

A-Geometric Difference of Grades in Percent	When S>L: $S = \frac{328.997}{A} + \frac{L}{2}$																				When S<L: $S = 25.684 \sqrt{\frac{L}{A}}$																				SD-4 A-Geometric Difference of Grades in Percent
	S = Sight Distance in Meters																																								
	L = Length of Vertical Curve in Meters																																								
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400																					
2.0	174	184	194	204	214	224	234	244	254	264	274	284	294	304	314	324	335	345	354	363	2.0																				
2.5	142	152	162	172	182	192	202	212	222	232	242	252	262	272	281	291	300	308	317	325	2.5																				
3.0	120	130	140	150	160	170	180	190	200	210	220	230	239	248	257	265	273	281	289	297	3.0																				
3.5	104	114	124	134	144	154	164	174	184	194	204	213	221	230	238	246	253	260	268	275	3.5																				
4.0	92	102	112	122	132	142	152	162	172	182	190	199	207	215	222	230	237	244	250	257	4.0																				
4.5	83	93	103	113	123	133	143	153	162	171	180	188	195	203	210	217	223	230	236	242	4.5																				
5.0	76	86	96	106	116	126	136	145	154	162	170	178	185	192	199	205	212	218	224	230	5.0																				
5.5	70	80	90	100	110	120	130	139	147	155	162	170	177	183	190	196	202	208	213	219	5.5																				
6.0	65	75	85	95	105	115	124	133	141	148	156	162	169	175	182	188	193	199	204	210	6.0																				
6.5	61	71	81	91	101	110	119	127	135	142	149	156	162	169	174	180	186	191	196	201	6.5																				
7.0	57	67	77	87	97	106	115	123	130	137	144	150	157	162	168	174	179	184	189	194	7.0																				
7.5	54	64	74	84	94	103	111	119	126	133	139	145	151	157	162	168	173	178	183	188	7.5																				
8.0	51	61	71	81	91	99	107	115	122	128	135	141	146	152	157	162	167	172	177	182	8.0																				
8.5	49	59	69	79	88	97	104	111	118	125	131	136	142	147	153	158	162	167	172	176	8.5																				
9.0	47	57	67	77	86	94	101	108	115	121	127	133	138	143	148	153	158	162	167	171	9.0																				
9.5	45	55	65	75	83	91	99	105	112	118	124	129	134	139	144	149	154	158	162	167	9.5																				
10.0	43	53	63	73	81	89	96	103	109	115	120	126	131	136	141	145	150	154	158	162	10.0																				
10.5	41	51	61	71	79	87	94	100	106	112	118	123	128	133	137	142	146	150	155	159	10.5																				
11.0	40	50	60	69	77	85	92	98	104	110	115	120	125	130	134	139	143	147	151	155	11.0																				
11.5	39	49	59	68	76	83	90	96	102	107	112	117	122	127	131	135	140	144	148	151	11.5																				
12.0	37	47	57	66	74	81	88	94	99	105	110	115	120	124	128	133	137	141	145	148	12.0																				
12.5	36	46	56	65	73	80	86	92	97	103	108	113	117	122	126	130	134	138	142	145	12.5																				
13.0	35	45	55	64	71	78	84	90	96	101	106	110	115	119	123	127	131	135	139	142	13.0																				
13.5	34	44	54	63	70	77	83	88	94	99	104	108	113	117	121	125	129	133	136	140	13.5																				
14.0	33	43	53	61	69	75	81	87	92	97	102	106	111	115	119	123	127	130	134	137	14.0																				
14.5	33	43	52	60	67	74	80	85	90	95	100	104	109	113	117	121	124	128	131	135	14.5																				
15.0	32	42	51	59	66	73	78	84	89	94	98	103	107	111	115	119	122	126	129	133	15.0																				
16.0	31	41	50	57	64	70	76	81	86	91	95	99	104	107	111	115	118	122	125	128	16.0																				
17.0	29	39	48	56	62	68	74	79	84	88	92	97	100	104	108	111	115	118	121	125	17.0																				
18.0	28	38	47	54	61	66	72	77	81	86	90	94	98	101	105	108	112	115	118	121	18.0																				
19.0	27	37	46	53	59	65	70	75	79	83	87	91	95	99	102	105	109	112	115	118	19.0																				
20.0	26	36	44	51	57	63	68	73	77	81	85	89	93	96	99	103	106	109	112	115	20.0																				

SIGHT DISTANCE ON VERTICAL CURVES

HEIGHT OF EYE 1.08 METERS

HEIGHT OF OBJECT = 0.60 METERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

608.06

SD-4 A-Geometric Difference of Grades in Percent	When S>L: $S = \frac{328.997}{A} + \frac{L}{2}$ When S<L: $S = 25.684 \sqrt{\frac{L}{A}}$ S = Sight Distance in Meters																			A-Geometric Difference of Grades in Percent	
	L = Length of Vertical Curve in Meters																				
	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	
2.0	372	381	390	398	406	414	422	430	437	445	452	459	467	474	481	487	494	501	507	514	2.0
2.5	333	341	348	356	363	370	377	384	391	398	404	411	417	424	430	436	442	448	454	459	2.5
3.0	304	311	318	325	332	338	345	351	357	363	369	375	381	387	392	398	403	409	414	419	3.0
3.5	281	288	294	301	307	313	319	325	331	336	342	347	353	358	363	368	373	378	383	388	3.5
4.0	263	269	275	281	287	293	298	304	309	315	320	325	330	335	340	345	349	354	359	363	4.0
4.5	248	254	260	265	271	276	281	287	292	297	301	306	311	316	320	325	329	334	338	342	4.5
5.0	235	241	246	252	257	262	267	272	277	281	286	291	295	300	304	308	312	317	321	325	5.0
5.5	224	230	235	240	245	250	254	259	264	268	273	277	281	286	290	294	298	302	306	310	5.5
6.0	215	220	225	230	234	239	244	248	253	257	261	265	269	273	277	281	285	289	293	297	6.0
6.5	206	211	216	221	225	230	234	238	243	247	251	255	259	263	267	270	274	278	281	285	6.5
7.0	199	204	208	213	217	221	226	230	234	238	242	246	249	253	257	260	264	268	271	275	7.0
7.5	192	197	201	205	210	214	218	222	226	230	234	237	241	245	248	252	255	259	262	265	7.5
8.0	186	190	195	199	203	207	211	215	219	222	226	230	233	237	240	244	247	250	254	257	8.0
8.5	181	185	189	193	197	201	205	208	212	216	219	223	226	230	233	236	240	243	246	249	8.5
9.0	175	180	184	188	191	195	199	203	206	210	213	217	220	223	227	230	233	236	239	242	9.0
9.5	171	175	179	183	186	190	194	197	201	204	207	211	214	217	220	224	227	230	233	236	9.5
10.0	166	170	174	178	182	185	189	192	196	199	202	205	209	212	215	218	221	224	227	230	10.0
10.5	162	166	170	174	177	181	184	188	191	194	197	201	204	207	210	213	216	219	221	224	10.5
11.0	159	162	166	170	173	177	180	183	187	190	193	196	199	202	205	208	211	213	216	219	11.0
11.5	155	159	162	166	169	173	176	179	182	186	189	192	195	198	200	203	206	209	212	214	11.5
12.0	152	156	159	162	166	169	172	175	179	182	185	188	190	193	196	199	202	204	207	210	12.0
12.5	149	152	156	159	162	166	169	172	175	178	181	184	187	189	192	195	198	200	203	205	12.5
13.0	146	149	153	156	159	162	166	169	172	174	177	180	183	186	188	191	194	196	199	201	13.0
13.5	143	147	150	153	156	159	162	165	168	171	174	177	180	182	185	188	190	193	195	198	13.5
14.0	141	144	147	150	153	157	160	162	165	168	171	174	176	179	182	184	187	189	192	194	14.0
14.5	138	141	145	148	151	154	157	160	162	165	168	171	173	176	178	181	183	186	188	191	14.5
15.0	136	139	142	145	148	151	154	157	160	162	165	168	170	173	175	178	180	183	185	188	15.0
16.0	132	135	138	141	144	146	149	152	155	157	160	162	165	167	170	172	175	177	179	182	16.0
17.0	128	131	134	136	139	142	145	147	150	153	155	158	160	162	165	167	169	172	174	176	17.0
18.0	124	127	130	133	135	138	141	143	146	148	151	153	156	158	160	162	165	167	169	171	18.0
19.0	121	124	126	129	132	134	137	139	142	144	147	149	151	154	156	158	160	162	165	167	19.0
20.0	118	120	123	126	128	131	133	136	138	141	143	145	148	150	152	154	156	158	160	162	20.0

SIGHT DISTANCE ON VERTICAL CURVES

HEIGHT OF EYE 1.08 METERS

HEIGHT OF OBJECT =0.60 METERS

NEW 10/02

608.07

VIRGINIA DEPARTMENT OF TRANSPORTATION

A-Geometric Difference of Grades in Percent	When S > L: $S = \frac{4.32}{A} + \frac{L}{2}$																				When S < L: $S = 29.394 \sqrt{\frac{L}{A}}$																				S = Sight Distance in Meters		SD-5
	L = Length of Vertical Curve in Meters																																								A-Geometric Difference of Grades in Percent		
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400																							
2.0	226	236	246	256	266	276	286	296	306	316	326	336	346	356	366	376	386	396	406	416	2.0																						
2.5	183	193	203	213	223	233	243	253	263	273	283	293	303	313	323	333	343	353	362	372	2.5																						
3.0	154	164	174	184	194	204	214	224	234	244	254	264	274	284	294	304	313	322	331	339	3.0																						
3.5	133	143	153	163	173	183	193	203	213	223	233	243	253	263	272	281	290	298	306	314	3.5																						
4.0	118	128	138	148	158	168	178	188	198	208	218	228	237	246	255	263	271	279	286	294	4.0																						
4.5	106	116	126	136	146	156	166	176	186	196	206	215	223	232	240	248	256	263	270	277	4.5																						
5.0	96	106	116	126	136	146	156	166	176	186	195	204	212	220	228	235	242	249	256	263	5.0																						
5.5	89	99	109	119	129	139	149	159	168	177	186	194	202	210	217	224	231	238	244	251	5.5																						
6.0	82	92	102	112	122	132	142	152	161	170	178	186	193	201	208	215	221	228	234	240	6.0																						
6.5	76	86	96	106	116	126	136	146	155	163	171	179	186	193	200	206	213	219	225	231	6.5																						
7.0	72	82	92	102	112	122	131	141	149	157	165	172	179	186	192	199	205	211	217	222	7.0																						
7.5	68	78	88	98	108	118	127	136	144	152	159	166	173	180	186	192	198	204	209	215	7.5																						
8.0	64	74	84	94	104	114	123	131	139	147	154	161	168	174	180	186	192	197	203	208	8.0																						
8.5	61	71	81	91	101	110	119	128	135	143	150	156	163	169	175	180	186	191	197	202	8.5																						
9.0	58	68	78	88	98	107	116	124	131	139	145	152	158	164	170	175	181	186	191	196	9.0																						
9.5	55	65	75	85	95	104	113	121	128	135	141	148	154	160	165	171	176	181	186	191	9.5																						
10.0	53	63	73	83	93	102	110	118	125	131	138	144	150	156	161	166	171	176	181	186	10.0																						
10.5	51	61	71	81	91	99	107	115	122	128	135	141	146	152	157	162	167	172	177	181	10.5																						
11.0	49	59	69	79	89	97	105	112	119	125	131	137	143	148	154	159	163	168	173	177	11.0																						
11.5	48	58	68	78	87	95	103	110	116	123	129	134	140	145	150	155	160	164	169	173	11.5																						
12.0	46	56	66	76	85	93	100	107	114	120	126	131	137	142	147	152	156	161	165	170	12.0																						
12.5	45	55	65	74	83	91	98	105	112	118	123	129	134	139	144	149	153	158	162	166	12.5																						
13.0	43	53	63	73	82	89	96	103	109	115	121	126	131	136	141	146	150	155	159	163	13.0																						
13.5	42	52	62	72	80	89	95	101	107	113	119	124	129	134	139	143	148	152	156	160	13.5																						
14.0	41	51	61	70	79	86	93	99	105	111	117	122	127	131	136	141	145	149	153	157	14.0																						
14.5	40	50	60	69	77	85	91	98	104	109	114	120	124	129	134	138	142	146	150	154	14.5																						
15.0	39	49	59	68	76	83	90	96	102	107	113	118	122	127	131	136	140	144	148	152	15.0																						
16.0	37	47	57	66	73	80	87	93	99	104	109	114	118	123	127	131	135	139	143	147	16.0																						
17.0	35	45	55	64	71	78	84	90	96	101	106	110	115	119	123	128	131	135	139	143	17.0																						
18.0	34	44	54	62	69	76	82	88	93	98	103	107	112	116	120	124	128	131	135	139	18.0																						
19.0	33	43	52	60	67	74	80	85	90	95	100	104	109	113	117	121	124	128	131	135	19.0																						
20.0	32	42	51	59	66	72	78	83	88	93	97	102	106	110	114	118	121	125	128	131	20.0																						

SIGHT DISTANCE FOR CROSSOVERS

HEIGHT OF EYE 1.08 METERS HEIGHT OF OBJECT = 1.08 METERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

608.08

SD-5		When S > L: $S = \frac{432}{A} + \frac{L}{2}$																			When S < L: $S = 29.394 \sqrt{\frac{L}{A}}$																			S = Sight Distance in Meters																			Sheet 2 Of 2	
A- Algebraic Difference of Grades in Percent	L = Length of Vertical Curve in Meters																				A- Algebraic Difference of Grades in Percent																																							
	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800																																								
2.0	426	436	446	455	465	474	483	492	501	509	518	526	534	542	550	558	565	573	580	588	2.0																																							
2.5	381	390	399	407	416	424	432	440	448	455	463	470	478	485	492	499	506	513	519	526	2.5																																							
3.0	348	356	364	372	379	387	394	402	409	416	423	429	436	443	449	455	462	468	474	480	3.0																																							
3.5	322	330	337	344	351	358	365	372	378	385	391	397	404	410	416	422	427	433	439	444	3.5																																							
4.0	301	308	315	322	329	335	342	348	354	360	366	372	378	383	389	394	400	405	410	416	4.0																																							
4.5	284	291	297	304	310	316	322	328	334	339	345	351	356	361	367	372	377	382	387	392	4.5																																							
5.0	269	276	282	288	294	300	305	311	317	322	327	333	338	343	348	353	358	362	367	372	5.0																																							
5.5	257	263	269	275	280	286	291	297	302	307	312	317	322	327	332	336	341	346	350	355	5.5																																							
6.0	246	252	257	263	268	274	279	284	289	294	299	304	308	313	317	322	326	331	335	339	6.0																																							
6.5	236	242	247	253	258	263	268	273	278	282	287	292	296	301	305	309	314	318	322	326	6.5																																							
7.0	228	233	238	243	248	253	258	263	268	272	277	281	285	290	294	298	302	306	310	314	7.0																																							
7.5	220	225	230	235	240	245	249	254	258	263	267	272	276	280	284	288	292	296	300	304	7.5																																							
8.0	213	218	223	228	232	237	241	246	250	255	259	263	267	271	275	279	283	286	290	294	8.0																																							
8.5	207	211	216	221	225	230	234	239	243	247	251	255	259	263	267	271	274	278	282	285	8.5																																							
9.0	201	206	210	215	219	223	228	232	236	240	244	248	252	256	259	263	267	270	274	277	9.0																																							
9.5	195	200	205	209	213	217	222	226	230	234	237	241	245	249	252	256	259	263	266	270	9.5																																							
10.0	190	195	199	204	208	212	216	220	224	228	231	235	239	242	246	249	253	256	260	263	10.0																																							
10.5	186	190	195	199	203	207	211	215	218	222	226	229	233	237	240	243	247	250	253	257	10.5																																							
11.0	182	186	190	194	198	202	206	210	213	217	221	224	228	231	234	238	241	244	248	251	11.0																																							
11.5	178	182	186	190	194	198	201	205	209	212	216	219	223	226	229	233	236	239	242	245	11.5																																							
12.0	174	178	182	186	190	193	197	201	204	208	211	215	218	221	225	228	231	234	237	240	12.0																																							
12.5	170	174	178	182	186	190	193	197	200	204	207	210	214	217	220	223	226	229	232	235	12.5																																							
13.0	167	171	175	179	182	186	189	193	196	200	203	206	209	213	216	219	222	225	228	231	13.0																																							
13.5	164	168	172	175	179	182	186	189	193	196	199	202	206	209	212	215	218	221	223	226	13.5																																							
14.0	161	165	168	172	176	179	183	186	189	192	196	199	202	205	208	211	214	217	219	222	14.0																																							
14.5	158	162	166	169	173	176	179	183	186	189	192	195	198	201	204	207	210	213	216	218	14.5																																							
15.0	156	159	163	166	170	173	176	180	183	186	189	192	195	198	201	204	206	209	212	215	15.0																																							
16.0	151	154	158	161	164	168	171	174	177	180	183	186	189	192	194	197	200	203	205	208	16.0																																							
17.0	146	150	153	156	159	163	166	169	172	175	178	180	183	186	189	191	194	197	199	202	17.0																																							
18.0	142	145	149	152	155	158	161	164	167	170	173	175	178	181	183	186	188	191	193	196	18.0																																							
19.0	138	141	145	148	151	154	157	160	162	165	168	171	173	176	178	181	183	186	188	191	19.0																																							
20.0	135	138	141	144	147	150	153	156	158	161	164	166	169	171	174	176	179	181	184	186	20.0																																							

SIGHT DISTANCE FOR CROSSOVERS

HEIGHT OF EYE 1.08 METERS

HEIGHT OF OBJECT = 1.08 METERS

NEW 10/02

608.09

VIRGINIA DEPARTMENT OF TRANSPORTATION

STANDARD SYMBOLS

- LOCATION \bar{E}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 KILOMETERS PER HOUR USING STANDARD RATE OF SUPERELEVATION.
- NCAPPROXIMATE MAXIMUM SAFE SPEED IN KILOMETERS PER HOUR WITH NO SUPERELEVATION
- LSLENGTH OF TRANSITION CURVE MEASURED ALONG BASELINE. WHERE NO TRANSITION CURVE IS APPLIED LS IS LENGTH OF SUPERELEVATION TRANSITION.
- W OR PWWIDTH OF STANDARD PAVEMENT.
- ZTDISTANCE FROM TRANSITIONED BASELINE TO EDGES OF TRANSITIONED PAVEMENT
- 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.
- CRSTANDARD PAVEMENT CROWN TRANSITION OR CROWN RUNOFF LENGTH.
- CPCHORD POINT (1/10 INCREMENTS OF TRANSITION CURVE).
- NPC.....NORMAL PAVEMENT CROWN.

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

SPECIFICATION REFERENCE

TRANSITION CURVES FOR RURAL AND URBAN
HIGHWAYS AND STREET CONDITIONS

NEW 10/02

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 802.01](#).

A TABLE FOR "LOW SPEED URBAN" DESIGNS IS ON [SHEET 802.24](#) WITH A RANGE OF STANDARD PAVEMENT WIDTHS (W), TRANSITION LENGTHS (LS), 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 70km/h. 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 802.25 THRU 802.31](#)

WHEN URBAN CONDITIONS APPLY THERE WILL BE NO BASELINE TRANSITION OR PAVEMENT WIDENING. THE LENGTH OF TRANSITION (LS) DETERMINES THE LENGTH OF SUPERELEVATION TRANSITION THROUGH WHICH THE OUTER EDGE OF PAVEMENT IS RAISED ABOVE THE BASELINE GRADE TO A MAXIMUM OF $E \left(\frac{W}{2} \right)$ SEE [SHEET 802.07](#) FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

FOR CURVE RADII NOT LISTED IN TABLES REFER TO [SHEET 802.22](#) TO CALCULATE TRANSITION LENGTHS (LS).

LS SHOULD BE SHOWN ON THE PLANS FOR ALL CURVES.

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

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR URBAN CONDITIONS SEE [SHEET 802.19](#).

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE [SHEET 802.04](#).

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE URBAN CONDITION

NEW 10/02

802.02

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 802.01](#).

FOR MINIMUM DESIGN FACTORS FOR VARIOUS DESIGN SPEEDS FOR RURAL CONDITIONS SEE [SHEETS 802.32 THRU 802.40](#).

ON CURVES WITH GREATER THAN 850 m RADIUS, THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THE TABLES. SEE [SHEET 802.06](#) FOR A GRAPHICAL ILLUSTRATION OF THE APPLICATION OF THIS CORRECTION.

ON CURVES WITH PAVEMENT WIDTHS OF 7.2 m OR WIDER AND A RADIUS OF 230 m OR GREATER, THERE WILL BE NO SPIRAL TRANSITION OR PAVEMENT WIDENING. PAVEMENT WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE RATE SHOWN IN THESE TABLES.

FOR CURVE RADII NOT LISTED IN TABLES, REFER TO [SHEET 802.22](#) TO CALCULATE TRANSITION LENGTHS (LS) AND PAVEMENT WIDENING (w).

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

FOR GRAPHICAL ILLUSTRATION OF DESIGN SUPERELEVATION RATES FOR RURAL CONDITIONS SEE [SHEET 802.20](#).

FOR ADDITIONAL GENERAL INSTRUCTIONS (BOTH URBAN AND RURAL) SEE [SHEET 802.04](#).

SEE [SHEET 802.05](#) FOR A GRAPHICAL ILLUSTRATION OF SPIRAL TRANSITIONS.

SPECIFICATION REFERENCE	EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE RURAL CONDITION VIRGINIA DEPARTMENT OF TRANSPORTATION	NEW 10/02
		802.03

GENERAL CONDITION

ALL ORIGINAL CROSS SECTIONS SHALL BE TAKEN FROM THE BASELINE AT STATIONS, 20 METERS INTERVAL FOR RURAL PROJECTS, 10 METERS INTERVAL FOR URBAN PROJECTS, 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 802.16 FOR CROWN TRANSITIONS, SHEET 802.17 FOR URBAN PROJECTS AND SHEET 802.18 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 10 OR 20 m INTERVALS 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 10 OR 20 m INTERVALS 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 802.16 FOR CROWN TRANSITIONS, SHEET 802.17 FOR URBAN PROJECTS OR AS GIVEN ON SHEET 802.18 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 802.17 AND 802.18.

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 802.24 THRU 802.44 SINCE THESE TABLES WERE DERIVED WITHIN AASHTO GUIDELINES.

ALL CROWN RUNOFF (CR) VALUES AND TRANSITION LENGTHS (LS) LISTED IN THE TABLES HAVE BEEN ROUNDED UP TO THE NEAREST METER. ALL CR VALUES ARE BASED ON A 2% CROWN.

REFER TO APPENDIX A, SECTIONS A-1 AND A-4, OF THE ROAD DESIGN MANUAL FOR INFORMATION ON THE USE OF 5.4 m PAVEMENT WIDTHS (2.7 m LANE WIDTH).

EXPLANATION OF TABLES AND INSTRUCTIONS FOR USE GENERAL CONDITION

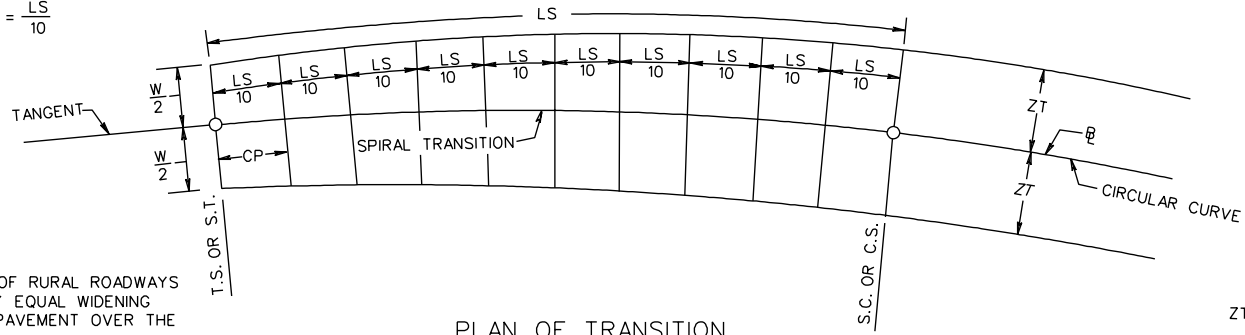
VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.04

SPECIFICATION
REFERENCE

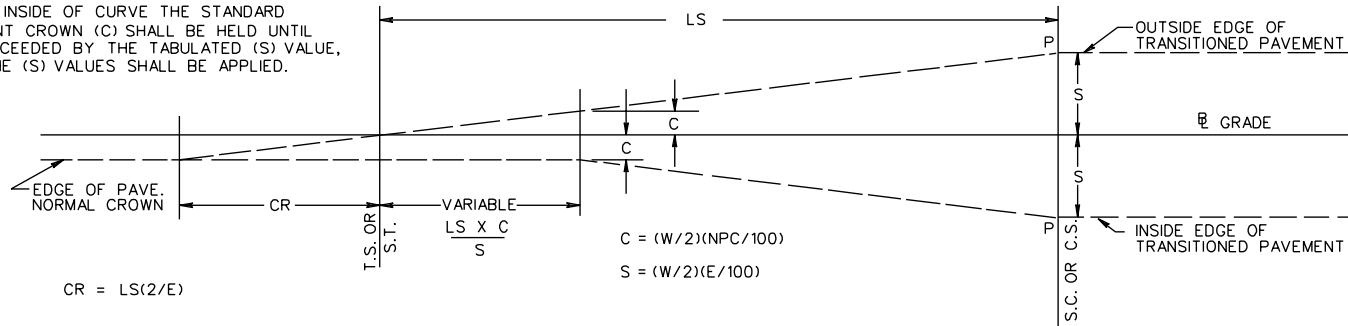
CHORD POINTS (CP) = $\frac{LS}{10}$



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

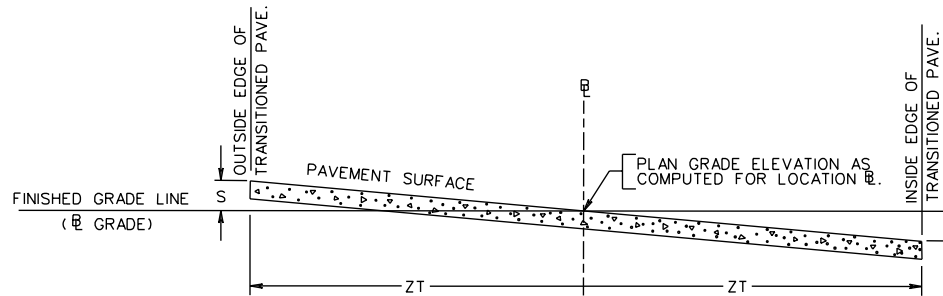
PLAN OF TRANSITION

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

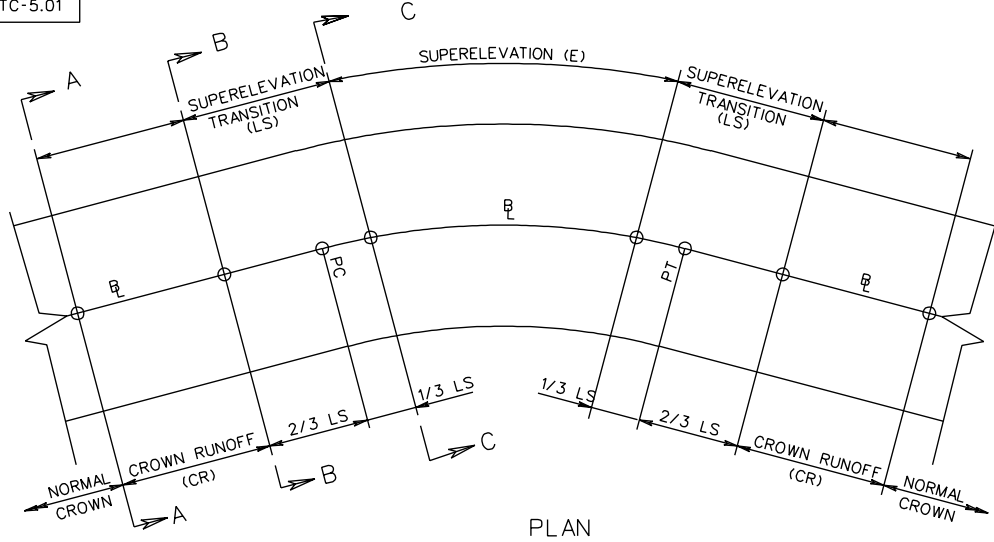
DETAILS FOR TRANSITIONED \mathbb{E}
RURAL CONDITION WITH PAVEMENT WIDENING

VIRGINIA DEPARTMENT OF TRANSPORTATION

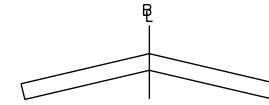
NEW 10/02

802.05

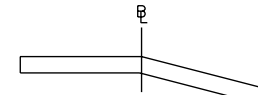
TC-5.01



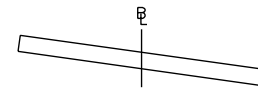
$CR = LS(2/E)$



SECTION A-A
NORMAL CROWN

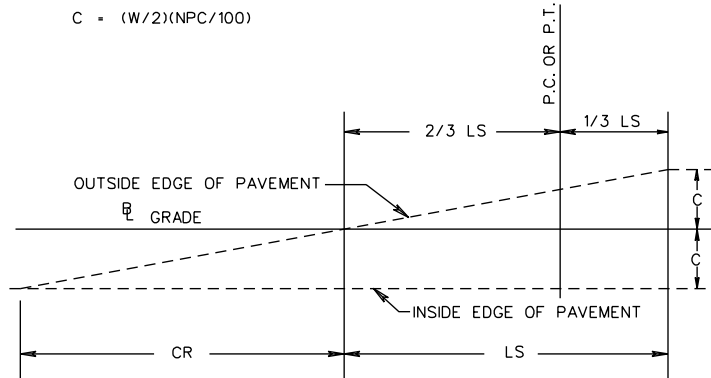


SECTION B-B
NORMAL CROWN
REMOVED (FLAT)



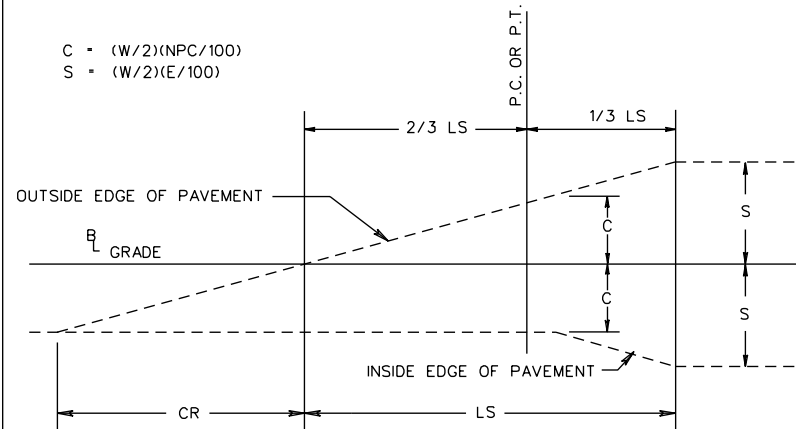
SECTION C-C
FULL SUPERELEVATION

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



SUPERELEVATED BY AN AMOUNT EQUAL TO THE
STANDARD PAVEMENT CROWN

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

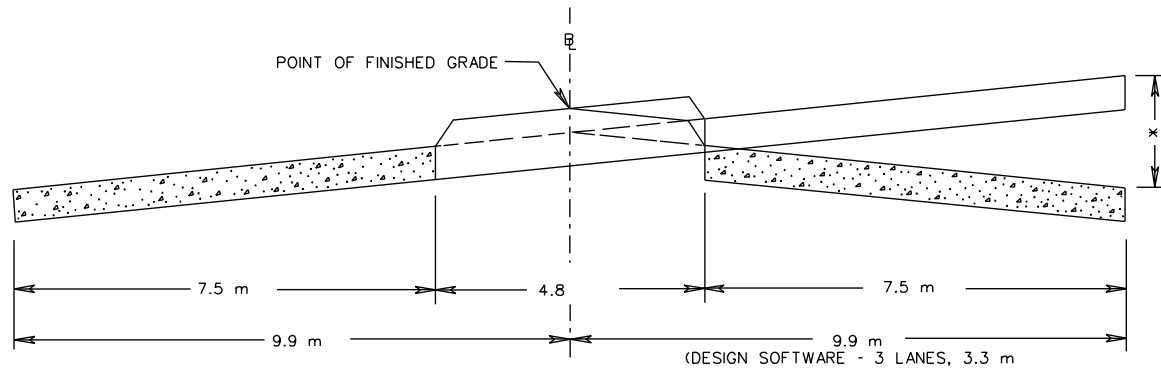
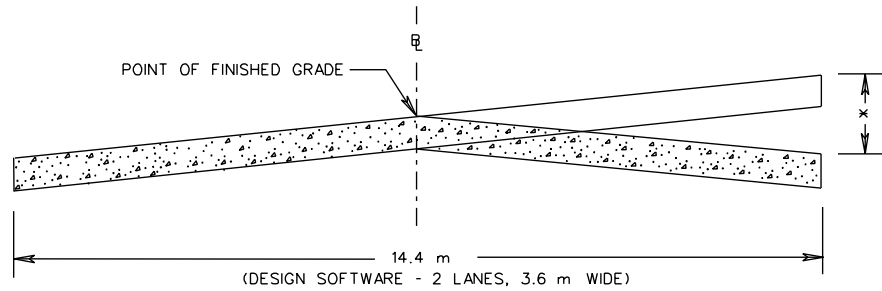


NOTE : ON THE INSIDE OF CURVE THE STANDARD PAVEMENT
CROWN (C) SHALL BE HELD UNTIL IT IS EXCEEDED BY THE
TABULATED RATE OF SUPERELEVATION (E).

SUPERELEVATED BY AN AMOUNT EXCEEDING THE
STANDARD PAVEMENT CROWN

DETAILS FOR NON-TRANSITION \mathbb{E}
URBAN CONDITIONS AND RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

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-5.01ULS, TC-5.01U , AND TC-5.01R (WITHOUT PAVEMENT WIDENING) SUPERELEVATED CURVES, POSITION THE LS TWO THIRDS (2/3) ON THE TANGENT AND ONE THIRD (1/3) INTO THE CURVE. STATIONS AND ELEVATIONS FOR THESE TRANSITIONS WILL NEED TO BE COMPUTED FOR ALL CHORD POINTS AND SHOWN ON THE PROFILES.

SPECIFICATION REFERENCE

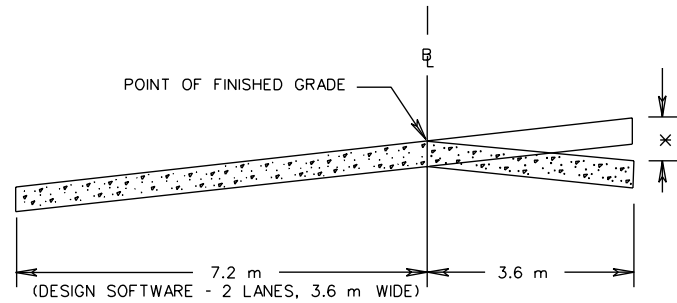
DETAILS OF SUPERELEVATION ABOUT BASELINE

VIRGINIA DEPARTMENT OF TRANSPORTATION

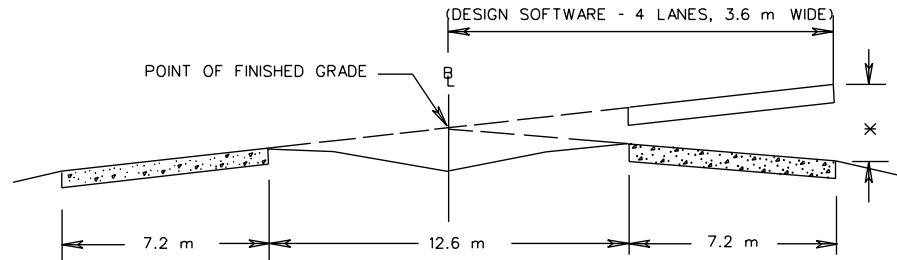
NEW 10/02

802.07

TC-5.01



THE PAVEMENT WIDTHS SHOWN IN THE STANDARD TC-5 TABLES ON SHEET 801.24 THROUGH 801.40 REPRESENT TWICE THE DISTANCE FROM THE CROWNLIN TO THE EDGE OF PAVEMENT ON THE HIGH SIDE.



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

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

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

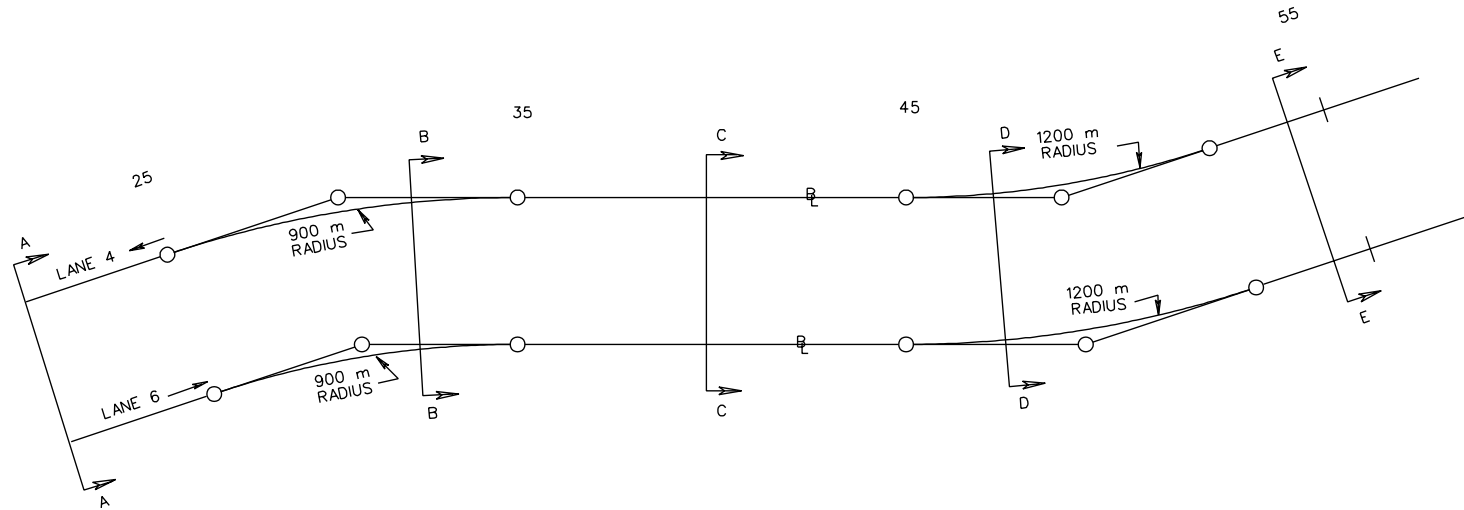
DETAILS OF SUPERELEVATION ABOUT BASELINE

NEW 10/02

802.08

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE



NOTE:

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

SPECIFICATION REFERENCE

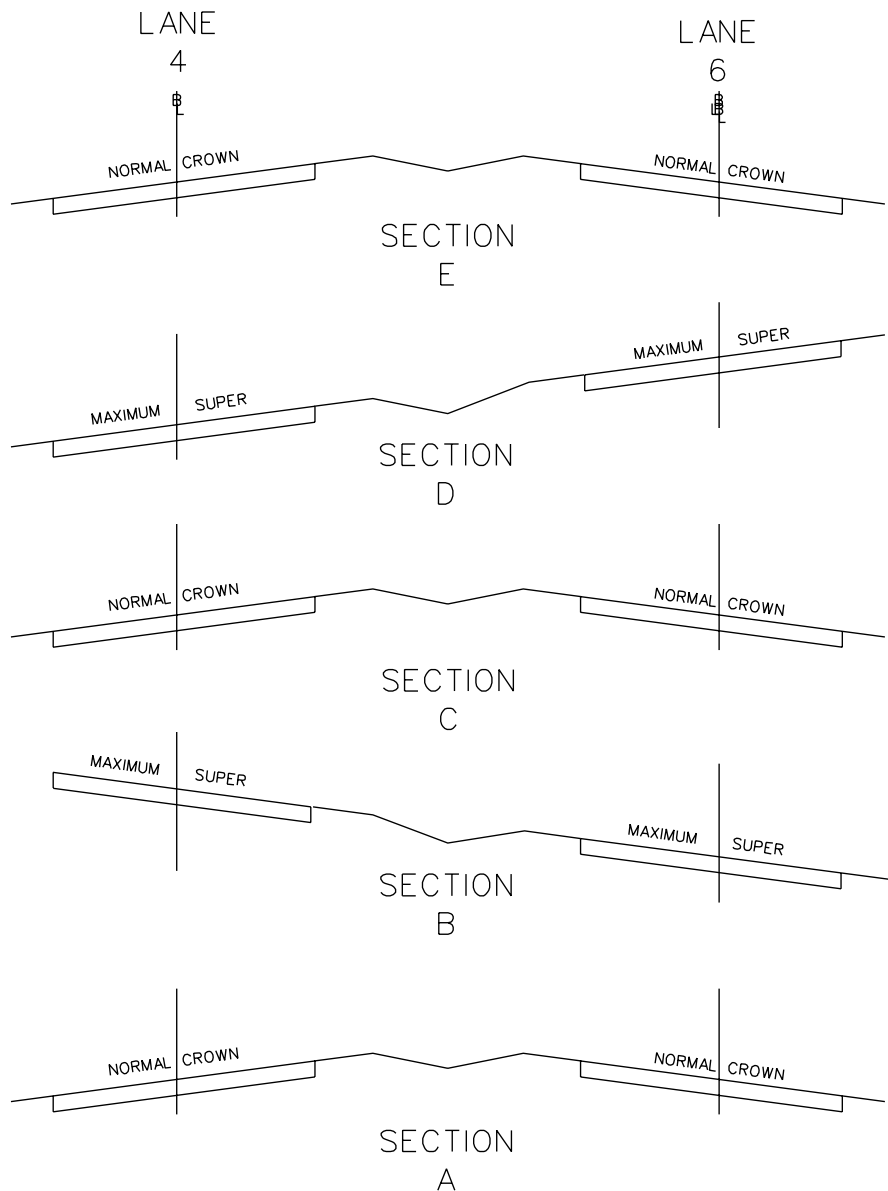
EXAMPLE FOR FOUR LANE ROADWAYS

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.09

TC-5.01

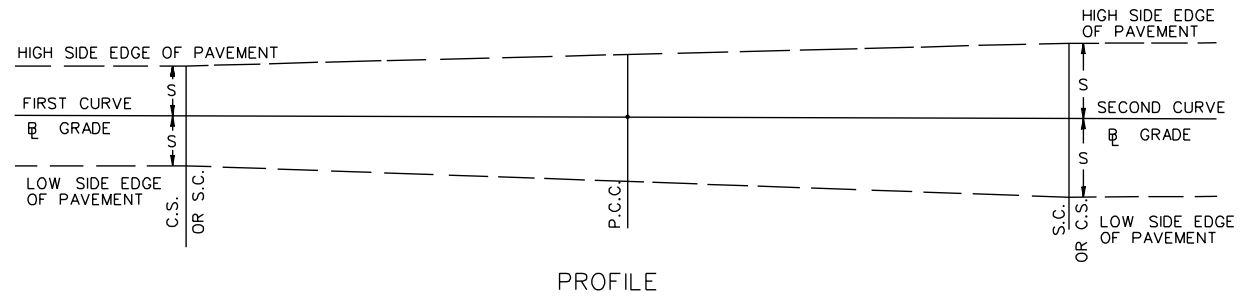
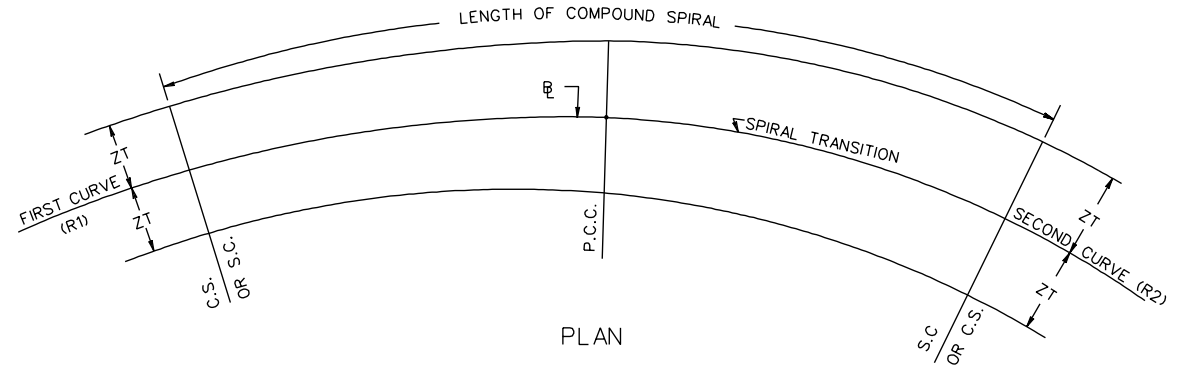


CROSS SECTION - FOUR LANE ROADWAY

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02
802.10

SPECIFICATION REFERENCE

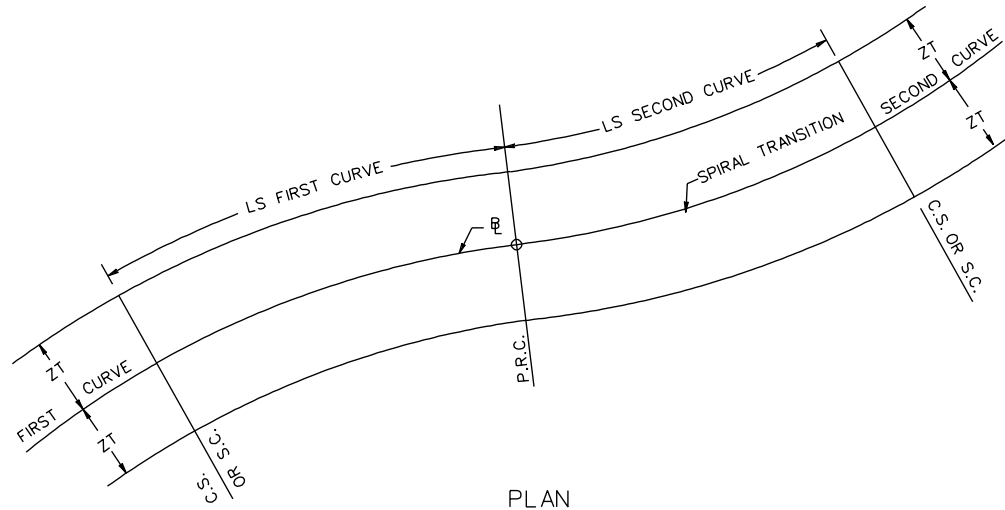


NOTE:

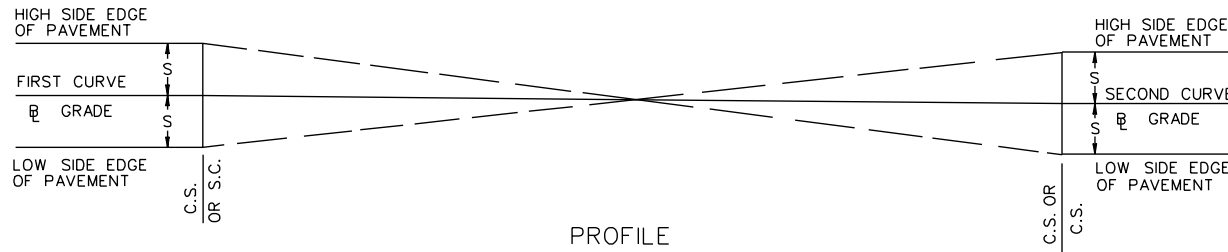
1. FOR COMPOUND CURVES ON ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1.
2. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
3. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL COMPOUND CURVE DESIGN INFORMATION.

SPECIFICATION REFERENCE

METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES
RURAL CONDITIONS WITH PAVEMENT WIDENING
VIRGINIA DEPARTMENT OF TRANSPORTATION



PLAN

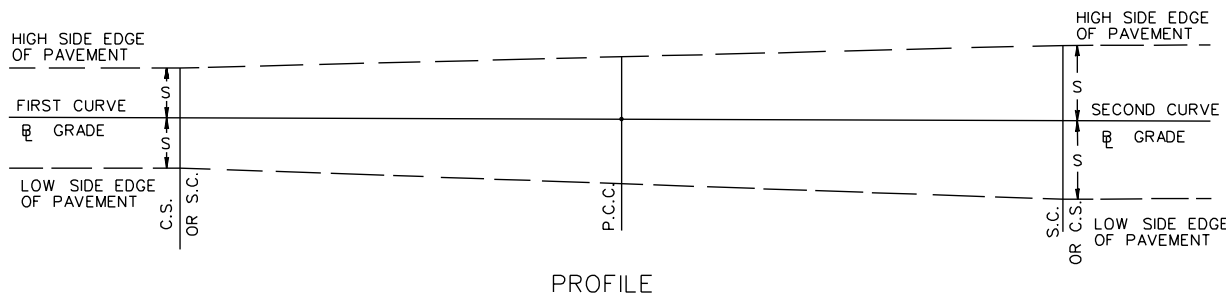
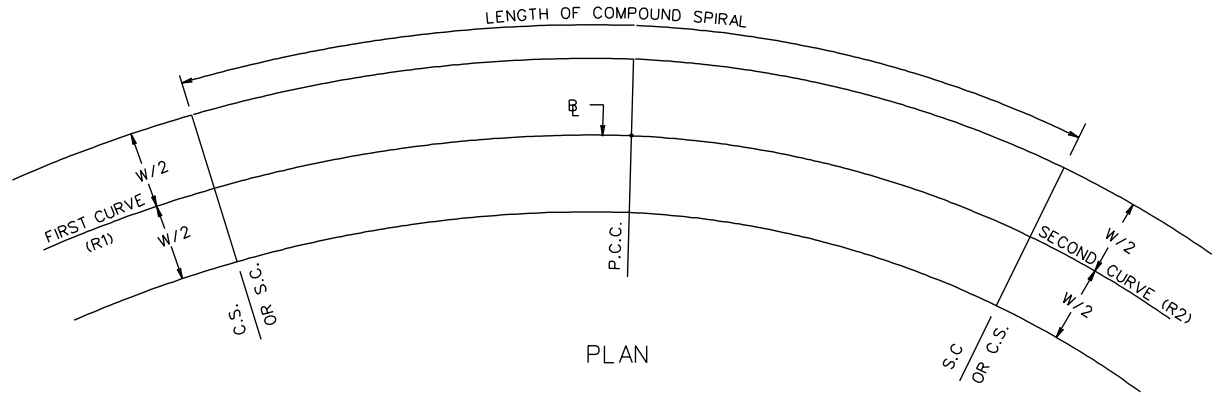


PROFILE

NOTE:

1. COMPUTE STRAIGHT LINE WIDENING AND SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE.
2. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.

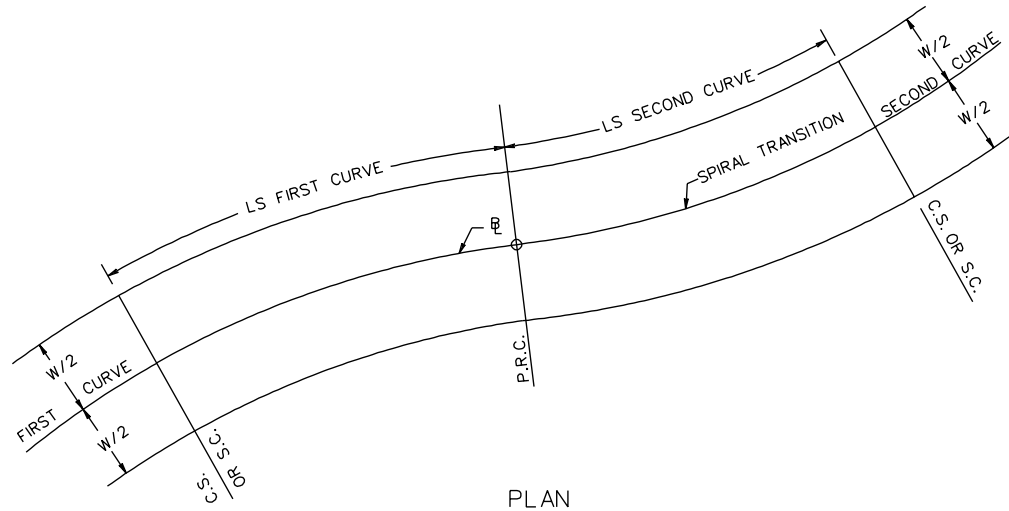
METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
RURAL CONDITIONS WITH PAVEMENT WIDENING



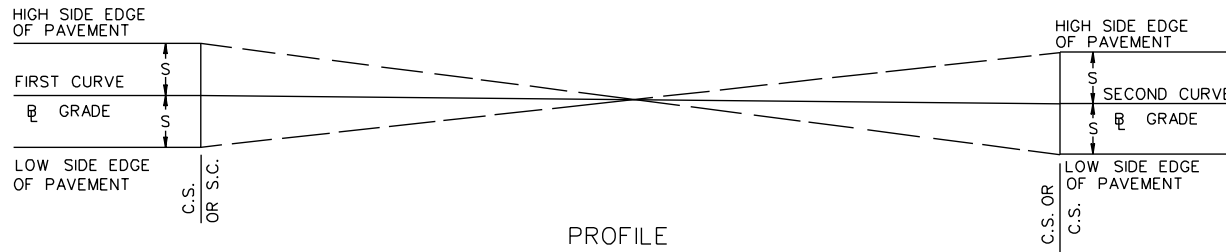
NOTE:

1. FOR COMPOUND CURVES ON 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. FOR COMPOUND CURVES ON RAMP, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1.
2. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF COMPOUND SPIRAL COMPUTED PER THE FOURTH EDITION OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS.
3. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL COMPOUND CURVE INFORMATION.

<p>SPECIFICATION REFERENCE</p>	<p>METHOD OF APPLYING TC-5.01 ON COMPOUND CURVES URBAN CONDITIONS & RURAL CONDITIONS WITHOUT PAVEMENT WIDENING</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>NEW 10/02</p>	<p>802.13</p>
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PLAN



PROFILE

NOTE:

1. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF LS (SPIRAL TRANSITIONS) COMPUTED PER FOURTH EDITION OF AASHTO'S A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS.
2. REFER TO APPENDIX A OF THE ROAD DESIGN MANUAL FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.

METHOD OF APPLYING TC-5.01 ON REVERSE CURVES
 URBAN CONDITIONS & RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

SPECIFICATION
 REFERENCE

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SPECIFICATION
REFERENCE

TRANSITION TABLE

LENGTH OF CROWN RUNOFF (CR)	START/END OF TRANSITION (LS)	DISTANCE IN METERS FROM START/END OF TRANSITION (LS)				NORMAL CROWN
		1	2	3	4	
65	0	13	26	39	52	65
60	0	12	24	36	48	60
55	0	11	22	33	44	55
50	0	10	20	30	40	50
45	0	9	18	27	36	45
40	0	8	16	24	32	40
35	0	7	14	21	28	35
30	0	6	12	18	24	30
25	0	5	10	15	20	25
20	0	5	10	15	—	20
12	0	6	—	—	—	12

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).

CROWN TRANSITION / CROWN RUNOFF (CR) TABLE

URBAN CONDITIONS

RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

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

LENGTH OF TRANSITION (LS)	END/BEGIN CROWN RUNOFF (CR)	DISTANCE IN METERS FROM P.C. OR P.T. ON TANGENT						P.C. OR P.T.	DISTANCE IN METERS FROM P.C. OR P.T. ON CURVE			FULL SUPER ELEVATION (E)
		1	2	3	4	5	6		7	8	9	
150	100	85	70	55	40	25	10	STAKE	5	20	35	50
145	96.5	82	67.5	53	38.5	24	9.5	STAKE	5	19.5	34	48.5
140	93.5	79.5	65.5	51.5	37.5	23.5	9.5	STAKE	4.5	18.5	32.5	46.5
135	90	76.5	63	49.5	36	22.5	9	STAKE	4.5	18	31.5	45
130	87	74	61	48	35	22	9	STAKE	4	17	30	43
125	83.5	71	56.5	46	33.5	21	8.5	STAKE	4	16.5	29	41.5
120	80	68	56	44	32	20	8	STAKE	4	16	28	40
115	76.5	65	53.5	42	30.5	19	7.5	STAKE	4	15.5	27	38.5
110	73.5	62.5	51.5	40.5	29.5	18.5	7.5	STAKE	3.5	14.5	25.5	36.5
105	70	59.5	49	38.5	28	17.5	7	STAKE	3.5	14	24.5	35
100	67	57	47	37	27	17	7	STAKE	3	13	23	33
95	63.5	54	44.5	35	25.5	16	6.5	STAKE	3	12.5	22	31.5
90	60	51	42	33	24	15	6	STAKE	3	12	21	30
85	56.5	48	39.5	31	22.5	14	5.5	STAKE	3	11.5	20	28.5
80	53.5	45.5 *	37.5	29.5 *	21.5	13.5 *	5.5	STAKE *	2.5	10.5 *	18.5	26.5
75	50	42.5 *	35	27.5 *	20	12.5 *	5	STAKE *	2.5	10	17.5	25
70	46.5	39.5 *	32.5	25.5 *	18.5	11.5 *	4.5	STAKE *	2.5	9.5 *	16.5	23.5
65	43.5	37 *	30.5	24 *	17.5	11 *	4.5	STAKE *	2	8.5 *	15	21.5
60	40	34 *	28	22 *	16	10 *	4	STAKE *	2	8	14	20

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.

RURAL CONDITIONS WITH PAVEMENT WIDENING

FOR USE WITH FLEXIBLE AND CONCRETE PAVEMENT

LENGTH OF TRANSITION (LS)	T.S. OR S.T.	DISTANCE IN METERS FROM T.S. OR S.T. ALONG SPIRAL TRANSITION									S.C. OR C.S.
		1	2	3	4	5	6	7	8	9	
		150	0	15	30	45	60	75	90	105	
145	0	14.5	29	43.5	58	72.5	87	101.5	115	130.5	145
140	0	14	28	42	56	70	84	98	112	126	140
135	0	13.5	27	40.5	54	67.5	81	94.5	108	121.5	135
130	0	13	26	39	52	65	78	91	104	117	130
125	0	12.5	25	37.5	50	62.5	75	87.5	100	112.5	125
120	0	12	24	36	48	60	72	84	96	108	120
115	0	11.5	23	34.5	46	57.5	69	80.5	92	103.5	115
110	0	11	22	33	44	55	66	77	88	99	110
105	0	10.5	21	31.5	42	52.5	63	73.5	84	94.5	105
100	0	10	20	30	40	50	60	70	80	90	100
95	0	9.5	19	28.5	38	47.5	57	66.5	76	85.5	95
90	0	9	18	27	36	45	54	63	72	81	90
85	0	8.5	17	25.5	34	42.5	51	59.5	68	76.5	85
80	0	8 *	16	24 *	32	40 *	48	56 *	64	72 *	80
75	0	7.5 *	15	22.5 *	30	37.5 *	45	52.5 *	60	67.5 *	75
70	0	7 *	14	21 *	28	35 *	42	49 *	56	63 *	70
65	0	6.5 *	13	19.5 *	26	32.5 *	39	45.5 *	52	58.5 *	65
60	0	6 *	12	18 *	24	30 *	36	42 *	48	54 *	60
55	0	5.5 *	11	16.5 *	22	27.5 *	33	38.5 *	44	49.5 *	55
50	0	5 *	10	15 *	20	25 *	30	35 *	40	45 *	50
45	0	4.5 *	9	13.5 *	18	22.5 *	27	31.5 *	36	40.5 *	45

NOTE :

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

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

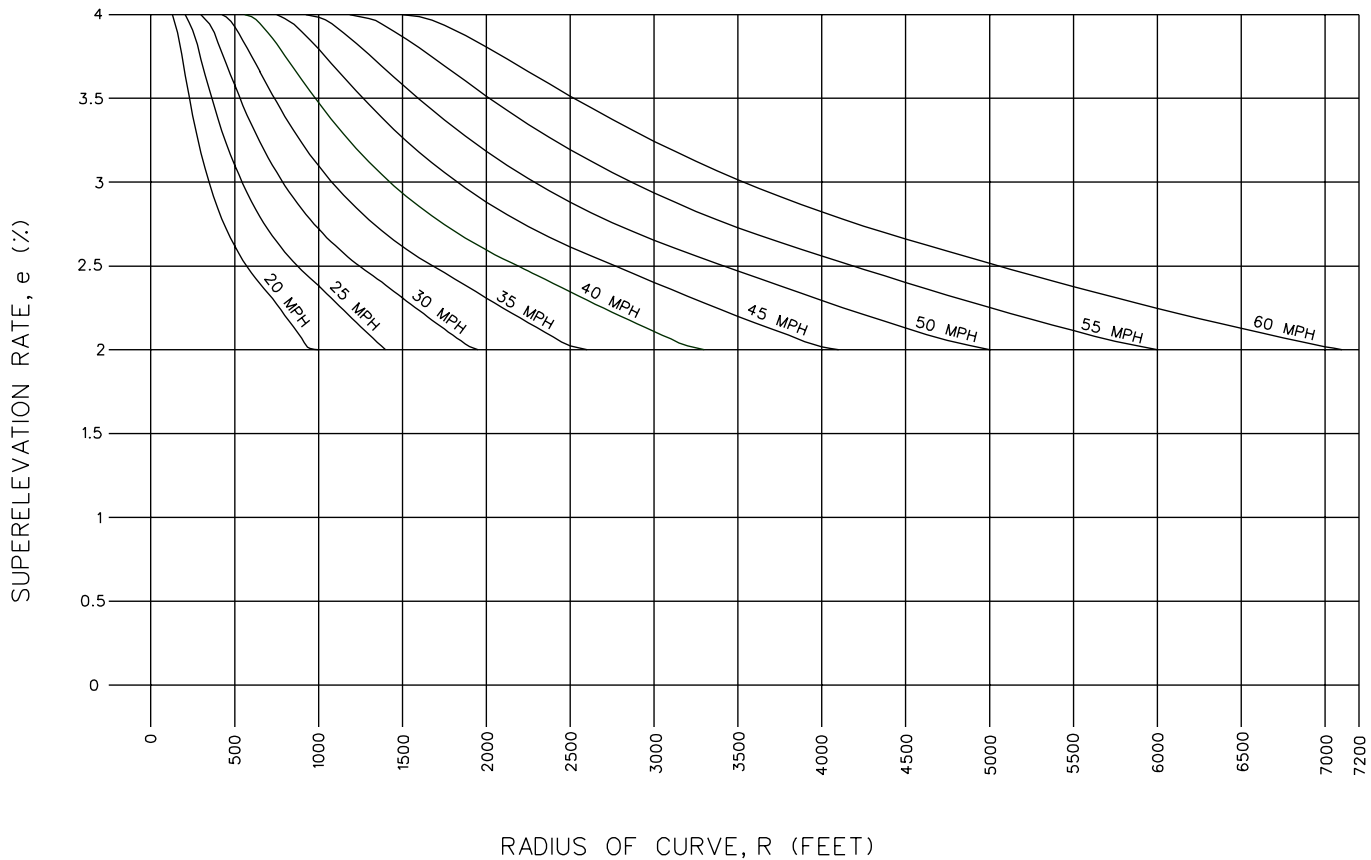
TABLE 2

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.18

SPECIFICATION
REFERENCE



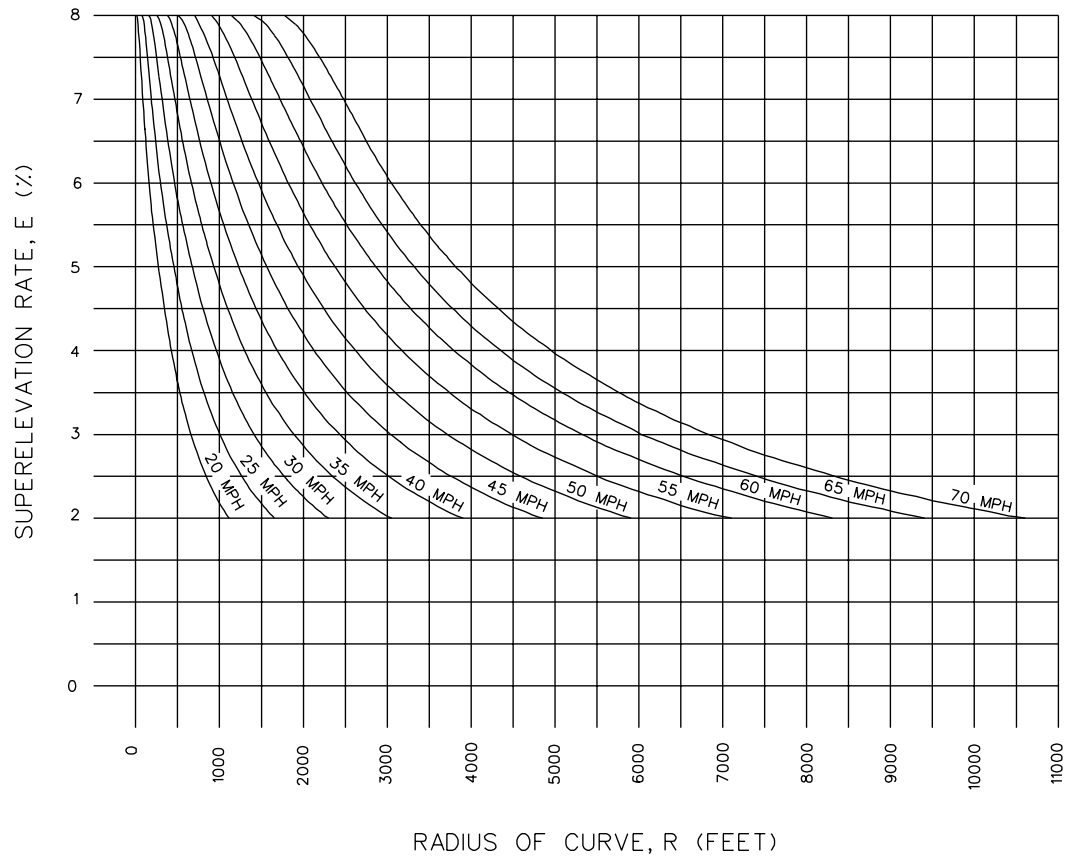
NOTE:
INTERMEDIATE UNITS OF SUPERELEVATION AND RADI NOT LISTED ON
GRAPH CAN BE GRAPHED USING A CIVIL ENGINEER'S 10 SCALE WITH
EACH MARK EQUAL TO 100' OF RADIUS AND 0.1% OF SUPERELEVATION.

DESIGN SUPERELEVATION RATES URBAN CONDITIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.19



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

DESIGN SUPERELEVATION RATES RURAL CONDITIONS

URBAN LOW SPEED DESIGN TABLE

DV/NC (Km/h)	MAX. f	C	MIN. LS (METERS)
70	0.163	1.00	30
60	0.186	1.05	30
50	0.214	1.10	25
40	0.252	1.15	25
30	0.312	1.20	20

LEGEND

- C- RATE OF CHANGE OF SIDE FRICTION (f) IN m/sec³
- e- SUPERELEVATION RATE IN PERCENT.
- f- FRICTION FACTOR.
- LS- LENGTH OF SUPERELEVATION TRANSITION.
- R- RADIUS OF CURVE.
- DV- DESIGN VELOCITY UTILIZING SUPERELEVATION.
- NC- MAXIMUM VELOCITY WITH NO SUPERELEVATION (NORMAL CROWN).

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

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

GENERAL DESIGN CONSIDERATIONS

1. WHEN "URBAN LOW SPEED" DESIGNS UTILIZE SUPERELEVATION, THEY WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN (TYPICALLY 2.0%) AND THE APPROXIMATE MAXIMUM SAFE SPEED (DV) AFFORDED THEREBY.
2. WHEN "URBAN LOW SPEED DESIGN" WITH NO SUPERELEVATION, THE APPROXIMATE MAXIMUM SAFE SPEED (NC) IS CALCULATED USING A NEGATIVE NORMAL CROWN (TYPICALLY -2.0 %).
3. WHEN THE CURVE IS SUPERELEVATED, THE LS IS APPLIED IN THE SAME MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).
4. PLEASE NOTE THAT THE RADIUS VALUES LISTED ON PAGE 802.24 HAVE BEEN ROUNDED UP TO THE NEAREST METER INCREMENT.

EXAMPLES

DV = 31 km/h

e = +2.0 %

f = MAXf ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

f = .252 + .9(.312 - .252) = .306

LS = 2.72 f DV

LS = 2.72(.306)(31) = 21.5 m

Rmin. = DV² / 127(e+f)

Rmin. = (31)² / 127(.02 + .306) = 23.2 m

NC = 57 km/h

e = -2.0 %

f = MAXf ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

f = .186 + .3(.214 - .186) = 0.1944

Rmin. = NC² / 127(-e+f)

Rmin. = (57)² / 127(-.02 + .1944) = 146.69 m

SPECIFICATION REFERENCE

METHODOLOGIES FOR CALCULATING TC-5.01 VALUES FOR URBAN LOW-SPEED STREETS

NEW 10/02

TC-5.01	<p style="text-align: center;">CURVE WIDENING TABLES</p> <p style="text-align: center;">SU DESIGN VEHICLE</p> <table border="1" style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <th style="text-align: center;">COMPONENT</th> <th style="text-align: center;">SIZE</th> </tr> <tr> <td>OVERALL WIDTH (u)</td> <td style="text-align: center;">2.4 m</td> </tr> <tr> <td>WHEELBASE (L)</td> <td style="text-align: center;">6.1 m</td> </tr> <tr> <td>FRONT OVERHANG (A)</td> <td style="text-align: center;">1.2 m</td> </tr> </table> <p style="text-align: center;">LATERAL CLEARANCE</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="text-align: center;">LANE WIDTH</th> <th style="text-align: center;">CLEARANCE (C)</th> </tr> <tr> <td style="text-align: center;">2.7 m</td> <td style="text-align: center;">.45 m</td> </tr> <tr> <td style="text-align: center;">3.0 m</td> <td style="text-align: center;">.60 m</td> </tr> <tr> <td style="text-align: center;">3.3 m</td> <td style="text-align: center;">.75 m</td> </tr> <tr> <td style="text-align: center;">3.6 m</td> <td style="text-align: center;">.90 m</td> </tr> <tr> <td style="text-align: center;">4.8 m</td> <td style="text-align: center;">1.5 m</td> </tr> </table>	COMPONENT	SIZE	OVERALL WIDTH (u)	2.4 m	WHEELBASE (L)	6.1 m	FRONT OVERHANG (A)	1.2 m	LANE WIDTH	CLEARANCE (C)	2.7 m	.45 m	3.0 m	.60 m	3.3 m	.75 m	3.6 m	.90 m	4.8 m	1.5 m	<p style="text-align: center;">ADJUSTMENT FACTORS</p> <table border="1" style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <th style="text-align: center;">NUMBER OF LANES ROTATED n_1</th> <th style="text-align: center;">ADJUSTMENT FACTOR (b_w)</th> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1.00</td> </tr> <tr> <td style="text-align: center;">1.5</td> <td style="text-align: center;">0.8333</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">0.75</td> </tr> <tr> <td style="text-align: center;">2.5</td> <td style="text-align: center;">0.70</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0.6667</td> </tr> <tr> <td style="text-align: center;">3.5</td> <td style="text-align: center;">0.6425</td> </tr> </table>	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	<p style="text-align: center;">RELATIVE GRADIENTS</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th rowspan="2" style="text-align: center;">DESIGN SPEED V_D MPH</th> <th rowspan="2" style="text-align: center;">MAXIMUM RELATIVE GRADIENT (rg)</th> <th colspan="2" style="text-align: center;">MIN. TRANSITION LENGTH IN METERS 2 SECOND RULE RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE CURVES FOR ALL CONDITIONS</th> </tr> <tr> <th style="text-align: center;">URBAN</th> <th style="text-align: center;">RURAL</th> </tr> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">0.75</td> <td style="text-align: center;">20</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">40</td> <td style="text-align: center;">0.70</td> <td style="text-align: center;">25</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">50</td> <td style="text-align: center;">0.65</td> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">60</td> <td style="text-align: center;">0.60</td> <td style="text-align: center;">35</td> <td style="text-align: center;">35</td> </tr> <tr> <td style="text-align: center;">70</td> <td style="text-align: center;">0.55</td> <td style="text-align: center;">40</td> <td style="text-align: center;">40</td> </tr> <tr> <td style="text-align: center;">80</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">45</td> <td style="text-align: center;">45</td> </tr> <tr> <td style="text-align: center;">90</td> <td style="text-align: center;">0.47</td> <td style="text-align: center;">50</td> <td style="text-align: center;">50</td> </tr> <tr> <td style="text-align: center;">100</td> <td style="text-align: center;">0.44</td> <td style="text-align: center;">60</td> <td style="text-align: center;">60</td> </tr> <tr> <td style="text-align: center;">110</td> <td style="text-align: center;">0.41</td> <td style="text-align: center;">65</td> <td style="text-align: center;">65</td> </tr> </table>	DESIGN SPEED V_D MPH	MAXIMUM RELATIVE GRADIENT (rg)	MIN. TRANSITION LENGTH IN METERS 2 SECOND RULE RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE CURVES FOR ALL CONDITIONS		URBAN	RURAL	30	0.75	20	30	40	0.70	25	30	50	0.65	30	30	60	0.60	35	35	70	0.55	40	40	80	0.50	45	45	90	0.47	50	50	100	0.44	60	60	110	0.41	65	65
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<h2 style="margin: 0;">METHODOLOGIES FOR CALCULATING TC-5.01 VALUES</h2>			<p style="text-align: center; font-size: small;">SPECIFICATION REFERENCE</p>																																																																												
NEW 10/02	VIRGINIA DEPARTMENT OF TRANSPORTATION																																																																														
802.22																																																																															

RURAL EXAMPLE
6.0 m PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 3.0 m)

$V_D = 80$ km/h $R = 375$ m
 $W_n = 3.0$ m $rg = 0.50$
 $E = 6.9$ (PER 802.39)

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

$$U = 2.4 + 375 - \sqrt{(375)^2 - (6.1)^2}$$

$$U = 2.4496$$

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

$$F_A = \sqrt{(375)^2 + 1.2[2(6.1+1.2)]} - 375$$

$$F_A = .0214$$

$$Z = .1(V_D / \sqrt{R})$$

$$Z = .1(80 / \sqrt{375})$$

$$Z = .4131$$

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

$$W_c = 2(2.4496 + .6) + 0.214 + .4131$$

$$W_c = 6.5337$$

$$w = W_c - 2W_n = 6.5337 - 2(3.0) = .5337 \text{ (ROUND TO .6)}$$

($R < 850$ & $w > .6$ THEREFORE WIDENING IS REQUIRED)

$$LS = [E n_1 (W + w/2) / rg] b_w$$

$$LS = [(6.9)(1)(3.0 + .6/2) / 0.50] 1$$

$$LS = 6.9(3.3) / .5$$

$$LS = 45.54 \text{ (ROUND TO 46)}$$

RURAL EXAMPLE
21.6 m PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 3.6 m)

$V_D = 70$ km/h $R = 200$ m
 $W_n = 3.6$ m $rg = 0.55$
 $E = 7.9$ (PER PAGE 802.38)

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

$$U = 2.4 + 200 - \sqrt{(200)^2 - (6.1)^2}$$

$$U = 2.4930$$

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

$$F_A = \sqrt{(200)^2 + 1.2[2(6.1+1.2)]} - 200$$

$$F_A = .0402$$

$$Z = .1(V_D / \sqrt{R})$$

$$Z = .1(70 / \sqrt{200})$$

$$Z = .4950$$

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

$$W_c = 2(2.4930 + .9) + 0.0402 + .4950$$

$$W_c = 7.3212$$

$$w = W_c - 2W_n = 7.3212 - 2(3.6) = .121 \text{ (ROUND TO .2)}$$

FOR 21.6 m PAVEMENT WIDTH

$$w = 3(.2) = .6$$

($R < 230$ & $w > .6$ THEREFORE WIDENING IS REQUIRED)

$$LS = [E n_1 (W + W/3) / rg] b_w$$

$$LS = [7.9(3)(3.6 + .6/3) / 0.55] 0.6667$$

$$LS = (90 / 0.55) 0.6667$$

$$LS = 109.1691 \text{ (ROUND TO 110)}$$

OR

$$LS = M[E(W + w/N) / rg]$$

$$LS = 2[7.9(3.6 + .6/3) / 0.55]$$

$$LS = 2(30.02 / 0.55)$$

$$LS = 109.1636$$

URBAN EXAMPLES

7.2 m PAVEMENT WIDTH
(DESIGN SOFTWARE - 1 LANE AT 3.6 m)

$V_D = 60$ km/h $R = 175$ m
 $W_n = 3.6$ m $rg = 0.60$
 $E = 4.0$ (PER PAGE 802.29)

$$LS = (W n_1 E / rg) b_w$$

$$LS = [3.6(1)(4.0) / 0.6](1)$$

$$LS = 14.4 / .6$$

$$LS = 24$$

19.8 m PAVEMENT WIDTH
(DESIGN SOFTWARE - 3 LANES AT 3.3 m)

$V_D = 60$ km/h $R = 175$ m
 $W_n = 3.3$ m $rg = 0.60$
 $E = 4.0$ (PER PAGE 801.29)

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

$$LS = 0.6667[3.3(3)(4) / .6]$$

$$LS = 0.6667 (39.6 / 0.6)$$

$$LS = 44.0022$$

OR

$$LS = m (E W_n / rg)$$

$$LS = 2[4(3.3) / 0.6]$$

$$LS = 2(13.2 / 0.6)$$

$$LS = 44.0000$$

SPECIFICATION
REFERENCE

CALCULATED TC-5.01 EXAMPLES

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.23

MINIMUM RADII AND TRANSITION LENGTHS FOR 2% SUPERELEVATION

RADIUS (METERS)	E (%)	F	DV (km/h)	LS (METERS)	
				PAVEMENT WIDTH (W)	
				W ≤ 21.6 m	W > 21.6 m
>211	2.0	.163	70	32	NOTE: FOR PAVEMENT WIDTHS GREATER THAN 21.6 m USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.
138	2.0	.186	60	30	
85	2.0	.214	50	27	
47	2.0	.252	40	25	
22	2.0	.312	30	25	

MINIMUM RADII FOR DESIGNS
UTILIZING NORMAL PAVEMENT CROWN

RADIUS (METERS)	F	NC (km/h)
> 270	.163	70
171	.186	60
102	.214	50
55	.252	40
25	.312	30

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

TC-5.01

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
400	NC	0	0	0	0	0	0	0	0	0	0	0	0
255	2.0	10	10	12	12	15	15	16	16	18	18	20	20
235	2.1	10	11	12	13	15	16	16	17	18	19	20	21
215	2.2	10	11	12	14	15	16	16	18	18	20	20	22
195	2.3	10	12	12	14	15	17	16	19	18	21	20	23
174	2.4	10	12	12	15	15	18	16	20	18	22	20	24
153	2.5	10	12	12	15	15	18	16	20	18	22	20	24
137	2.6	10	13	12	16	15	19	16	21	18	23	20	25
123	2.7	10	13	12	17	15	20	16	22	18	24	20	26
112	2.8	10	14	12	17	15	21	16	23	18	25	20	27
102	2.9	10	14	12	18	15	21	16	24	18	26	20	28
93	3.0	10	15	12	18	15	22	16	24	18	27	20	29
86	3.1	10	15	12	19	15	23	16	25	18	28	20	30
79	3.2	10	16	12	20	15	24	16	26	18	29	20	31
73	3.3	10	16	12	20	15	24	16	27	18	30	20	32
67	3.4	10	17	12	21	15	25	16	28	18	30	20	33
62	3.5	10	17	12	21	15	26	16	28	18	31	20	34
57	3.6	10	18	12	22	15	26	16	29	18	32	20	35
52	3.7	10	18	12	23	15	27	16	30	18	33	20	36
48	3.8	10	19	12	23	15	28	16	31	18	34	20	37
43	3.9	10	19	12	24	15	29	16	32	18	35	20	38
34	4.0	10	20	12	24	15	30	16	32	18	36	20	40

NOTE:

CR AND LS VALUES IN METERS.

FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

SPECIFICATION REFERENCE

TRANSITION CURVES - URBAN
30 km/h DESIGN SPEED
VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.25

TC-5.01 DESIGN FACTORS FOR A DESIGN SPEED OF 40 km/h (URBAN) USING E= 4% MAX.

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS		
700	NC	0	0	0	0	0	0	0	0	0	0	0	
453	2.0	11	11	13	13	16	16	18	18	19	19	21	21
417	2.1	11	11	13	14	16	17	18	18	19	20	21	22
382	2.2	11	12	13	15	16	17	18	19	19	21	21	23
347	2.3	11	12	13	15	16	18	18	20	19	22	21	24
308	2.4	11	13	13	16	16	19	18	21	19	23	21	25
272	2.5	11	13	13	17	16	20	18	22	19	24	21	26
243	2.6	11	14	13	17	16	21	18	23	19	25	21	27
219	2.7	11	14	13	18	16	21	18	24	19	26	21	28
199	2.8	11	15	13	18	16	22	18	24	19	27	21	29
181	2.9	11	15	13	19	16	23	18	25	19	28	21	30
166	3.0	11	16	13	20	16	24	18	26	19	29	21	31
152	3.1	11	16	13	20	16	24	18	27	19	30	21	32
140	3.2	11	17	13	21	16	25	18	28	19	31	21	33
129	3.3	11	17	13	22	16	26	18	29	19	32	21	34
119	3.4	11	18	13	22	16	27	18	30	19	33	21	35
110	3.5	11	18	13	23	16	27	18	30	19	33	21	36
101	3.6	11	19	13	24	16	28	18	31	19	34	21	38
93	3.7	11	20	13	24	16	29	18	32	19	35	21	39
84	3.8	11	20	13	25	16	30	18	33	19	36	21	40
76	3.9	11	21	13	25	16	31	18	34	19	37	21	41
60	4.0	11	22	13	26	16	32	18	36	19	38	21	42

NOTE:
 CR AND LS VALUES IN METERS.
 FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.
 LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

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

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
1000	NC	0	0	0	0	0	0	0	0	0	0	0	0
642	2.0	12	12	14	14	17	17	19	19	21	21	23	23
594	2.1	12	12	14	15	17	18	19	20	21	22	23	24
549	2.2	12	13	14	16	17	19	19	21	21	23	23	25
505	2.3	12	13	14	16	17	20	19	22	21	24	23	26
460	2.4	12	14	14	17	17	20	19	23	21	25	23	27
414	2.5	12	14	14	18	17	21	19	24	21	26	23	28
374	2.6	12	15	14	18	17	22	19	24	21	27	23	29
339	2.7	12	15	14	19	17	23	19	25	21	28	23	30
310	2.8	12	16	14	20	17	24	19	26	21	29	23	32
284	2.9	12	17	14	20	17	25	19	27	21	30	23	33
261	3.0	12	17	14	21	17	25	19	28	21	31	23	34
241	3.1	12	18	14	22	17	26	19	29	21	32	23	35
222	3.2	12	18	14	23	17	27	19	30	21	33	23	36
206	3.3	12	19	14	23	17	28	19	31	21	34	23	37
191	3.4	12	19	14	24	17	29	19	32	21	35	23	38
176	3.5	12	20	14	25	17	30	19	33	21	36	23	39
163	3.6	12	20	14	25	17	30	19	34	21	37	23	40
150	3.7	12	21	14	26	17	31	19	35	21	38	23	41
137	3.8	12	22	14	27	17	32	19	36	21	39	23	43
123	3.9	12	22	14	27	17	33	19	36	21	40	23	44
99	4.0	12	24	14	28	17	34	19	38	21	42	23	46

NOTE:

CR AND LS VALUES IN METERS.

FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
50 km/h DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

TC-5.01 DESIGN FACTORS FOR A DESIGN SPEED OF 60 km/h (URBAN) USING E= 4% MAX.

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
1300	NC	0	0	0	0	0	0	0	0	0	0	0	0
894	2.0	12	12	15	15	18	18	20	20	22	22	24	24
830	2.1	12	13	15	16	18	19	20	21	22	24	24	26
769	2.2	12	14	15	17	18	20	20	22	22	25	24	27
711	2.3	12	14	15	18	18	21	20	23	22	26	24	28
655	2.4	12	15	15	18	18	22	20	24	22	27	24	29
597	2.5	12	15	15	19	18	23	20	25	22	28	24	30
542	2.6	12	16	15	20	18	24	20	26	22	29	24	32
495	2.7	12	17	15	21	18	25	20	27	22	30	24	33
454	2.8	12	17	15	21	18	26	20	28	22	31	24	34
418	2.9	12	18	15	22	18	27	20	29	22	32	24	35
386	3.0	12	18	15	23	18	27	20	30	22	33	24	36
357	3.1	12	19	15	24	18	28	20	31	22	35	24	38
331	3.2	12	20	15	24	18	29	20	32	22	36	24	39
307	3.3	12	20	15	25	18	30	20	33	22	37	24	40
284	3.4	12	21	15	26	18	31	20	34	22	38	24	41
264	3.5	12	21	15	27	18	32	20	35	22	39	24	42
244	3.6	12	22	15	27	18	33	20	36	22	40	24	44
225	3.7	12	23	15	28	18	34	20	37	22	41	24	45
206	3.8	12	23	15	29	18	35	20	38	22	42	24	46
186	3.9	12	24	15	30	18	36	20	39	22	43	24	47
150	4.0	12	24	15	30	18	36	20	40	22	44	24	48

NOTE:
 CR AND LS VALUES IN METERS.
 FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.
 LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

DESIGN FACTORS FOR A DESIGN SPEED OF 70 km/h
(URBAN) USING E= 4% MAX.

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
2000	NC	0	0	0	0	0	0	0	0	0	0	0	0
1191	2.0	14	14	17	17	20	20	22	22	24	24	27	27
1108	2.1	14	14	17	18	20	21	22	23	24	26	27	28
1030	2.2	14	15	17	18	20	22	22	24	24	27	27	29
957	2.3	14	16	17	19	20	23	22	26	24	28	27	31
886	2.4	14	16	17	20	20	24	22	27	24	29	27	32
817	2.5	14	17	17	21	20	25	22	28	24	30	27	33
747	2.6	14	18	17	22	20	26	22	29	24	32	27	35
685	2.7	14	18	17	23	20	27	22	30	24	33	27	36
631	2.8	14	19	17	23	20	28	22	31	24	34	27	37
583	2.9	14	19	17	24	20	29	22	32	24	35	27	38
540	3.0	14	20	17	25	20	30	22	33	24	36	27	40
501	3.1	14	21	17	26	20	31	22	34	24	38	27	41
466	3.2	14	21	17	27	20	32	22	35	24	39	27	42
433	3.3	14	22	17	27	20	33	22	36	24	40	27	44
403	3.4	14	23	17	28	20	34	22	38	24	41	27	45
374	3.5	14	23	17	29	20	35	22	39	24	42	27	46
347	3.6	14	24	17	30	20	36	22	40	24	44	27	48
323	3.7	14	25	17	31	20	37	22	41	24	45	27	49
294	3.8	14	25	17	31	20	38	22	42	24	46	27	50
265	3.9	14	26	17	32	20	39	22	43	24	47	27	52
215	4.0	14	28	17	34	20	40	22	44	24	48	27	54

NOTE:

CR AND LS VALUES IN METERS.

FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
70 km/h DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

TC-5.01 DESIGN FACTORS FOR A DESIGN SPEED OF 80 km/h (URBAN) USING E= 4% MAX.

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
2500	NC	0	0	0	0	0	0	0	0	0	0	0	0
1485	2.0	15	15	18	18	22	22	24	24	27	27	29	29
1383	2.1	15	16	18	19	22	23	24	26	27	28	29	31
1289	2.2	15	16	18	20	22	24	24	27	27	30	29	32
1199	2.3	15	17	18	21	22	25	24	28	27	31	29	34
1115	2.4	15	18	18	22	22	26	24	29	27	32	29	35
1032	2.5	15	18	18	23	22	27	24	30	27	33	29	36
950	2.6	15	19	18	24	22	29	24	32	27	35	29	38
874	2.7	15	20	18	25	22	30	24	33	27	36	29	39
807	2.8	15	21	18	26	22	31	24	34	27	37	29	41
747	2.9	15	21	18	26	22	32	24	35	27	39	29	42
694	3.0	15	22	18	27	22	33	24	36	27	40	29	44
645	3.1	15	23	18	28	22	34	24	38	27	41	29	45
600	3.2	15	24	18	29	22	35	24	39	27	43	29	47
559	3.3	15	24	18	30	22	36	24	40	27	44	29	48
521	3.4	15	25	18	31	22	37	24	41	27	45	29	49
485	3.5	15	26	18	32	22	38	24	42	27	47	29	51
450	3.6	15	26	18	33	22	39	24	44	27	48	29	52
416	3.7	15	27	18	34	22	40	24	45	27	49	29	54
382	3.8	15	28	18	35	22	42	24	46	27	51	29	55
346	3.9	15	29	18	35	22	43	24	47	27	52	29	57
280	4.0	15	30	18	36	22	44	24	48	27	54	29	58

NOTE:
 CR AND LS VALUES IN METERS.
 FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.
 LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

DESIGN FACTORS FOR A DESIGN SPEED OF 90 km/h
(URBAN) USING E= 4% MAX.

RADIUS (METERS)	E (%)	PAVEMENT WIDTH											
		7.2 m		10.8 m		14.4 m		18.0 m		19.8 m		21.6 m	
		DESIGN SPEED EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 3.6 m		1.5 @ 3.6 m		2 @ 3.6 m		3 @ 3.0 m		3 @ 3.3 m		3 @ 3.6 m	
		CR	LS	CR	LS	CR	LS	CR	LS	CR	LS	CR	LS
3000	NC	0	0	0	0	0	0	0	0	0	0	0	0
1830	2.0	16	16	20	20	23	23	26	26	29	29	31	31
1709	2.1	16	17	20	21	23	25	26	27	29	30	31	33
1597	2.2	16	17	20	21	23	26	26	29	29	31	31	34
1492	2.3	16	18	20	22	23	27	26	30	29	33	31	36
1393	2.4	16	19	20	23	23	28	26	31	29	34	31	37
1299	2.5	16	20	20	24	23	29	26	32	29	36	31	39
1208	2.6	16	20	20	25	23	30	26	34	29	37	31	40
1118	2.7	16	21	20	26	23	32	26	35	29	38	31	42
1038	2.8	16	22	20	27	23	33	26	36	29	40	31	43
965	2.9	16	23	20	28	23	34	26	38	29	41	31	45
900	3.0	16	23	20	29	23	35	26	39	29	43	31	46
840	3.1	16	24	20	30	23	36	26	40	29	44	31	48
784	3.2	16	25	20	31	23	37	26	41	29	45	31	50
733	3.3	16	26	20	32	23	38	26	43	29	47	31	51
685	3.4	16	27	20	33	23	40	26	44	29	48	31	53
639	3.5	16	27	20	34	23	41	26	45	29	50	31	54
595	3.6	16	28	20	35	23	42	26	46	29	51	31	56
552	3.7	16	29	20	36	23	43	26	48	29	52	31	57
508	3.8	16	30	20	37	23	44	26	49	29	54	31	59
461	3.9	16	30	20	38	23	45	26	50	29	55	31	60
376	4.0	16	32	20	40	23	46	26	52	29	58	31	62

NOTE:

CR AND LS VALUES IN METERS.

FOR PAVEMENT WIDTHS GREATER THAN 21.6 METERS USE LS VALUES DEVELOPED BY DESIGN SOFTWARE.

LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, AND LS VALUES.

TRANSITION CURVES - URBAN
90 km/h DESIGN SPEED

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 10/02

802.31

SPECIFICATION REFERENCE	DESIGN FACTORS FOR A DESIGN SPEED OF 40 km/h (RURAL) USING E = 8% MAX.																									
	DESIGN VELOCITY =40		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																				INTERCHANGE RAMPS			
	WIDTH= 5.4 m		WIDTH=6.0 m					WIDTH=6.6 m					WIDTH=7.2 m					WIDTH=14.4 m					4.8 m		5.4 m	
	1 @ 2.7 m		1 @ 3.0 m				1 @ 3.3 m				1 @ 3.6 m				2 @ 3.6 m				CR		LS					
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS	CR
800	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
571	2.0	25	25	0.6	9	9	0.0	10	10	0.0	11	11	0.0	11	11	0.0	16	16	0.0	13	13	13	13	13	13	13
541	2.1	24	25	0.6	9	9	0.0	10	10	0.0	11	11	0.0	11	11	0.0	16	17	0.0	13	13	13	14	14	14	14
513	2.2	23	25	0.6	9	10	0.0	10	11	0.0	11	12	0.0	16	17	0.0	16	17	0.0	13	14	13	14	13	15	15
488	2.3	22	25	0.6	9	10	0.0	10	11	0.0	11	12	0.0	16	18	0.0	16	18	0.0	13	14	13	14	13	15	15
465	2.4	21	25	0.6	9	11	0.0	10	12	0.0	11	13	0.0	16	19	0.0	13	15	0.0	13	15	13	16	13	17	17
444	2.5	20	25	0.6	9	11	0.0	10	12	0.0	11	13	0.0	16	20	0.0	16	20	0.0	13	16	13	17	16	13	17
424	2.6	20	25	0.7	9	12	0.0	10	13	0.0	11	14	0.0	16	21	0.0	16	21	0.0	13	16	13	17	16	13	17
406	2.7	19	25	0.7	9	12	0.0	10	13	0.0	11	14	0.0	16	22	0.0	16	22	0.0	13	17	13	18	13	18	18
388	2.8	18	25	0.7	9	12	0.0	10	14	0.0	11	15	0.0	16	23	0.0	16	23	0.0	13	18	13	19	13	19	19
372	2.9	18	25	0.7	9	13	0.0	10	14	0.0	11	15	0.0	16	23	0.0	16	23	0.0	13	19	13	19	13	19	19
357	3.0	17	25	0.7	9	13	0.0	10	15	0.0	11	16	0.0	16	24	0.0	16	24	0.0	13	19	13	20	13	20	20
343	3.1	17	25	0.7	9	14	0.0	10	15	0.0	11	16	0.0	16	24	0.0	16	24	0.0	13	19	13	20	13	20	20
330	3.2	16	25	0.7	9	14	0.0	10	16	0.0	11	17	0.0	16	25	0.0	16	25	0.0	13	20	13	21	13	21	21
318	3.3	16	25	0.7	9	15	0.0	10	16	0.0	11	17	0.0	16	26	0.0	16	26	0.0	13	21	13	22	13	22	22
306	3.4	15	25	0.7	9	15	0.0	10	17	0.0	11	18	0.0	16	27	0.0	16	27	0.0	13	21	13	22	13	22	22
295	3.5	15	25	0.7	9	15	0.0	10	17	0.0	11	18	0.0	16	27	0.0	16	27	0.0	13	22	13	23	13	23	23
285	3.6	14	25	0.7	9	16	0.0	10	17	0.0	11	19	0.0	16	28	0.0	16	28	0.0	13	22	13	24	13	24	24
274	3.7	14	25	0.8	9	16	0.0	10	18	0.0	11	20	0.0	16	29	0.0	16	29	0.0	13	23	13	24	13	24	24
265	3.8	14	25	0.8	9	17	0.0	10	18	0.0	11	20	0.0	16	30	0.0	16	30	0.0	13	24	13	25	13	25	25
256	3.9	13	25	0.8	9	17	0.0	10	19	0.0	11	21	0.0	16	31	0.0	16	31	0.0	13	24	13	26	13	26	26
247	4.0	13	25	0.8	9	18	0.0	10	19	0.0	11	21	0.0	16	31	0.0	16	31	0.0	13	25	13	26	13	26	26
239	4.1	13	25	0.8	9	18	0.0	10	20	0.0	11	22	0.0	16	32	0.0	16	32	0.0	13	25	13	27	13	27	27
231	4.2	12	25	0.8	9	18	0.0	10	20	0.0	11	22	0.0	16	33	0.0	16	33	0.0	13	26	13	27	13	27	27
223	4.3	12	25	0.8	9	19	0.0	10	21	0.0	11	23	0.0	16	34	0.0	16	34	0.0	13	27	13	28	13	28	28
216	4.4	12	25	0.8	9	19	0.0	10	21	0.0	11	23	0.0	16	34	0.0	16	34	0.0	13	27	13	29	13	29	29
208	4.5	12	25	0.8	9	20	0.0	10	22	0.0	11	24	0.0	16	35	0.0	16	35	0.0	13	28	13	29	13	29	29
201	4.6	11	25	0.9	11	25	0.6	10	22	0.0	11	24	0.0	16	36	0.0	16	36	0.0	13	28	13	30	13	30	30
195	4.7	11	25	0.9	11	25	0.6	10	23	0.0	11	25	0.0	16	37	0.0	16	37	0.0	13	29	13	31	13	31	31
188	4.8	11	25	0.9	11	25	0.6	10	23	0.0	11	25	0.0	16	38	0.0	16	38	0.0	13	30	13	31	13	31	31
182	4.9	11	25	0.9	11	25	0.6	10	24	0.0	11	26	0.0	16	38	0.0	16	38	0.0	13	30	13	32	13	32	32
175	5.0	10	25	0.9	10	25	0.6	10	24	0.0	11	26	0.0	16	39	0.0	16	39	0.0	13	31	13	33	13	33	33
169	5.1	10	25	0.9	10	25	0.6	10	25	0.0	11	27	0.0	16	40	0.0	16	40	0.0	13	31	13	33	13	33	33
163	5.2	10	25	0.9	10	25	0.6	10	25	0.0	11	27	0.0	16	41	0.0	16	41	0.0	13	32	13	34	13	34	34
157	5.3	10	25	1.0	10	26	0.7	10	25	0.0	11	28	0.0	16	41	0.0	16	41	0.0	13	33	13	35	13	35	35
151	5.4	10	25	1.0	10	26	0.7	10	26	0.0	11	28	0.0	16	42	0.0	16	42	0.0	13	33	13	35	13	35	35
145	5.5	10	26	1.0	10	27	0.7	10	26	0.0	11	29	0.0	16	43	0.0	16	43	0.0	13	34	13	36	13	36	36
140	5.6	10	26	1.0	10	27	0.7	10	27	0.0	11	29	0.0	16	44	0.0	16	44	0.0	13	35	13	36	13	36	36
135	5.7	10	27	1.0	10	28	0.7	10	27	0.0	11	30	0.0	16	44	0.0	16	44	0.0	13	35	13	37	13	37	37
130	5.8	10	27	1.0	10	28	0.7	10	28	0.0	11	30	0.0	16	45	0.0	16	45	0.0	13	36	13	38	13	38	38
126	5.9	10	28	1.1	10	29	0.8	10	28	0.0	11	31	0.0	16	46	0.0	16	46	0.0	13	36	13	38	13	38	38
121	6.0	10	28	1.1	10	30	0.8	10	29	0.0	11	31	0.0	16	47	0.0	16	47	0.0	13	37	13	39	13	39	39
117	6.1	10	29	1.1	10	30	0.8	10	29	0.0	11	32	0.0	16	48	0.0	16	48	0.0	13	38	13	40	13	40	40
113	6.2	10	29	1.1	10	31	0.8	10	30	0.0	11	32	0.0	16	48	0.0	16	48	0.0	13	38	13	40	13	40	40
110	6.3	10	30	1.1	10	31	0.8	10	30	0.0	11	33	0.0	16	49	0.0	16	49	0.0	13	39	13	41	13	41	41
106	6.4	10	31	1.2	10	32	0.9	11	33	0.6	11	34	0.0	17	50	0.6	17	50	0.6	13	40	13	42	13	42	42
102	6.5	10	31	1.2	10	33	0.9	11	34	0.6	11	34	0.0	17	51	0.6	17	51	0.6	13	40	13	43	13	43	43
99	6.6	10	32	1.2	10	33	0.9	11	34	0.6	11	34	0.0	17	51	0.6	17	51	0.6	13	41	13	44	13	44	44
96	6.7	10	32	1.2	10	34	0.9	11	35	0.6	11	35	0.0	17	52	0.6	17	52	0.6	13	41	13	44	13	44	44
92	6.8	10	33	1.3	10	34	1.0	11	36	0.7	11	36	0.0	18	53	0.6	18	53	0.6	13	42	13	45	13	45	45
89	6.9	10	34	1.3	10	35	1.0	11	36	0.7	11	36	0.0	18	54	0.6	18	54	0.6	13	42	13	45	13	45	45
86	7.0	10	34	1.3	10	35	1.0	11	37	0.7	11	37	0.0	18	55	0.6	18	55	0.6	13	43	13	46	13	46	46
83	7.1	10	34	1.3	10	36	1.0	11	38	0.7	11	38	0.0	18	56	0.6	18	56	0.6	13	44	13	47	13	47	47
80	7.2	10	35	1.4	11	37	1.1	11	39	0.8	11	38	0.0	18	57	0.6	18	57	0.6	13	44	13	47	13	47	47
77	7.3	10	36	1.4	11	38	1.1	11	39	0.8	11	39	0.0	18	58	0.6	18	58	0.6	13	45	13	48	13	48	48
75	7.4	10	36	1.4	11	38	1.1	11	40	0.8	11	39	0.0	18	59	0.6	18	59	0.6	13	45	13	48	13	48	48
72	7.5	10	37	1.5	11	39	1.2	11	41	0.9	12	40	0.6	19	60	0.6	19	60	0.6	13	46	13	49	13	49	49
69	7.6	10	38	1.5	11	40	1.2	11	41	0.9	12	41	0.6	19	61	0.6	19	61	0.6	13	47	13	50	13	50	50
66	7.7	10	38	1.5	11	40	1.2	11	42	0.9	12	43	0.6	19	62	0.6	19									

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

DESIGN VELOCITY =50	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)										INTERCHANGE RAMPS																
	WIDTH=5.4 m					WIDTH=6.0 m					WIDTH=6.6 m					WIDTH=7.2 m					WIDTH=14.4 m						
	1 @ 2.7 m		1 @ 3.0 m			1 @ 3.3 m			1 @ 3.6 m			1 @ 3.6 m			2 @ 3.6 m			4.8 m			5.4 m						
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w			
1200	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	0			
851	2.0	9	0.0	10	0.0	11	0.0	11	0.0	11	0.0	12	0.0	12	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0		
850	2.0	30	0.6	10	0.0	11	0.0	11	0.0	12	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0		
796	2.0	30	0.6	10	0.0	11	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0		
754	2.1	29	30	0.6	10	0.0	11	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	
716	2.2	28	30	0.6	10	11	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
682	2.3	27	30	0.6	10	11	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
650	2.4	25	30	0.6	10	12	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
620	2.5	24	30	0.6	10	12	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
593	2.6	24	30	0.6	10	12	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
568	2.7	23	30	0.6	10	13	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
544	2.8	22	30	0.6	10	13	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
523	2.9	21	30	0.7	10	14	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
502	3.0	20	30	0.7	10	14	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
483	3.1	20	30	0.7	10	15	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
465	3.2	19	30	0.7	10	15	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
448	3.3	19	30	0.7	10	16	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
432	3.4	18	30	0.7	10	16	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
417	3.5	18	30	0.7	10	17	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
402	3.6	17	30	0.7	10	17	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
389	3.7	17	30	0.7	10	18	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
376	3.8	16	30	0.7	10	17	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
363	3.9	16	30	0.7	10	18	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
352	4.0	15	30	0.7	10	19	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
340	4.1	15	30	0.8	10	19	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
329	4.2	15	30	0.8	10	20	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
319	4.3	14	30	0.8	10	20	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
309	4.4	14	30	0.8	10	21	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
300	4.5	14	30	0.8	10	21	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
280	4.6	14	30	0.8	10	22	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
281	4.7	13	30	0.8	10	22	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
273	4.8	13	30	0.8	10	23	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
265	4.9	13	30	0.8	10	23	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
256	5.0	12	30	0.8	10	24	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
249	5.1	12	30	0.8	10	24	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
241	5.2	12	30	0.9	12	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
233	5.3	12	30	0.9	12	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
226	5.4	12	30	0.9	12	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
219	5.5	11	30	0.9	11	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
212	5.6	11	30	0.9	11	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
205	5.7	11	30	0.9	11	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
198	5.8	11	30	0.9	11	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
192	5.9	11	30	0.9	11	30	0.6	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
186	6.0	10	30	1.0	11	31	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
180	6.1	10	31	1.0	11	32	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
175	6.2	10	31	1.0	11	32	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
170	6.3	10	32	1.0	11	33	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
164	6.4	10	32	1.0	11	33	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
159	6.5	10	32	1.0	11	34	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
154	6.6	10	33	1.0	11	35	0.7	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
150	6.7	10	34	1.1	11	36	0.8	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
145	6.8	10	34	1.1	11	36	0.8	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
141	6.9	10	35	1.1	11	37	0.8	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
136	7.0	10	35	1.1	11	37	0.8	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0
132	7.1	10	36	1.1	11	38	0.8	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0	17	0.0

SPECIFICATION REFERENCE	DESIGN FACTORS FOR A DESIGN SPEED OF 60 km/h (RURAL) USING E = 8% MAX.																															
	DESIGN VELOCITY -60		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS																	
			1 @ 2.7 m			1 @ 3.0 m			1 @ 3.3 m			1 @ 3.6 m			2 @ 3.6 m			3 @ 3.6 m			4.8 m			5.4 m								
	WIDTH+5.4 m		WIDTH+6.0 m		WIDTH+6.6 m		WIDTH+7.2 m		WIDTH+7.2 m		WIDTH+14.4 m		WIDTH+21.6 m		CR		LS		w		CR		LS		w		CR		LS		w	
	RADIUS (m/E ²)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	
1500	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	0.0	0	0.0	0	0.0	0		
1097	2.0	9	0.0	10	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11		
1040	2.1	9	0.0	10	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11	0.0	11		
988	2.2	9	10	0.0	10	11	0.0	11	13	0.0	12	14	0.0	18	20	0.0	24	27	0.0	15	16	15	17	15	18	15	17	15	18	15		
940	2.3	9	11	0.0	10	12	0.0	11	13	0.0	12	14	0.0	18	21	0.0	24	28	0.0	15	16	15	17	15	18	15	17	15	18	15		
896	2.4	9	11	0.0	10	12	0.0	11	14	0.0	12	15	0.0	18	22	0.0	24	29	0.0	15	17	15	18	15	18	15	17	15	18	15		
856	2.5	9	12	0.0	10	13	0.0	11	14	0.0	12	15	0.0	18	23	0.0	24	30	0.0	15	18	15	19	15	19	15	19	15	20	15		
851	2.6	9	12	0.0	10	13	0.0	11	15	0.0	12	16	0.0	18	24	0.0	24	32	0.0	15	19	15	20	15	20	15	20	15	21	15		
850	2.6	27	35	0.6	10	13	0.0	11	15	0.0	12	16	0.0	18	24	0.0	24	32	0.0	15	19	15	20	15	20	15	20	15	21	15		
819	2.6	27	35	0.6	10	13	0.0	11	15	0.0	12	16	0.0	18	24	0.0	24	32	0.0	15	19	15	20	15	20	15	20	15	21	15		
785	2.7	26	35	0.6	10	14	0.0	11	15	0.0	12	17	0.0	18	25	0.0	24	33	0.0	15	20	15	21	15	21	15	21	15	22	15		
753	2.8	25	35	0.6	10	14	0.0	11	16	0.0	12	17	0.0	18	26	0.0	24	34	0.0	15	20	15	21	15	21	15	21	15	22	15		
723	2.9	25	35	0.6	10	15	0.0	11	16	0.0	12	18	0.0	18	27	0.0	24	35	0.0	15	21	15	22	15	22	15	22	15	23	15		
695	3.0	24	35	0.6	10	15	0.0	11	17	0.0	12	18	0.0	18	27	0.0	24	36	0.0	15	22	15	23	15	23	15	23	15	24	15		
669	3.1	23	35	0.6	10	16	0.0	11	18	0.0	12	19	0.0	18	28	0.0	24	38	0.0	15	22	15	24	15	24	15	24	15	25	15		
644	3.2	22	35	0.7	10	16	0.0	11	18	0.0	12	20	0.0	18	29	0.0	24	39	0.0	15	22	15	24	15	24	15	24	15	25	15		
621	3.3	22	35	0.7	10	17	0.0	11	19	0.0	12	20	0.0	18	30	0.0	24	40	0.0	15	24	15	25	15	24	15	25	15	26	15		
599	3.4	21	35	0.7	10	17	0.0	11	19	0.0	12	21	0.0	18	31	0.0	24	41	0.0	15	24	15	26	15	24	15	26	15	27	15		
578	3.5	20	35	0.7	10	18	0.0	11	20	0.0	12	21	0.0	18	32	0.0	24	42	0.0	15	25	15	27	15	27	15	27	15	28	15		
559	3.6	20	35	0.7	10	18	0.0	11	20	0.0	12	22	0.0	18	33	0.0	24	44	0.0	15	26	15	27	15	27	15	28	15	29	15		
540	3.7	19	35	0.7	10	19	0.0	11	21	0.0	12	23	0.0	18	34	0.0	24	45	0.0	15	27	15	28	15	28	15	29	15	30	15		
523	3.8	19	35	0.7	10	19	0.0	11	21	0.0	12	23	0.0	18	35	0.0	24	46	0.0	15	27	15	29	15	29	15	30	15	31	15		
506	3.9	18	35	0.7	10	20	0.0	11	22	0.0	12	24	0.0	18	36	0.0	24	47	0.0	15	28	15	30	15	30	15	31	15	32	15		
490	4.0	18	35	0.7	10	20	0.0	11	22	0.0	12	24	0.0	18	36	0.0	24	48	0.0	15	29	15	31	15	31	15	32	15	33	15		
475	4.1	18	35	0.7	10	21	0.0	11	23	0.0	12	25	0.0	18	37	0.0	24	50	0.0	15	29	15	31	15	31	15	32	15	33	15		
460	4.2	17	35	0.7	10	21	0.0	11	24	0.0	12	26	0.0	18	38	0.0	24	51	0.0	15	30	15	32	15	32	15	33	15	34	15		
446	4.3	17	35	0.7	10	22	0.0	11	24	0.0	12	26	0.0	18	39	0.0	24	52	0.0	15	31	15	33	15	33	15	34	15	35	15		
433	4.4	16	35	0.7	10	22	0.0	11	25	0.0	12	27	0.0	18	40	0.0	24	53	0.0	15	32	15	33	15	33	15	34	15	35	15		
420	4.5	16	35	0.8	10	23	0.0	11	25	0.0	12	27	0.0	18	41	0.0	24	54	0.0	15	32	15	34	15	34	15	35	15	36	15		
407	4.6	16	35	0.8	10	23	0.0	11	26	0.0	12	28	0.0	18	42	0.0	24	56	0.0	15	33	15	35	15	35	15	36	15	37	15		
395	4.7	15	35	0.8	10	24	0.0	11	26	0.0	12	29	0.0	18	43	0.0	24	57	0.0	15	34	15	36	15	36	15	37	15	38	15		
384	4.8	15	35	0.8	10	24	0.0	11	27	0.0	12	29	0.0	18	44	0.0	24	58	0.0	15	34	15	36	15	36	15	37	15	38	15		
373	4.9	15	35	0.8	10	25	0.0	11	27	0.0	12	30	0.0	18	45	0.0	24	59	0.0	15	35	15	37	15	37	15	38	15	39	15		
362	5.0	14	35	0.8	10	25	0.0	11	28	0.0	12	30	0.0	18	45	0.0	24	60	0.0	15	36	15	38	15	38	15	39	15	40	15		
352	5.1	14	35	0.8	10	26	0.0	11	29	0.0	12	31	0.0	18	46	0.0	24	62	0.0	15	36	15	39	15	39	15	40	15	41	15		
341	5.2	14	35	0.8	10	26	0.0	11	29	0.0	12	32	0.0	18	47	0.0	24	63	0.0	15	37	15	39	15	39	15	40	15	41	15		
332	5.3	14	35	0.8	10	27	0.0	11	30	0.0	12	32	0.0	18	48	0.0	24	64	0.0	15	38	15	40	15	40	15	41	15	42	15		
322	5.4	13	35	0.8	10	27	0.0	11	30	0.0	12	33	0.0	18	49	0.0	24	65	0.0	15	39	15	41	15	41	15	42	15	43	15		
313	5.5	13	35	0.8	10	28	0.0	11	31	0.0	12	33	0.0	18	50	0.0	24	66	0.0	15	39	15	42	15	42	15	43	15	44	15		
303	5.6	13	35	0.8	10	28	0.0	11	31	0.0	12	34	0.0	18	51	0.0	24	68	0.0	15	40	15	42	15	42	15	43	15	44	15		
294	5.7	13	35	0.9	13	35	0.6	11	32	0.0	12	35	0.0	18	52	0.0	24	69	0.0	15	41	15	43	15	43	15	44	15	45	15		
286	5.8	13	35	0.9	13	35	0.6	11	32	0.0	12	35	0.0	18	53	0.0	24	70	0.0	15	41	15	44	15	44	15	45	15	46	15		
277	5.9	12	35	0.9	12	35	0.6	11	33	0.0	12	36	0.0	18	54	0.0	24	71	0.0	15	42	15	45	15	45	15	46	15	47	15		
269	6.0	12	35	0.9	12	35	0.6	11	33	0.0	12	36	0.0	18	54	0.0	24	72	0.0	15	43	15	45	15	45	15	46	15	47	15		
262	6.1	12	35	0.9	12	35	0.6	11	34	0.0	12	37	0.0	18	55	0.0	24	74	0.0	15	44	15	46	15	46	15	47	15	48	15		
254	6.2	12	35	0.9	11	35	0.6	11	35	0.0	12	38	0.0	18	56	0.0	24	75	0.0	15	44	15	47	15	47	15	48	15	49	15		
247	6.3	12	35	0.9	11	35	0.6	11	35	0.0	12	38	0.0	18	57	0.0	24	76	0.0	15	45	15	48	15	48	15	49	15	50	15		
240	6.4	11	35	0.9	11	36	0.6	11	36	0.0	12	39	0.0	18	58	0.0	24	77	0.0	15	46	15	48	15	48	15	49	15	50	15		
233	6.5	11	35	0.9	11	36	0.6	11	36	0.0	12	39	0.0	18	59	0.0	24	78	0.0	15	46	15	49	15	49	15	50	15	51	15		
226	6.6	11	35	0.9	11	37	0.6	11	37	0.0	12	40	0.0	18	60	0.0	24	80	0.0	15	47	15	50	15	50	15	51	15	52	15		
219	6.7	11	36	1.0	12	38	0.7	11	37	0.0	12	41	0.0																			

DESIGN FACTORS FOR A DESIGN SPEED OF 70 km/h (RURAL) USING E = 8% MAX.		WIDTH* 5.4 m		WIDTH+6.0 m		WIDTH+6.6 m		WIDTH+7.2 m		WIDTH+7.2 m		WIDTH+14.4 m		WIDTH+21.6 m		INTERCHANGE RAMPS		WIDTH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
DESIGN VELOCITY -70	RADIUS (m/E (%)	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		1 @ 2.7 m				1 @ 3.0 m				1 @ 3.3 m				1 @ 3.6 m				2 @ 3.6 m				3 @ 3.6 m				4.8 m		5.4 m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
2000	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	0	0	0.0	0	0	0	0	0.0	0	0	0	0	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1447	2.0	10	10	0.0	11	11	0.0	12	12	0.0	13	13	0.0	14	14	0.0	15	15	0.0	16	16	0.0	17	17	0.0	18	18	0.0	19	19	0.0	20	20	0.0	21	21	0.0	22	22	0.0	23	23	0.0	24	24	0.0	25	25	0.0	26	26	0.0	27	27	0.0	28	28	0.0	29	29	0.0	30	30	0.0	31	31	0.0	32	32	0.0	33	33	0.0	34	34	0.0	35	35	0.0	36	36	0.0	37	37	0.0	38	38	0.0	39	39	0.0	40	40	0.0	41	41	0.0	42	42	0.0	43	43	0.0	44	44	0.0	45	45	0.0	46	46	0.0	47	47	0.0	48	48	0.0	49	49	0.0	50	50	0.0	51	51	0.0	52	52	0.0	53	53	0.0	54	54	0.0	55	55	0.0	56	56	0.0	57	57	0.0	58	58	0.0	59	59	0.0	60	60	0.0	61	61	0.0	62	62	0.0	63	63	0.0	64	64	0.0	65	65	0.0	66	66	0.0	67	67	0.0	68	68	0.0	69	69	0.0	70	70	0.0	71	71	0.0	72	72	0.0	73	73	0.0	74	74	0.0	75	75	0.0	76	76	0.0	77	77	0.0	78	78	0.0	79	79	0.0	80	80	0.0	81	81	0.0	82	82	0.0	83	83	0.0	84	84	0.0	85	85	0.0	86	86	0.0	87	87	0.0	88	88	0.0	89	89	0.0	90	90	0.0	91	91	0.0	92	92	0.0	93	93	0.0	94	94	0.0	95	95	0.0	96	96	0.0	97	97	0.0	98	98	0.0	99	99	0.0	100	100	0.0	101	101	0.0	102	102	0.0	103	103	0.0	104	104	0.0	105	105	0.0	106	106	0.0	107	107	0.0	108	108	0.0	109	109	0.0	110	110	0.0	111	111	0.0	112	112	0.0	113	113	0.0	114	114	0.0	115	115	0.0	116	116	0.0	117	117	0.0	118	118	0.0	119	119	0.0	120	120	0.0	121	121	0.0	122	122	0.0	123	123	0.0	124	124	0.0	125	125	0.0	126	126	0.0	127	127	0.0	128	128	0.0	129	129	0.0	130	130	0.0	131	131	0.0	132	132	0.0	133	133	0.0	134	134	0.0	135	135	0.0	136	136	0.0	137	137	0.0	138	138	0.0	139	139	0.0	140	140	0.0	141	141	0.0	142	142	0.0	143	143	0.0	144	144	0.0	145	145	0.0	146	146	0.0	147	147	0.0	148	148	0.0	149	149	0.0	150	150	0.0	151	151	0.0	152	152	0.0	153	153	0.0	154	154	0.0	155	155	0.0	156	156	0.0	157	157	0.0	158	158	0.0	159	159	0.0	160	160	0.0	161	161	0.0	162	162	0.0	163	163	0.0	164	164	0.0	165	165	0.0	166	166	0.0	167	167	0.0	168	168	0.0	169	169	0.0	170	170	0.0	171	171	0.0	172	172	0.0	173	173	0.0	174	174	0.0	175	175	0.0	176	176	0.0	177	177	0.0	178	178	0.0	179	179	0.0	180	180	0.0	181	181	0.0	182	182	0.0	183	183	0.0	184	184	0.0	185	185	0.0	186	186	0.0	187	187	0.0	188	188	0.0	189	189	0.0	190	190	0.0	191	191	0.0	192	192	0.0	193	193	0.0	194	194	0.0	195	195	0.0	196	196	0.0	197	197	0.0	198	198	0.0	199	199	0.0	200	200	0.0	201	201	0.0	202	202	0.0	203	203	0.0	204	204	0.0	205	205	0.0	206	206	0.0	207	207	0.0	208	208	0.0	209	209	0.0	210	210	0.0	211	211	0.0	212	212	0.0	213	213	0.0	214	214	0.0	215	215	0.0	216	216	0.0	217	217	0.0	218	218	0.0	219	219	0.0	220	220	0.0	221	221	0.0	222	222	0.0	223	223	0.0	224	224	0.0	225	225	0.0	226	226	0.0	227	227	0.0	228	228	0.0	229	229	0.0	230	230	0.0	231	231	0.0	232	232	0.0	233	233	0.0	234	234	0.0	235	235	0.0	236	236	0.0	237	237	0.0	238	238	0.0	239	239	0.0	240	240	0.0	241	241	0.0	242	242	0.0	243	243	0.0	244	244	0.0	245	245	0.0	246	246	0.0	247	247	0.0	248	248	0.0	249	249	0.0	250	250	0.0	251	251	0.0	252	252	0.0	253	253	0.0	254	254	0.0	255	255	0.0	256	256	0.0	257	257	0.0	258	258	0.0	259	259	0.0	260	260	0.0	261	261	0.0	262	262	0.0	263	263	0.0	264	264	0.0	265	265	0.0	266	266	0.0	267	267	0.0	268	268	0.0	269	269	0.0	270	270	0.0	271	271	0.0	272	272	0.0	273	273	0.0	274	274	0.0	275	275	0.0	276	276	0.0	277	277	0.0	278	278	0.0	279	279	0.0	280	280	0.0	281	281	0.0	282	282	0.0	283	283	0.0	284	284	0.0	285	285	0.0	286	286	0.0	287	287	0.0	288	288	0.0	289	289	0.0	290	290	0.0	291	291	0.0	292	292	0.0	293	293	0.0	294	294	0.0	295	295	0.0	296	296	0.0	297	297	0.0	298	298	0.0	299	299	0.0	300	300	0.0	301	301	0.0	302	302	0.0	303	303	0.0	304	304	0.0	305	305	0.0	306	306	0.0	307	307	0.0	308	308	0.0	309	309	0.0	310	310	0.0	311	311	0.0	312	312	0.0	313	313	0.0	314	314	0.0	315	315	0.0	316	316	0.0	317	317	0.0	318	318	0.0	319	319	0.0	320	320	0.0	321	321	0.0	322	322	0.0	323	323	0.0	324	324	0.0	325	325	0.0	326	326	0.0	327	327	0.0	328	328	0.0	329	329	0.0	330	330	0.0	331	331	0.0	332	332	0.0	333	333	0.0	334	334	0.0	335	335	0.0	336	336	0.0	337	337	0.0	338	338	0.0	339	339	0.0	340	340	0.0	341	341	0.0	342	342	0.0	343	343	0.0	344	344	0.0	345	345	0.0	346	346	0.0	347	347	0.0	348	348	0.0	349	349	0.0	350	350	0.0	351	351	0.0	352	352	0.0	353	353	0.0	354	354	0.0	355	355	0.0	356	356	0.0	357	357	0.0	358	358	0.0	359	359	0.0	360	360	0.0	361	361	0.0	362	362	0.0	363	363	0.0	364	364	0.0	365	365	0.0	366	366	0.0	367	367	0.0	368	368	0.0	369	369	0.0	370	370	0.0	371	371	0.0	372	372	0.0	373	373	0.0	374	374	0.0	375	375	0.0	376	376	0.0	377	377	0.0	378	378	0.0	379	379	0.0	380	380	0.0	381	381	0.0	382	382	0.0	383	383	0.0	384	384	0.0	385	385	0.0	386	386	0.0	387	387	0.0	388	388	0.0	389	389	0.0	390	390	0.0	391	391	0.0	392	392	0.0	393	393	0.0	394	394	0.0	395	395	0.0	396	396	0.0	397	397	0.0	398	398	0.0	399	399	0.0	400	400	0.0	401	401	0.0	402	402	0.0	403	403	0.0	404	404	0.0	405	405	0.0	406	406	0.0	407	407	0.0	408	408	0.0	409	409	0.0	410	410	0.0	411	411	0.0	412	412	0.0	413	413	0.0	414	414	0.0	415	415	0.0	416	416	0.0	417	417	0.0	418	418	0.0	419	419	0.0	420	420	0.0	421	421	0.0	422	422	0.0	423	423	0.0	424	424	0.0	425	425	0.0	426	426	0.0	427	427	0.0	428	428	0.0	429	429	0.0	430	430	0.0	431	431	0.0	432	432	0.0	433	433	0.0	434	434	0.0	435	435	0.0	436	436	0.0	437	437	0.0	438	438	0.0	439	439	0.0	440	440	0.0	441	441	0.0	442	442	0.0	443	443	0.0	444	444	0.0	445	445	0.0	446	446	0.0	447	447	0.0	448	448	0.0	449	449	0.0	450	450	0.0	451	451	0.0	452	452	0.0	453	453	0.0	454	454	0.0	455	455	0.0	456	456	0.0	457	457	0.0	458	458	0.0	459	459	0.0	460	460	0.0	461	461	0.0	462	462	0.0	463	463	0.0	464	464	0.0	465	465	0.0	466	466	0.0	467	467	0.0	468	468	0.0	469	469	0.0	470	470	0.0	471	471	0.0	472	472	0.0	473	473	0.0	474	474	0.0	475	475	0.0	476	476	0.0	477	477	0.0	478	478	0.0	479	479	0.0	480	480	0.0	481	481	0.0	482	482	0.0	483	483	0.0	484	484	0.0	485	485	0.0	486	486	0.0	487	487	0.0	488	488	0.0	489	489	0.0	490	490	0.0	491	491	0.0	492	492	0.0

DESIGN VELOCITY -80		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											INTERCHANGE RAMPS																							
		1 @ 2.7 m			1 @ 3.0 m			1 @ 3.3 m			2 @ 3.6 m			3 @ 3.6 m			4.8 m			5.4 m																
RADIUS (m/E (2))		CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w		
2500	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				
1794	2.0	11	11	0.0	12	12	0.0	14	14	0.0	15	15	0.0	22	22	0.0	29	29	0.0	31	31	0.0	29	29	0.0	17	17	18	18	18	18	18				
1701	2.1	11	12	0.0	12	13	0.0	14	15	0.0	16	16	0.0	22	23	0.0	29	31	0.0	17	18	19	18	18	19	18	18	18	19	19	19	19	19			
1617	2.2	11	12	0.0	12	14	0.0	14	15	0.0	16	16	0.0	22	24	0.0	29	32	0.0	17	19	20	18	18	20	18	18	18	19	18	18	18	21			
1541	2.3	11	13	0.0	12	14	0.0	14	16	0.0	17	17	0.0	22	25	0.0	29	34	0.0	17	20	21	18	20	18	18	18	18	19	18	18	18	21			
1470	2.4	11	14	0.0	12	15	0.0	14	16	0.0	18	18	0.0	22	26	0.0	29	35	0.0	17	21	22	18	22	18	20	18	18	18	18	18	18	21			
1405	2.5	11	14	0.0	12	15	0.0	14	17	0.0	15	18	0.0	22	27	0.0	29	36	0.0	17	22	23	18	23	18	20	18	18	18	18	18	18	23			
1345	2.6	11	15	0.0	12	16	0.0	14	18	0.0	15	19	0.0	22	29	0.0	29	38	0.0	17	22	23	18	24	18	20	18	18	18	18	18	18	24			
1289	2.7	11	16	0.0	12	17	0.0	14	18	0.0	15	20	0.0	22	30	0.0	29	39	0.0	17	23	23	18	25	18	20	18	18	18	18	18	18	25			
1190	2.9	11	16	0.0	12	18	0.0	14	20	0.0	15	21	0.0	22	32	0.0	29	42	0.0	17	25	18	27	18	20	18	18	18	18	18	18	18	27			
1144	3.0	11	17	0.0	12	18	0.0	14	20	0.0	15	22	0.0	22	33	0.0	29	44	0.0	17	26	18	27	18	20	18	18	18	18	18	18	18	27			
1102	3.1	11	17	0.0	12	19	0.0	14	21	0.0	15	23	0.0	22	34	0.0	29	45	0.0	17	27	18	28	18	20	18	18	18	18	18	18	18	28			
1063	3.2	11	18	0.0	12	20	0.0	14	22	0.0	15	24	0.0	22	35	0.0	29	47	0.0	17	27	18	29	18	20	18	18	18	18	18	18	18	29			
1025	3.3	11	18	0.0	12	20	0.0	14	22	0.0	15	24	0.0	22	36	0.0	29	48	0.0	17	28	18	30	18	20	18	18	18	18	18	18	18	30			
990	3.4	11	19	0.0	12	21	0.0	14	23	0.0	15	25	0.0	22	37	0.0	29	49	0.0	17	29	18	31	18	20	18	18	18	18	18	18	18	31			
957	3.5	11	19	0.0	12	21	0.0	14	24	0.0	15	26	0.0	22	38	0.0	29	51	0.0	17	30	18	32	18	20	18	18	18	18	18	18	18	32			
926	3.6	11	20	0.0	12	22	0.0	14	24	0.0	15	26	0.0	22	39	0.0	29	52	0.0	17	31	18	33	18	20	18	18	18	18	18	18	18	33			
896	3.7	11	20	0.0	12	23	0.0	14	25	0.0	15	27	0.0	22	40	0.0	29	54	0.0	17	32	18	34	18	20	18	18	18	18	18	18	18	34			
868	3.8	11	21	0.0	12	23	0.0	14	26	0.0	15	28	0.0	22	42	0.0	29	55	0.0	17	32	18	35	18	20	18	18	18	18	18	18	18	18	35		
851	3.9	24	45	0.7	12	24	0.0	14	26	0.0	15	29	0.0	22	43	0.0	29	57	0.0	17	33	18	36	18	20	18	18	18	18	18	18	18	18	36		
850	3.9	24	45	0.7	12	24	0.0	14	26	0.0	15	29	0.0	22	43	0.0	29	57	0.0	17	33	18	36	18	20	18	18	18	18	18	18	18	18	36		
841	3.9	24	45	0.7	12	24	0.0	14	26	0.0	15	29	0.0	22	43	0.0	29	57	0.0	17	33	18	36	18	20	18	18	18	18	18	18	18	18	36		
815	4.0	23	45	0.7	12	24	0.0	14	27	0.0	15	29	0.0	22	44	0.0	29	58	0.0	17	34	18	36	18	20	18	18	18	18	18	18	18	18	36		
791	4.1	22	45	0.7	12	25	0.0	14	28	0.0	15	30	0.0	22	45	0.0	29	60	0.0	17	35	18	37	18	20	18	18	18	18	18	18	18	18	37		
768	4.2	22	45	0.7	12	26	0.0	14	28	0.0	15	31	0.0	22	46	0.0	29	61	0.0	17	36	18	38	18	20	18	18	18	18	18	18	18	18	38		
745	4.3	21	45	0.7	12	26	0.0	14	29	0.0	15	31	0.0	22	47	0.0	29	62	0.0	17	37	18	39	18	20	18	18	18	18	18	18	18	18	39		
724	4.4	21	45	0.7	12	27	0.0	14	30	0.0	15	32	0.0	22	48	0.0	29	64	0.0	17	38	18	40	18	20	18	18	18	18	18	18	18	18	40		
704	4.5	20	45	0.7	12	27	0.0	14	30	0.0	15	33	0.0	22	49	0.0	29	65	0.0	17	38	18	41	18	20	18	18	18	18	18	18	18	18	41		
684	4.6	20	45	0.7	12	28	0.0	14	31	0.0	15	34	0.0	22	50	0.0	29	67	0.0	17	39	18	42	18	20	18	18	18	18	18	18	18	18	42		
665	4.7	20	45	0.7	12	29	0.0	14	32	0.0	15	34	0.0	22	51	0.0	29	68	0.0	17	40	18	43	18	20	18	18	18	18	18	18	18	18	43		
647	4.8	19	45	0.7	12	29	0.0	14	32	0.0	15	35	0.0	22	52	0.0	29	70	0.0	17	41	18	44	18	20	18	18	18	18	18	18	18	18	44		
630	4.9	19	45	0.7	12	30	0.0	14	33	0.0	15	36	0.0	22	53	0.0	29	71	0.0	17	42	18	45	18	20	18	18	18	18	18	18	18	18	45		
613	5.0	18	45	0.7	12	30	0.0	14	33	0.0	15	36	0.0	22	54	0.0	29	72	0.0	17	43	18	45	18	20	18	18	18	18	18	18	18	18	18	45	
596	5.1	18	45	0.8	12	31	0.0	14	34	0.0	15	37	0.0	22	56	0.0	29	74	0.0	17	43	18	46	18	20	18	18	18	18	18	18	18	18	18	46	
581	5.2	18	45	0.8	12	32	0.0	14	35	0.0	15	38	0.0	22	57	0.0	29	75	0.0	17	44	18	47	18	20	18	18	18	18	18	18	18	18	18	47	
565	5.3	17	45	0.8	12	32	0.0	14	35	0.0	15	39	0.0	22	58	0.0	29	77	0.0	17	44	18	48	18	20	18	18	18	18	18	18	18	18	18	48	
551	5.4	17	45	0.8	12	33	0.0	14	36	0.0	15	39	0.0	22	59	0.0	29	78	0.0	17	46	18	49	18	20	18	18	18	18	18	18	18	18	18	49	
536	5.5	17	45	0.8	12	33	0.0	14	37	0.0	15	40	0.0	22	60	0.0	29	80	0.0	17	47	18	50	18	20	18	18	18	18	18	18	18	18	18	50	
523	5.6	17	45	0.8	12	34	0.0	14	37	0.0	15	41	0.0	22	61	0.0	29	81	0.0	17	48	18	51	18	20	18	18	18	18	18	18	18	18	18	51	
509	5.7	16	45	0.8	12	35	0.0	14	38	0.0	15	42	0.0	22	62	0.0	29	83	0.0	17	48	18	52	18	20	18	18	18	18	18	18	18	18	18	52	
496	5.8	16	45	0.8	12	35	0.0	14	39	0.0	15	42	0.0	22	63	0.0	29	84	0.0	17	49	18	53	18	20	18	18	18	18	18	18	18	18	18	18	53
483	5.9	16	45	0.8	12	36	0.0	14	39	0.0	15	43	0.0	22	64	0.0	29	85	0.0	17	50	18	54	18	20	18	18	18	18	18	18	18	18	18	18	54
470	6.0	15	45	0.8	12	36	0.0	14	40	0.0	15	44	0.0	22	65	0.0	29	87	0.0	17	51	18	54	18	20	18	18	18	18	18	18	18	18	18	18	54
458	6.1	15	45	0.8	12	37	0.0	14	41	0.0	15	44	0.0	22	66	0.0	29	88	0.0	17	52	18	55	18	20	18	18	18	18	18	18	18	18	18	18	55
446	6.2	15	45	0.8	12	38	0.0	14	42	0.0	15	45	0.0	22	67	0.0	29	90	0.0	17	53	18	56	18	20	18	18	18	18	18	18	18	18	18	18	56
435	6.3	15	45	0.8	12	38	0.0	14	42	0.0	15	46	0.0	22	69	0.0	29	91	0.0	17	54	18	57	18	20	18	18	18	18	18	18	18	18	18	18	57
424	6.4	15	45	0.8	12																															

DESIGN FACTORS FOR A DESIGN SPEED OF 110 km/h (RURAL) USING E = 8% MAX.			INTERCHANGE RAMP																		
DESIGN VELOCITY -110	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											WIDTH									
	WIDTH= 5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m		4.8 m		5.4 m						
	1 @ 2.7 m	CR	LS	w	1 @ 3.0 m	CR	LS	w	1 @ 3.3 m	CR	LS	w	1 @ 3.6 m	CR	LS	w	1 @ 3.6 m	CR	LS	w	
RADIUS (m)E (°)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
5000	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
3096	2.0	14	14	0.0	15	16	0.0	17	0.0	18	19	0.0	20	0.0	22	0.0	24	0.0	27	0.0	30
2941	2.1	14	15	0.0	16	17	0.0	18	0.0	19	20	0.0	21	0.0	22	0.0	23	0.0	24	0.0	25
2799	2.2	14	15	0.0	17	18	0.0	19	0.0	20	21	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26
2670	2.3	14	16	0.0	17	19	0.0	20	0.0	22	24	0.0	26	0.0	28	0.0	31	0.0	34	0.0	37
2551	2.4	14	16	0.0	17	20	0.0	21	0.0	23	25	0.0	28	0.0	31	0.0	34	0.0	37	0.0	40
2442	2.5	14	17	0.0	18	21	0.0	23	0.0	25	27	0.0	31	0.0	34	0.0	37	0.0	40	0.0	43
2341	2.6	14	18	0.0	19	22	0.0	24	0.0	26	28	0.0	34	0.0	37	0.0	40	0.0	43	0.0	46
2248	2.7	14	18	0.0	19	21	0.0	23	0.0	25	27	0.0	31	0.0	34	0.0	37	0.0	40	0.0	43
2161	2.8	14	19	0.0	19	21	0.0	23	0.0	25	27	0.0	31	0.0	34	0.0	37	0.0	40	0.0	43
2080	2.9	14	20	0.0	19	22	0.0	24	0.0	26	28	0.0	31	0.0	34	0.0	37	0.0	40	0.0	43
2004	3.0	14	20	0.0	19	22	0.0	24	0.0	26	28	0.0	31	0.0	34	0.0	37	0.0	40	0.0	43
1934	3.1	14	21	0.0	19	23	0.0	25	0.0	27	29	0.0	34	0.0	37	0.0	40	0.0	43	0.0	46
1867	3.2	14	22	0.0	19	24	0.0	26	0.0	28	30	0.0	34	0.0	37	0.0	40	0.0	43	0.0	46
1805	3.3	14	22	0.0	19	25	0.0	27	0.0	29	31	0.0	34	0.0	37	0.0	40	0.0	43	0.0	46
1746	3.4	14	23	0.0	19	25	0.0	27	0.0	29	31	0.0	34	0.0	37	0.0	40	0.0	43	0.0	46
1691	3.5	14	24	0.0	19	26	0.0	29	0.0	31	33	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1639	3.6	14	24	0.0	19	27	0.0	29	0.0	32	34	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1589	3.7	14	25	0.0	19	28	0.0	30	0.0	32	34	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1542	3.8	14	26	0.0	19	28	0.0	31	0.0	33	35	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1498	3.9	14	26	0.0	19	29	0.0	32	0.0	34	36	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1455	4.0	14	27	0.0	19	30	0.0	33	0.0	35	37	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1415	4.1	14	27	0.0	19	30	0.0	33	0.0	35	37	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1376	4.2	14	28	0.0	19	31	0.0	34	0.0	36	38	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1340	4.3	14	29	0.0	19	32	0.0	35	0.0	37	39	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1305	4.4	14	29	0.0	19	33	0.0	36	0.0	38	40	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1271	4.5	14	30	0.0	19	33	0.0	36	0.0	38	40	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1239	4.6	14	31	0.0	19	34	0.0	37	0.0	38	41	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1208	4.7	14	31	0.0	19	35	0.0	38	0.0	39	42	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1178	4.8	14	32	0.0	19	36	0.0	39	0.0	40	43	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1150	4.9	14	33	0.0	19	36	0.0	39	0.0	40	44	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1123	5.0	14	33	0.0	19	37	0.0	40	0.0	41	44	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1096	5.1	14	34	0.0	19	38	0.0	41	0.0	42	45	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1071	5.2	14	35	0.0	19	39	0.0	42	0.0	43	46	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1047	5.3	14	35	0.0	19	39	0.0	42	0.0	43	46	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1023	5.4	14	36	0.0	19	40	0.0	43	0.0	44	47	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
1000	5.5	14	37	0.0	19	41	0.0	44	0.0	45	48	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
978	5.6	14	37	0.0	19	41	0.0	44	0.0	45	48	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
957	5.7	14	38	0.0	19	42	0.0	45	0.0	46	49	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
937	5.8	14	39	0.0	19	43	0.0	46	0.0	47	50	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
917	5.9	14	39	0.0	19	44	0.0	47	0.0	48	50	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
898	6.0	14	40	0.0	19	44	0.0	47	0.0	48	50	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
879	6.1	14	41	0.0	19	45	0.0	48	0.0	49	51	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
861	6.2	14	41	0.0	19	46	0.0	49	0.0	50	51	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
851	6.3	14	42	0.0	19	47	0.0	50	0.0	51	52	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
850	6.3	21	65	0.8	15	47	0.0	51	0.0	52	53	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
843	6.3	21	65	0.8	15	47	0.0	51	0.0	52	53	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
826	6.4	21	65	0.8	15	47	0.0	51	0.0	52	53	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
809	6.5	20	65	0.8	15	48	0.0	52	0.0	53	54	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
793	6.6	20	65	0.8	15	49	0.0	53	0.0	54	55	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
777	6.7	20	65	0.8	15	50	0.0	54	0.0	54	55	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
760	6.8	20	65	0.8	15	50	0.0	54	0.0	54	55	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
744	6.9	19	65	0.8	15	51	0.0	55	0.0	55	56	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
728	7.0	19	65	0.8	15	52	0.0	56	0.0	56	57	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
711	7.1	19	65	0.8	15	52	0.0	56	0.0	56	57	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
695	7.2	19	65	0.8	15	53	0.0	57	0.0	57	58	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
678	7.3	18	65	0.8	15	54	0.0	58	0.0	58	59	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
661	7.4	18	65	0.8	15	55	0.0	59	0.0	59	60	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
643	7.5	18	65	0.9	18	65	0.6	60	0.0	60	61	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
625	7.6	18	65	0.9	18	66	0.6	61	0.0	61	62	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
605	7.7	17	65	0.9	17	66	0.6	62	0.0	62	63	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
583	7.8	17	65	0.9	17	67	0.6	63	0.0	63	64	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
557	7.9	17	65	0.9	17	67	0.6	63	0.0	63	64	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49
502	8.0	17	65	0.9	17	65	0.6	65	0.0	65	66	0.0	37	0.0	40	0.0	43	0.0	46	0.0	49

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.