

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DESIGN DIRECTIVE**

**DD-624
RAMP TERMINALS**
February 1, 2006

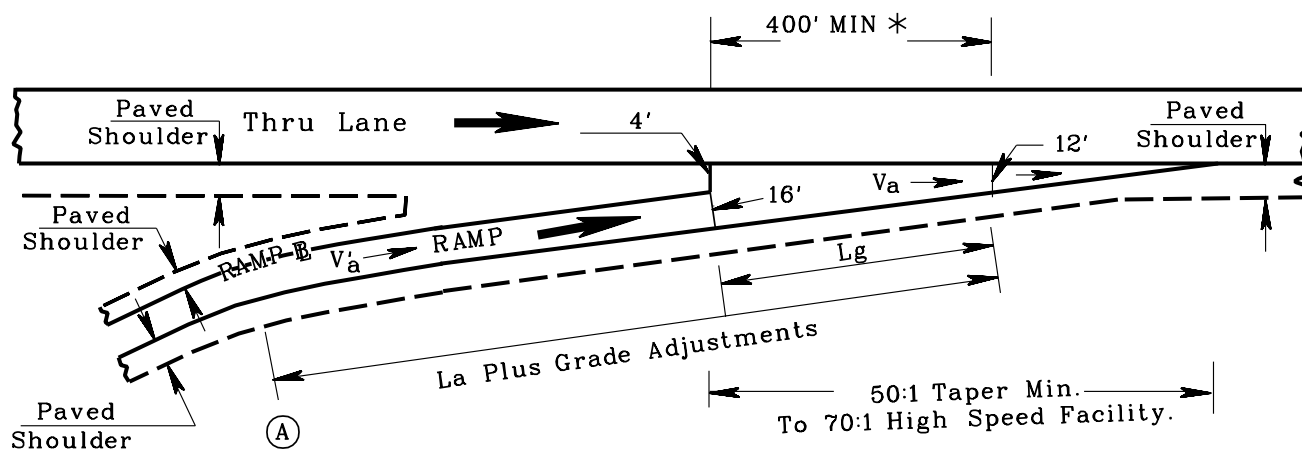
The attached drawings are for your use in the design of ramp terminals.

Additional information concerning the subject may be found in Chapter 10 of the 2004 AASHTO publication "*A Policy on Geometric Design of Highways and Streets.*"

Generally, the attached tapered designs will be used but conditions may warrant parallel design, especially entrance ramps.

Attachments

SINGLE LANE ENTRANCE RAMP TERMINAL



Legend:

1. L_a Is The Required Acceleration Length As Shown In Exhibit 10-70 Or As Adjusted By Exhibit 10-71.
2. Point (A) Controls Safe Speed On The Ramp. L_a Should Not Start Back On The Curvature Of The Ramp Unless The Radius Equals 1000' Or More.
3. L_g is Required Gap Acceptance Length. L_g Should Be A Minimum Of 400' Depending On The Taper Rate. *
4. The Value Of L_a Or L_g , Whichever Produces The Greater Distance Downstream From The Nose, Shall Be Used In The Design Of The Ramp Entrance.
5. V_a Is The Speed Reached By A Vehicle Entering The Thru Lane.
6. $V'a$ Is The Initial Speed Of An Entering Vehicle.

RAMP ACCELERATION LENGTHS

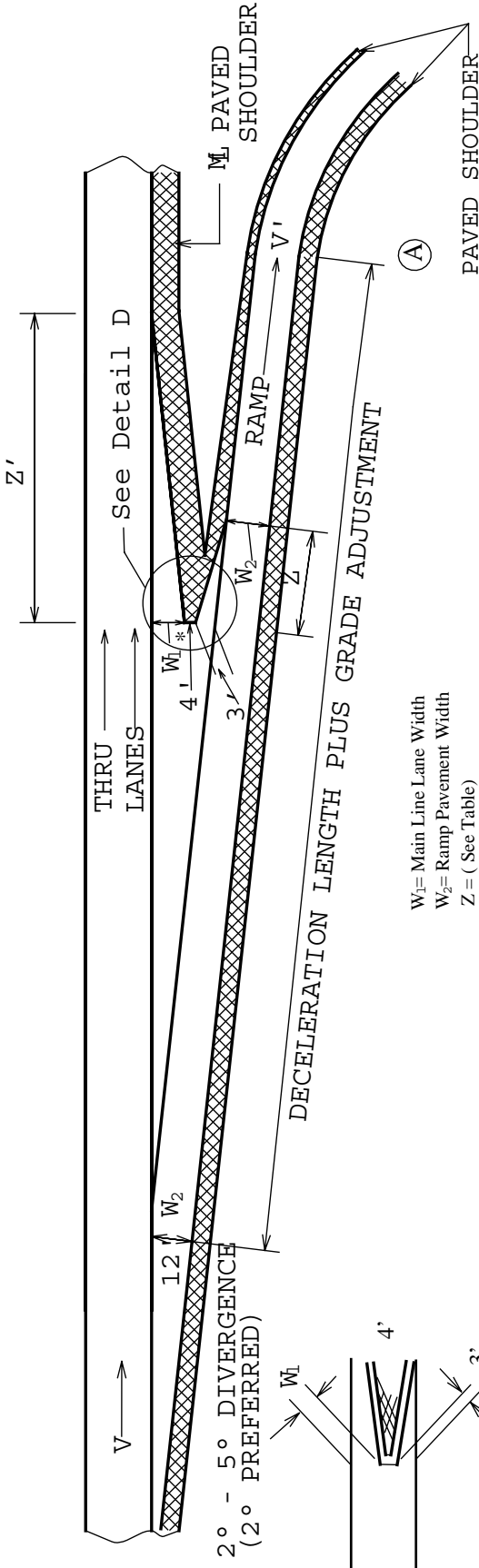
US CUSTOMARY										
Acceleration Length, L (ft.) For Entrance Curve Design Speed (mph)										
Highway	Stop Condition	15	20	25	30	35	40	45	50	
Design Speed, V (mph)	Speed Reached, V_a (mph)	And Initial Speed, $V'a$ (mph)								
		0	14	18	22	26	30	36	40	44
30	23	180	140	-	-	-	-	-	-	-
35	27	280	220	160	-	-	-	-	-	-
40	31	360	300	270	210	120	-	-	-	-
45	35	560	490	440	380	280	160	-	-	-
50	39	720	660	610	550	450	350	130	-	-
55	43	960	900	810	780	670	550	320	150	-
60	47	1200	1140	1100	1020	910	800	550	420	180
65	50	1410	1350	1310	1220	1120	1000	770	600	370
70	53	1620	1560	1520	1420	1350	1230	1000	820	580
75	55	1790	1730	1630	1580	1510	1420	1160	1040	780

