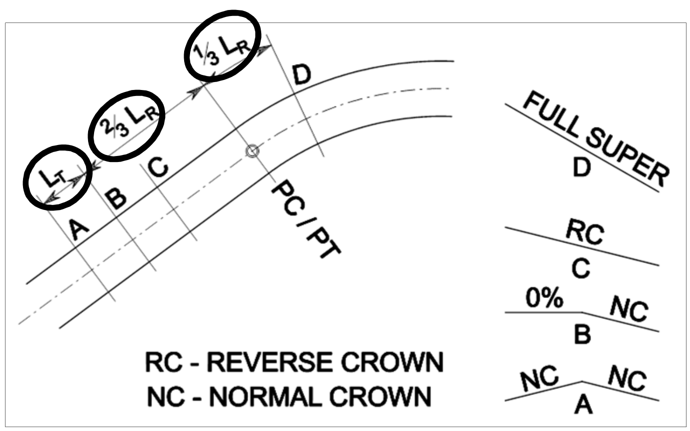
Superelevation Transition

- Superelevation runoff, L_r: length of roadway needed to change cross slope from adverse cross slope removed to fully superelevated
- Tangent runout, L_t: length needed to change the highway cross slope from a normal crown section to a section with the adverse cross slope removed

Superelevation Transition



$$T = L_t + L_r$$

Procedure for Designing Superelevation Transition

1. Determine $\mathbf{e_{max}}$**: 6% or 8%** from design criteria
2. Determine proposed **design speed:** $\mathbf{V_d}$
3. Determine **radius: R,** of curve under consideration
4. Identify constraints which may impact the design
5. Determine required superelevation rate: e
6. Determine required Superelevation runoff, L_r
7. Determine required Tangent runout, L_t
8. Determine stations where L_t and L_r begin and end.

Superelevation Tables

- AASHTO developed tables of Minimum Radii for various combinations of e_{max}, design speeds, and superelevation rates.
- Tables are organized by the following five e_{max} rates: 4%, 6%, 8%, 10%, and 12%.
- AASHTO also provides a table of L_r lengths based on combinations of design speed, required superelevation rate, and number of lanes (2 or 4) rotated.
- Once the required L_r length is known, AASHTO provides an equation for calculating the required L_t length.
- This section will familiarize you with the use of these tables and the equation for L_t .

Civil P.E. Exam Review

AASHTO Green Book

AASHTO Exhibit 3-15. Minimum Radius Using Limiting Values of *e* and *f*

Source: AASHTO Green Book (2004), page 147

METRIC						US Customary					
Design Speed (km/h)	Maximum e (%)	Maximum f	Total (e/100 + f)	Calculated Radius (m)	Rounded Radius (m)	Design Speed (mph)	Maximum e (%)	Maximum f	Total (e/100 + f)	Calculated Radius (ft)	Rounded Radius (ft)
15	4.0	0.40	0.44	4.0	4	10	4.0	0.38	0.42	15.9	16
20	4.0	0.35	0.39	8.1	8	15	4.0	0.32	0.36	41.7	42
30	4.0	0.28	0.32	22.1	22	20	4.0	0.27	0.31	86.0	86
40	4.0	0.23	0.27	46.7	47	25	4.0	0.23	0.27	154.3	154
50	4.0	0.19	0.23	85.6	86	30	4.0	0.20	0.24	250.0	250
60	4.0	0.17	0.21	135.0	135	35	4.0	0.18	0.22	371.2	371
70	4.0	0.15	0.19	203.1	203	40	4.0	0.16	0.20	533.3	533
80	4.0	0.14	0.18	280.0	280	45	4.0	0.15	0.19	710.5	711
90	4.0	0.13	0.17	375.2	375	50	4.0	0.14	0.18	925.9	926
100	4.0	0.12	0.16	492.1	492	55	4.0	0.13	0.17	1186.3	1190
						60	4.0	0.12	0.16	1500.0	1500
15	6.0	0.40	0.46	3.9	4	10	6.0	0.38	0.44	15.2	15
20	6.0	0.35	0.41	7.7	8	15	6.0	0.32	0.38	39.5	39
30	6.0	0.28	0.34	20.8	21	20	6.0	0.27	0.33	80.8	81
40	6.0	0.23	0.29	43.4	43	25	6.0	0.23	0.29	143.7	144
50	6.0	0.19	0.25	78.7	79	30	6.0	0.20	0.26	230.8	231
60	6.0	0.17	0.23	123.2	123	35	6.0	0.18	0.24	340.3	340
70	6.0	0.15	0.21	183.7	184	40	6.0	0.16	0.22	484.8	485
80	6.0	0.14	0.20	252.0	252	45	6.0	0.15	0.21	642.9	643
90	6.0	0.13	0.19	335.7	336	50	6.0	0.14	0.20	833.3	833
100	6.0	0.12	0.18	437.4	437	55	6.0	0.13	0.19	1061.4	1060
110	6.0	0.11	0.17	560.4	560	60	6.0	0.12	0.18	1333.3	1330
120	6.0	0.09	0.15	755.9	756	65	6.0	0.11	0.17	1656.9	1660
130	6.0	0.08	0.14	950.5	951	70	6.0	0.10	0.16	2041.7	2040
						75	6.0	0.09	0.15	2500.0	2500
						80	6.0	0.08	0.14	3047.6	3050
15	8.0	0.40	0.48	3.7	4	10	8.0	0.38	0.46	14.5	14
20	8.0	0.35	0.43	7.3	7	15	8.0	0.32	0.40	37.5	38
30	8.0	0.28	0.36	19.7	20	20	8.0	0.27	0.35	76.2	76
40	8.0	0.23	0.31	40.6	41	25	8.0	0.23	0.31	134.4	134
50	8.0	0.19	0.27	72.9	73	30	8.0	0.20	0.28	214.3	214
60	8.0	0.17	0.25	113.4	113	35	8.0	0.18	0.26	314.1	314
70	8.0	0.15	0.23	167.8	168	40	8.0	0.16	0.24	444.4	444
80	8.0	0.14	0.22	229.1	229	45	8.0	0.15	0.23	587.0	587
90	8.0	0.13	0.21	303.7	304	50	8.0	0.14	0.22	757.6	758
100	8.0	0.12	0.20	393.7	394	55	8.0	0.13	0.21	960.3	960
110	8.0	0.11	0.19	501.5	501	60	8.0	0.12	0.20	1200.0	1200
120	8.0	0.09	0.17	667.0	667	65	8.0	0.11	0.19	1482.5	1480
130	8.0	0.08	0.16	831.7	832	70	8.0	0.10	0.18	1814.8	1810
						75	8.0	0.09	0.17	2205.9	2210
						80	8.0	0.08	0.16	2666.7	2670

8

Superelevation Tables

Minimum Radii for Superelevation rates, Design Speeds, and e_{max} = 6%

e (%)	V_d = 15 mph R (ft)	V_d = 20 mph R (ft)	V_d = 25 mph R (ft)	V_d = 30 mph R (ft)	V_d = 35 mph R (ft)	V_d = 40 mph R (ft)	V_d = 45 mph R (ft)	V_d = 50 mph R (ft)	V_d = 55 mph R (ft)	V_d = 60 mph R (ft)	V_d = 65 mph R (ft)	V_d = 70 mph R (ft)	V_d = 75 mph R (ft)	V_d = 80 mph R (ft)
NC	868	1580	2290	3130	4100	5230	6480	7870	9410	11100	12600	14100	15700	17400
RC	614	1120	1630	2240	2950	3770	4680	5700	6820	8060	9130	10300	11500	12900
2.2	543	991	1450	2000	2630	3370	4190	5100	6110	7230	8200	9240	10400	11600
2.4	482	884	1300	1790	2360	3030	3770	4600	5520	6540	7430	8380	9420	10600
2.6	430	791	1170	1610	2130	2740	3420	4170	5020	5950	6770	7660	8620	9670
2.8	384	709	1050	1460	1930	2490	3110	3800	4580	[illegible]	[illegible]	7030	7930	8910
3.0	[illegible]	[illegible]	944	1320	1760	2270	2840	3480	[illegible]	4990	[illegible]	[illegible]	7330	8260
3.2	[illegible]	[illegible]	850	1200	1600	2080	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6810	7680
3.4	[illegible]	498	761	1080	1460	1900	2390	2940	[illegible]	[illegible]	4890	[illegible]	[illegible]	7180
3.6	[illegible]	[illegible]	673	972	1320	1740	[illegible]	[illegible]	3290	[illegible]	4540	[illegible]	[illegible]	6720
3.8	176	358	[illegible]	[illegible]	[illegible]	[illegible]	2010	2490	3040	[illegible]	4230	4860	[illegible]	6320
4.0	151	309	[illegible]	[illegible]	[illegible]	[illegible]	1840	2300	2810	3390	3950	4550	5220	5950
4.2	131	270	[illegible]	[illegible]	[illegible]	[illegible]	1680	2110	2590	3140	3680	4270	4910	5620
4.4	116	238	402	615	868	1190	1540	1940	2400	2920	3440	4010	4630	5320
4.6	102	212	360	555	788	1090	1410	1780	2210	2710	3220	3770	4380	5040
4.8	91	189	324	502	718	995	1300	1640	2050	2510	3000	3550	4140	4790
5.0	82	169	292	456	654	911	1190	1510	1890	2330	2800	3330	3910	4550
5.2	73	152	264	413	595	833	1090	1390	1750	2160	2610	3120	3690	4320
5.4	65	136	237	373	540	759	995	1280	1610	1990	2420	2910	3460	4090
5.6	58	121	212	335	487	687	903	1160	1470	1830	2230	2700	3230	3840
5.8	51	106	186	296	431	611	806	1040	1320	1650	2020	2460	2970	3560
6.0	39	81	144	231	340	485	643	833	1060	1330	1660	2040	2500	3050

e_{max} = 6%

Exhibit 3-26

Superelevation Tables

Minimum Radii for Superelevation rates, Design Speeds, and e_{max} = 8%

e_{max} = 8%

	V_d = 15 mph	V_d = 20 mph	V_d = 25 mph	V_d = 30 mph	V_d = 35 mph	V_d = 40 mph	V_d = 45 mph	V_d = 50 mph	V_d = 55 mph	V_d = 60 mph	V_d = 65 mph	V_d = 70 mph	V_d = 75 mph	V_d = 80 mph
e (%)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)
NC	932	1640	2370	3240	4260	5410	6710	8150	9720	11500	12900	14500	16100	17800
RC	676	1190	1720	2370	3120	3970	4930	5990	7150	8440	9510	10700	12000	13300
2.2	605	1070	1550	2130	2800	3570	4440	5400	6450	7620	8600	9660	10800	12000
2.4	546	959	1400	1930	2540	3240	4030	4910	5870	6930	7830	8810	9850	11000
2.6	496	872	1280	1760	2320	2960	3690	4490	5370	6350	7180	8090	9050	10100
2.8	453	796	1170	1610	2130	2720	3390	4130	4950	5850	6630	7470	8370	9340
3.0	415	730	1070	1480	1960	2510	3130	3820	4580	5420	6140	6930	7780	8700
3.2	382	672	985	1370	1820	2330	2900	3550	4250	5040	[illegible]	6460	[illegible]	8130
3.4	352	620	911	1270	1690	2170	2700	3300	3970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	324	572	845	1180	1570	2020	2520	3090	3710	[illegible]	5010	[illegible]	[illegible]	[illegible]
[illegible]	300	530	784	1100	1470	1890	[illegible]	[illegible]	3480	4140	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	277	490	729	1030	1370	1770	[illegible]	[illegible]	3270	[illegible]	[illegible]	5050	5710	[illegible]
4.2	255	453	678	955	1280	1660	2080	2560	3080	[illegible]	4200	4780	5410	[illegible]
[illegible]	235	418	630	893	1200	1560	[illegible]	[illegible]	2910	[illegible]	[illegible]	4540	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1850	2280	2750	3290	[illegible]	4310	[illegible]	5530
4.8	[illegible]	[illegible]	[illegible]	[illegible]	1060	[illegible]	1750	2160	2610	3120	3590	4100	4670	5280
5.0	[illegible]	[illegible]	[illegible]	727	991	[illegible]	1650	2040	2470	2960	3410	3910	4460	5050
5.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1560	1930	2350	2820	3250	3740	4260	4840
5.4	139	258	420	627	870	1160	1480	1830	2230	2680	3110	3570	4090	4640
5.6	126	236	387	582	813	1090	1390	1740	2120	2550	2970	3420	3920	4460
5.8	115	216	358	542	761	1030	1320	1650	2010	2430	2840	3280	3760	4290
6.0	105	199	332	506	713	965	1250	1560	1920	2320	2710	3150	3620	4140
6.2	97	184	308	472	669	909	1180	1480	1820	2210	2600	3020	3480	3990
6.4	89	170	287	442	628	857	1110	1400	1730	2110	2490	2910	3360	3850
6.6	82	157	267	413	590	808	1050	1330	1650	2010	2380	2790	3240	3720
6.8	76	146	248	386	553	761	990	1260	1560	1910	2280	2690	3120	3600
7.0	70	135	231	360	518	716	933	1190	1480	1820	2180	2580	3010	3480
7.2	64	125	214	336	485	672	878	1120	1400	1720	2070	2470	2900	3370
7.4	59	115	198	312	451	628	822	1060	1320	1630	1970	2350	2780	3250
7.6	54	105	182	287	417	583	765	980	1230	1530	1850	2230	2650	3120
7.8	48	94	164	261	380	533	701	901	1140	1410	1720	2090	2500	2970
8.0	38	76	134	214	314	444	587	758	960	1200	1480	1810	2210	2670

Exhibit 3-27

Minimum Radii for Design Superelevation Rates

	V_d = 15 mph		V_d = 20 mph		V_d = 25 mph		V_d = 30 mph		V_d = 35 mph		V_d = 40 mph		V_d = 45 mph		V_d = 50 mph		V_d = 55 mph		V_d = 60 mph		V_d = 65 mph		V_d = 70 mph		V_d = 75 mph		V_d = 80 mph	
	Number of Lanes Rotated. Note that 1 lane rotated is typical for a 2-lane highway, 2 lanes rotated is typical for a 4-lane highway, etc. (See Table 3-16.)																											
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
e (%)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)
1.5	23	35	24	37	26	39	27	41	29	44	31	47	33	50	36	54	38	58	40	60	42	63	45	68	47	71	52	77
2.0	31	46	32	49	34	51	36	55	39	58	41	62	44	67	48	72	51	77	53	80	56	84	60	90	63	95	69	103
2.2	34	51	36	54	38	57	40	60	43	64	46	68	49	73	53	79	56	84	59	88	61	92	66	99	69	104	75	113
2.4	37	55	39	58	41	62	44	65	46	70	50	74	53	80	58	86	61	92	64	96	67	100	72	108	76	114	82	123
2.6	40	60	42	63	45	67	47	71	50	75	54	81	58	87	62	94	66	100	69	104	73	109	78	117	82	123	89	134
2.8	43	65	45	68	48	72	51	76	54	81	58	87	62	93	67	101	71	107	75	112	78	117	84	126	88	133	96	144
3.0	46	69	49	73	51	77	55	82	58	87	62	93	67	100	72	108	77	115	80	120	84	126	90	135	95	142	103	154
3.2	49	74	52	78	55	82	58	87	62	93	66	99	71	107	77	115	82	123	85	128	89	134	96	144	101	152	110	165
3.4	52	78	55	83	58	87	62	93	66	99	70	106	76	113	82	122	87	130	91	136	95	142	102	153	107	161	117	175
3.6	55	83	58	88	62	93	65	98	70	105	74	112	80	120	86	130	92	138	96	144	100	151	108	162	114	171	123	185
3.8	58	88	62	92	65	98	69	104	74	110	79	118	84	127	91	137	97	146	101	152	106	159	114	171	120	180	130	195
4.0	62	92	65	97	69	103	73	109	77	116	83	124	89	133	96	144	102	153	107	160	112	167	120	180	126	189	137	206
4.2	65	97	68	102	72	108	76	115	81	122	87	130	93	140	101	151	107	161	112	168	117	176	126	189	133	199	144	216
4.4	68	102	71	107	75	113	80	120	85	128	91	137	98	147	106	158	112	169	117	176	123	184	132	198	139	208	151	226
4.6	71	106	75	112	79	118	84	125	89	134	95	143	102	153	110	166	117	176	123	184	128	193	138	207	145	218	158	237
4.8	74	111	78	117	82	123	87	131	93	139	99	149	107	160	115	173	123	184	128	192	134	201	144	216	152	227	165	247
5.0	77	115	81	122	86	129	91	136	97	145	103	155	111	167	120	180	128	191	133	200	140	209	150	225	158	237	171	257
5.2	80	120	84	126	89	134	95	142	101	151	108	161	116	173	125	187	133	199	139	208	145	218	156	234	164	246	178	267
5.4	83	125	88	131	93	139	98	147	105	157	112	168	120	180	130	194	138	207	144	216	151	226	162	243	171	256	185	278
5.6	86	129	91	136	96	144	102	153	108	163	116	174	124	187	134	202	143	214	149	224	156	234	168	252	177	265	192	288
5.8	89	134	94	141	99	149	105	158	112	168	120	180	129	193	139	209	148	222	155	232	162	243	174	261	183	275	199	298
6.0	92	138	97	146	103	154	109	164	116	174	124	186	133	200	144	216	153	230	160	240	167	251	180	270	189	284	206	309
6.2	95	143	101	151	106	159	113	169	120	180	128	192	138	207	149	223	158	237	165	248	173	260	186	279	196	294	213	319
6.4	98	148	104	156	110	165	116	175	124	186	132	199	142	213	154	230	163	245	171	256	179	268	192	288	202	303	219	329
6.6	102	152	107	161	113	170	120	180	128	192	137	205	147	220	158	238	169	253	176	264	184	276	198	297	208	313	226	339
6.8	105	157	110	165	117	175	124	185	132	197	141	211	151	227	163	245	174	260	181	272	190	285	204	306	215	322	233	350
7.0	108	162	114	170	120	180	127	191	135	203	145	217	156	233	168	252	179	268	187	280	195	293	210	315	221	332	240	360
7.2	111	166	117	175	123	185	131	196	139	209	149	223	160	240	173	259	184	276	192	288	201	301	216	324	227	341	247	370
7.4	114	171	120	180	127	190	135	202	143	215	153	230	164	247	178	266	189	283	197	296	207	310	222	333	234	351	254	381
7.6	117	175	123	185	130	195	138	207	147	221	157	236	169	253	182	274	194	291	203	304	212	318	228	342	240	360	261	391
7.8	120	180	126	190	134	201	142	213	151	226	161	242	173	260	187	281	199	299	208	312	218	327	234	351	246	369	267	401
8.0	123	185	130	195	137	206	145	218	155	232	166	248	178	267	192	288	204	306	213	320	223	335	240	360	253	379	274	411
8.2	126	189	133	199	141	211	149	224	159	238	170	254	182	273	197	295	209	314	219	328	229	343	246	369	259	388	281	422
8.4	129	194	136	204	144	216	153	229	163	244	174	261	187	280	202	302	214	322	224	336	234	352	252	378	265	398	288	432
8.6	132	198	139	209	147	221	156	235	166	250	178	267	191	287	206	310	220	329	229	344	240	360	258	387	272	407	295	442
8.8	135	203	143	214	151	226	160	240	170	255	182	273	196	293	211	317	225	337	235	352	246	368	264	396	278	417	302	453
9.0	138	208	146	219	154	231	164	245	174	261	186	279	200	300	216	324	230	345	240	360	251	377	270	405	284	426	309	463
9.2	142	212	149	224	158	237	167	251	178	267	190	286	204	307	221	331	235	352	245	368	257	385	276	414	291	436	315	473
9.4	145	217	152	229	161	242	171	256	182	273	194	292	209	313	226	338	240	360	251	376	262	393	282	423	297	445	322	483
9.6	148	222	156	234	165	247	175	262	186	279	199	298	213	320	230	346	245	368	256	384	268	402	288	432	303	455	329	494
9.8	151	226	159	238	168	252	178	267	190	285	203	304	218	327	235	353	250	375	261	392	273	410	294	441	309	464	336	504
10.0	154	231	162	243	171	257	182	273	194	290	207	310	222	333	240	360	255	383	267	400	279	419	300	450	316	474	343	514
10.2	157	235	165	248	175	262	185	278	197	296	211	317	227	340	245	367	260	391	272	408	285	427	306	459	322	483	350	525
10.4	160	240	169	253	178	267	189	284	201	302	215	323	231	347	250	374	266	398	277	416	290	435	312	468	328	493	357	535
10.6	163	245	172	258	182	273	193	289	205	308	219	329	236	353	254	382	271	406	283	424	296	444	318	477	335	502	363	545
10.8	166	249	175	263	185	278	196	295	209	314	223	335	240	360	259	389	276	414	288	432	301	452	324	486	341	512	370	555
11.0	169	254	178	268	189	283	200	300	213	319	228	341	244	367	264	396	281	421	293	440	307	460	330	495	347	521	377	566
11.2	172	258	182	272	192	288	204	305	217	325	232	348	249	373	269	403	286	429	299	448	313	469	336	504	354	531	384	576
11.4	175	263	185	277	195	293	207	311	221	331	236	354	253	380	274	410	291	437	304	456	318	477	342	513	360	540	391	586
11.6	178	268	188	282	199	298	211	316	225	337	240	360	258	387	278	418	296	444	309	464	324	486	348	522	366	549	398	597
11.8	182	272	191	287	202	303	215	322	228	343	244	366	262	393	283	425	301	452	315	472	329	494	354	531	373	559	405	607
12.0	185	277	195	292	206	309	218	327	232	348	248	372	267	400	288	432	306	460	320	480	335	502	360	540	379	568	411	617

Exhibit 3-29

Superelevation Transition

Prevent abrupt edge-of-pavement profiles

Minimum Runoff Lengths

1. Two- and Four-Lane Highways with 12 ft. lanes … See Exhibit 3-32.
2. Three-Lanes Highway: 1.2 times length for two-lane pavements
3. Six-Lane Undivided: 2.0 times length for two-lane pavements

Example 1

Given:

e_{max} = 6%

Design Speed, V_d = 25 mph

Two 12-foot lanes; R = 200 ft

Find:

1. Required Rate of Superelevation (e_{req})
2. Length of Superelevation Runoff (L_r)
3. Length of Tangent Runout (L_t)
4. Length of Superelevation Transition (T)

Example 1 Solution

Minimum Radii for Superelevation rates, Design Speeds, and e_{max} = 6%

V_d = 25 mph
Radius = 200 ft
R=212' > 200' >186'
Use e_{req} for R = 186'

e_{req} = **5.8%**

	V_d = 15 mph	V_d = 20 mph	V_d = 25 mph	V_d = 30 mph	V_d = 35 mph	V_d = 40 mph	V_d = 45 mph	V_d = 50 mph	V_d = 55 mph	V_d = 60 mph
e (%)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)
NC	868	1580	2290	3130	4100	5230	6480	7870	9410	11100
RC	614	1120	1630	2240	2950	3770	4680	5700	6820	8060
2.2	543	991	1450	2000	2630	3370	4190	5100	6110	7230
2.4	482	884	1300	1790	2360	3030	3770	4600	5520	6540
2.6	430	791	1170	1610	2130	2740	3420	4170	5020	5950
2.8	384	709	1050	1460	1930	2490	3110	3800	4580	5440
3.0	341	635	944	1320	1760	2270	2840	3480	4200	4990
3.2	300	566	850	1200	1600	2080	2600	3200	3860	4600
3.4	256	498	761	1080	1460	1900	2390	2940	3560	4250
3.6	209	422	673	972	1320	1740	2190	2710	3290	3940
3.8	176	358	583	864	1190	1590	2010	2490	3040	3650
4.0	151	309	511	766	1070	1440	1840	2300	2810	3390
4.2	131	270	452	684	960	1310	1680	2110	2590	3140
4.4	116	238	402	615	868	1190	1540	1940	2400	2920
4.6	102	212	360	555	788	1090	1410	1780	2210	2710
4.8	91	189	324	502	718	995	1300	1640	2050	2510
5.0	82	169	292	456	654	911	1190	1510	1890	2330
5.2	73	152	264	413	595	833	1090	1390	1750	2160
5.4	65	136	237	373	540	759	995	1280	1610	1990
5.6	58	121	212	335	487	687	903	1160	1470	1830
5.8	51	106	186	296	431	611	806	1040	1320	1650
6.0	39	81	144	231	340	485	643	833	1060	1330

Exhibit 3-26

Example 1 Solution

Find Length of Superelevation Runoff (L_r)

For V_d = 25 mph, 1 lane rotated, and e_{req} = 5.8%

e = 5.8%

	V_d = 15 mph		V_d = 20 mph		V_d = 25 mph		V_d = 30 mph		V_d = 35 mph	
	Number of Lanes Rotated. Note that 1 lane									
	1	2	1	2	1	2	1	2	1	2
e (%)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)	L_r (ft)
1.5	23	35	24	37	26	39	27	41	29	44
2.0	31	46	32	49	34	51	36	55	39	58
2.2	34	51	36	54	38	57	40	60	43	64
2.4	37	55	39	58	41	62	44	65	46	70
2.6	40	60	42	63	45	67	47	71	50	75
2.8	43	65	45	68	48	72	51	76	54	81
3.0	46	69	49	73	51	77	55	82	58	87
3.2	49	74	52	78	55	82	58	87	62	93
3.4	52	78	55	83	58	87	62	93	66	99
3.6	55	83	58	88	62	93	65	98	70	105
3.8	58	88	62	92	65	98	69	104	74	110
4.0	62	92	65	97	69	103	73	109	77	116
4.2	65	97	68	102	72	108	76	115	81	122
4.4	68	102	71	107	75	113	80	120	85	128
4.6	71	106	75	112	79	118	84	125	89	134
4.8	74	111	78	117	82	123	87	131	93	139
5.0	77	115	81	122	86	129	91	136	97	145
5.2	80	120	84	126	89	134	95	142	101	151
5.4	83	125	88	131	93	139	98	147	105	157
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	144	102	153	108	163
5.8	89	134	94	141	99	149	105	158	112	168
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	154	109	164	116	174
6.2	95	143	101	151	106	159	113	169	120	180
6.4	98	148	104	156	110	165	116	175	124	186
6.6	102	152	107	161	113	[illegible]	120	180	128	192
6.8	105	157	110	165	117	[illegible]	124	185	132	197
7.0	108	162	114	170	120	180	127	191	135	203

Exhibit 3-32.

L_r=99 ft

Example 1 Solution

Having determined the Superelvation Runoff, L_r = 99 ft, Calculate Tangent Runout, L_t

$$L_t = \frac{e_{NC}}{e_d} L_r = \frac{2.0}{5.8}(99) = 34.138 \sim 34\, ft$$

Therefore Superelevation Transition,

$T = L_r + L_t = 99 + 34 =$ <u>133 ft</u>