	120	168
7506	2.8	55	77	0	60	87	0	90	131	0	120	174	0	120	174	0	120	174	0	120	174	0	120	174
7227	2.9	55	80	0	60	90	0	90	135	0	120	180	0	120	180	0	120	180	0	120	180	0	120	180
6967	3	55	83	0	60	93	0	90	140	0	120	186	0	120	186	0	120	186	0	120	186	0	120	186
6724	3.1	55	86	0	60	96	0	90	144	0	120	192	0	120	192	0	120	192	0	120	192	0	120	192
6495	3.2	55	88	0	60	99	0	90	149	0	120	198	0	120	198	0	120	198	0	120	198	0	120	198
6281	3.3	55	91	0	60	102	0	90	153	0	120	204	0	120	204	0	120	204	0	120	204	0	120	204
6079	3.4	55	94	0	60	105	0	90	158	0	120	210	0	120	210	0	120	210	0	120	210	0	120	210
5888	3.5	55	97	0	60	108	0	90	162	0	120	216	0	120	216	0	120	216	0	120	216	0	120	216
5708	3.6	55	99	0	60	111	0	90	167	0	120	222	0	120	222	0	120	222	0	120	222	0	120	222
5537	3.7	55	102	0	60	114	0	90	171	0	120	228	0	120	228	0	120	228	0	120	228	0	120	228
5376	3.8	55	105	0	60	117	0	90	176	0	120	234	0	120	234	0	120	234	0	120	234	0	120	234
5222	3.9	55	108	0	60	120	0	90	180	0	120	240	0	120	240	0	120	240	0	120	240	0	120	240
5076	4	55	110	0	60	123	0	90	185	0	120	246	0	120	246	0	120	246	0	120	246	0	120	246
4937	4.1	55	113	0	60	126	0	90	189	0	120	252	0	120	252	0	120	252	0	120	252	0	120	252
4805	4.2	55	116	0	60	129	0	90	194	0	120	258	0	120	258	0	120	258	0	120	258	0	120	258
4679	4.3	55	119	0	60	132	0	90	198	0	120	264	0	120	264	0	120	264	0	120	264	0	120	264
4558	4.4	55	121	0	60	135	0	90	203	0	120	270	0	120	270	0	120	270	0	120	270	0	120	270
4443	4.5	55	124	0	60	138	0	90	207	0	120	276	0	120	276	0	120	276	0	120	276	0	120	276
4332	4.6	55	127	0	60	141	0	90	212	0	120	282	0	120	282	0	120	282	0	120	282	0	120	282
4226	4.7	55	130	0	60	144	0	90	216	0	120	288	0	120	288	0	120	288	0	120	288	0	120	288
4125	4.8	55	132	0	60	147	0	90	221	0	120	294	0	120	294	0	120	294	0	120	294	0	120	294
4027	4.9	55	135	0	60	150	0	90	225	0	120	300	0	120	300	0	120	300	0	120	300	0	120	300
3933	5	55	138	0	60	153	0	90	230	0	120	306	0	120	306	0	120	306	0	120	306	0	120	306
3843	5.1	55	141	0	60	156	0	90	234	0	120	312	0	120	312	0	120	312	0	120	312	0	120	312
3756	5.2	55	143	0	60	159	0	90	239	0	120	318	0	120	318	0	120	318	0	120	318	0	120	318
3673	5.3	55	146	0	60	162	0	90	243	0	120	324	0	120	324	0	120	324	0	120	324	0	120	324
3592	5.4	55	149	0	60	165	0	90	248	0	120	330	0	120	330	0	120	330	0	120	330	0	120	330