NOTE: Uniform 50:1 and 70:1 Tapers Are Recommended Where Lengths Of Acceleration Lanes Exceed 1300 Feet.

Exhibit 10-70 Minimum Acceleration Length For Entrance Terminals
With Flat Grades Of 2 Percent Or Less.

DD-624

SINGLE LANE EXIT RAMP TERMINAL



W_1 = Main Line Lane Width
 W_2 = Ramp Pavement Width
 Z = (See Table)

Detail D

RAMP DECELERATION LENGTHS

Highway	Deceleration Length, L (ft.) For Design Speed Of Exit Curve, V' (MPH)														
	15	20	25	30	35	40	45	50							
Design Speed, V (mph)	28	32	36	40	44	48	52	55	60	65	70	75			
Speed Reached, V_a (mph)	0	14	18	22	26	30	36	40	44						
For Average Running Speed On Exit Curve, V' (mph)	235	280	320	385	435	480	530	570	615	660					
V = Design Speed Of Highway (mph)	170	210	265	325	385	440	500	540	570	620					
V_a = Average Running Speed Of Exit Curve (mph)	140	185	235	295	355	410	460	500	520	535					
V' = Design Speed Of Exit Curve (mph)	150	185	220	250	285	315	350	380	430	470	490	500	520	535	555
V'_a = Average Running Speed On Exit Curve (mph)	185	235	285	335	385	430	470	500	520	535	555	575	600	620	635

V = Design Speed Of Highway (mph)
 V_a = Average Running Speed Of Exit Curve (mph)
 V' = Design Speed Of Exit Curve (mph)
 V'_a = Average Running Speed On Exit Curve (mph)

Exhibit 10-73. Minimum Deceleration Lengths For Exit Terminals With Flat Grades Of 2 Percent Or Less.

Design Speed of Approach Highway (mph)	Length Of Nose Taper (Z) Per Unit Width Of Nose Offset
30	15.0
35	17.5
40	20.0
45	22.5
50	25.0
55	27.5
60	30.0
65	32.5
70	35.0
75	37.5

Exhibit 10-61. Minimum Length Of Taper Beyond An Offset Nose

Legend :

- (A) Point Controlling Safe (Normally P.C. Of Exit Ramp Curve)
- V = Design Speed Of Highway
- V' = Design Speed Of Exit Curve
- Z Is Tapered Distance Along Thru Lane
- Z Is Tapered Distance Along The Ramp
- Z & Z' Have Same Taper Rate Per Foot

GRADE ADJUSTMENTS "See Exhibit 10-71 On Previous Page"

GRADE ADJUSTMENTS

US CUSTOMARY					
Deceleration Lanes					
Design Speed Of Highway (mhp)	Ratio Of Length On Grade To Length Of Level For Design Speed		Of Turning curve (mph) ^a		
All Speeds	3 To 4% Upgrade		3 To 4% Downgrade		
		0.9			1.2
All Speeds	5 To 6% Upgrade		5 To 6% Downgrade		
		0.8			1.35
Acceleration Lanes					
Design Speed Of Highway (mhp)	Ratio Of Length On Grade To Length Of Level For Design Speed		Of Turning curve (mph) ^a		
	20	30	40	50	All Speeds
		3 To 4% Upgrade		3 To 4% Downgrade	
40	1.3	1.3	-	-	0.7
45	1.3	1.35	-	-	0.675
50	1.3	1.4	1.4	-	0.65
55	1.35	1.45	1.45	-	0.625
60	1.4	1.5	1.5	1.6	0.6
65	1.45	1.55	1.6	1.7	0.6
70	1.5	1.6	1.7	1.8	0.6
		5 To 6% Upgrade		5 To 6% Downgrade	
40	1.5	1.5	-	-	0.6
45	1.5	1.6	-	-	0.575
50	1.5	1.7	1.9	-	0.55
55	1.6	1.8	2.05	-	0.525
60	1.7	1.9	2.2	2.5	0.5
65	1.85	2.05	2.4	2.75	0.5
70	2.0	2.2	2.6	3.0	0.5

Ratio From This Table Multiplied By The Length In Exhibit 10-70 Or Exhibit 10-73 Gives Length Of Speed Change Lane On Grade.

Exhibit 10-71. Speed Change Lane Adjustment Factors As A Function Of Grade