3514	5.5	55	152	0	60	168	0	90	252	0	120	336	0	120	336	0	120	336	0	120	336	0	120	336
3439	5.6	55	154	0	60	171	0	90	257	0	120	342	0	120	342	0	120	342	0	120	342	0	120	342
3366	5.7	55	157	0	60	174	0	90	261	0	120	348	0	120	348	0	120	348	0	120	348	0	120	348
3296	5.8	55	160	0	60	177	0	90	266	0	120	354	0	120	354	0	120	354	0	120	354	0	120	354
3228	5.9	55	163	0	60	180	0	90	270	0	120	360	0	120	360	0	120	360	0	120	360	0	120	360
3163	6	55	165	0	60	183	0	90	275	0	120	366	0	120	366	0	120	366	0	120	366	0	120	366
3099	6.1	55	168	0	60	186	0	90	279	0	120	372	0	120	372	0	120	372	0	120	372	0	120	372
3037	6.2	55	171	0	60	189	0	90	284	0	120	378	0	120	378	0	120	378	0	120	378	0	120	378
2977	6.3	55	174	0	60	192	0	90	288	0	120	384	0	120	384	0	120	384	0	120	384	0	120	384
2919	6.4	55	176	0	60	195	0	90	293	0	120	390	0	120	390	0	120	390	0	120	390	0	120	390
2862	6.5	60	195	2	60	198	0	90	297	0	120	396	0	120	396	0	120	396	0	120	396	0	120	396
2807	6.6	61	199	2.1	60	201	0	90	302	0	120	402	0	120	402	0	120	402	0	120	402	0	120	402
2753	6.7	61	202	2.1	60	204	0	90	306	0	120	408	0	120	408	0	120	408	0	120	408	0	120	408
2699	6.8	61	205	2.1	60	207	0	90	311	0	120	414	0	120	414	0	120	414	0	120	414	0	120	414
2645	6.9	61	208	2.1	60	210	0	90	315	0	120	420	0	120	420	0	120	420	0	120	420	0	120	420
2590	7	61	212	2.2	60	213	0	90	320	0	120	426	0	120	426	0	120	426	0	120	426	0	120	426
2535	7.1	61	215	2.2	60	216	0	90	324	0	120	432	0	120	432	0	120	432	0	120	432	0	120	432
2480	7.2	61	218	2.2	60	219	0	90	329	0	120	438	0	120	438	0	120	438	0	120	438	0	120	438
2423	7.3	61	222	2.3	60	222	0	90	333	0	120	444	0	120	444	0	120	444	0	120	444	0	120	444
2365	7.4	61	225	2.3	60	225	0	90	338	0	120	450	0	120	450	0	120	450	0	120	450	0	120	450
2305	7.5	61	228	2.3	60	228	0	90	342	0	120	456	0	120	456	0	120	456	0	120	456	0	120	456
2242	7.6	61	232	2.4	60	231	0	90	347	0	120	462	0	120	462	0	120	462	0	120	462	0	120	462
2175	7.7	61	235	2.4	60	234	0	90	351	0	120	468	0	120	468	0	120	468	0	120	468	0	120	468
2100	7.8	62	239	2.5	60	237	0	90	356	0	120	474	0	120	474	0	120	474	0	120	474	0	120	474
2010	7.9	62	243	2.6	60	240	0	90	360	0	120	480	0	120	480	0	120	480	0	120	480	0	120	480
1821	8	62	248	2.8	60	240	0	90	360	0	120	480	0	120	480	0	120	480	0	120	480	0	120	480



ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE

NOTE: L_t, L_r & w VALUES IN FEET. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, L_t, L_r, AND w VALUES. WIDENING SHOWN IS BASED ON A WB-62 DESIGN VEHICLE.

DESIGN FACTORS FOR A DESIGN SPEED OF 80 MPH (RURAL) USING E= 8% MAX.

DESIGN VELOCITY +80	WIDTH=22 FT		WIDTH=24 FT		WIDTH=48 FT		WIDTH=72 FT		INTERCHANGE RAMPS			
	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)			
	1 @ 11'		1 @ 12'		2 @ 12'		3 @ 12'		16 FT		18 FT	
	L _t	L _r	L _t	L _r	L _t	L _r	L _t	L _r	L _t	L _r	L _t	L _r
17800	NC	0	0	0	0	0	0	0	0	0	0	
13704	2	63	63	69	69	103	103	138	138	0	83	
12749	2.1	63	66	69	72	103	108	138	145	0	83	
12340	2.2	63	70	69	76	103	114	138	152	0	83	
11845	2.3	63	73	69	79	103	119	138	159	0	83	
11401	2.4	63	76	69	83	103	124	138	166	0	83	
10706	2.5	63	79	69	86	103	129	138	173	0	83	
10251	2.6	63	82	69	90	103	134	138	180	0	83	
9831	2.7	63	85	69	93	103	139	138	187	0	83	
9528	2.8	63	88	69	96	103	144	138	193	0	83	
9163	2.9	63	92	69	100	103	150	138	200	0	83	
8904	3	63	95	69	103	103	155	138	207	0	83	
8584	3.1	63	98	69	107	103	160	138	214	0	83	
8358	3.2	63	101	69	110	103	165	138	221	0	83	
8148	3.3	63	104	69	114	103	170	138	228	0	83	
7881	3.4	63	107	69	117	103	175	138	235	0	83	
7490	3.5	63	110	69	120	103	180	138	242	0	83	
7319	3.6	63	114	69	124	103	186	138	249	0	83	
7096	3.7	63	117	69	127	103	191	138	255	0	83	
6883	3.8	63	120	69	131	103	196	138	262	0	83	
6743	3.9	63	123	69	134	103	201	138	269	0	83	
6550	4	63	126	69	138	103	206	138	276	0	83	
6367	4.1	63	129	69	141	103	211	138	283	0	83	
6193	4.2	63	132	69	144	103	216	138	290	0	83	
6038	4.3	63	136	69	148	103	222	138	297	0	83	
5868	4.4	63	139	69	151	103	227	138	304	0	83	
5820	4.5	63	142	69	155	103	232	138	311	0	83	
5656	4.6	63	145	69	158	103	237	138	318	0	83	
5499	4.7	63	148	69	162	103	242	138	324	0	83	
5405	4.8	63	151	69	165	103	247	138	331	0	83	
5274	4.9	63	154	69	168	103	252	138	338	0	83	
5150	5	63	158	69	172	103	258	138	345	0	83	
5067	5.1	63	161	69	175	103	263	138	352	0	83	
4951	5.2	63	164	69	179	103	268	138	359	0	83	
4775	5.3	63	167	69	182	103	273	138	366	0	83	
4669	5.4	63	170	69	186	103	278	138	373	0	83	
4586	5.5	63	173	69	189	103	283	138	380	0	83	
4497	5.6	63	176	69	192	103	288	138	386	0	83	
4410	5.7	63	180	69	196	103	294	138	393	0	83	
4337	5.8	63	183	69	199	103	299	138	400	0	83	
4267	5.9	63	186	69	203	103	304	138	407	0	83	
4227	6	63	189	69	206	103	309	138	414	0	83	
4146	6.1	63	192	69	210	103	314	138	421	0	83	
4047	6.2	63	195	69	213	103	319	138	428	0	83	
3966	6.3	63	198	69	216	103	324	138	435	0	83	
3877	6.4	63	202	69	220	103	330	138	442	0	83	
3860	6.5	63	205	69	223	103	335	138	448	0	83	
3790	6.6	63	208	69	227	103	340	138	455	0	83	
3723	6.7	63	211	69	230	103	345	138	462	0	83	
3652	6.8	63	214	69	234	103	350	138	469	0	83	
3582	6.9	63	217	69	237	103	355	138	476	0	83	
3513	7	69	240	2	69	240	103	360	138	483	0	83
3467	7.1	69	244	2	69	244	103	366	138	490	0	83
3425	7.2	69	247	2	69	247	103	371	138	497	0	83
3354	7.3	69	251	2	69	251	103	376	138	504	0	83
3324	7.4	69	254	2	69	254	103	381	138	510	0	83
3218	7.5	69	259	2.1	69	258	103	386	138	517	0	83
3159	7.6	69	262	2.1	69	261	103	391	138	524	0	83
3115	7.7	69	266	2.1	69	264	103	396	138	531	0	83
3029	7.8	69	269	2.1	69	268	103	402	138	538	0	83
2895	7.9	70	274	2.2	69	271	103	407	138	545	0	83
2675	8	70	278	2.3	69	275	103	412	138	552	0	83



ROAD AND BRIDGE STANDARDS

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REVISION DATE

803.44

01/13

TRANSITION CURVES - RURAL

80 MPH DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE