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(601) SIGHT DISTANCE

601.1 GENERAL

A primary feature in design of a highway is the arrangement of the geometric elements so that there is sight distance adequate for safe and efficient operation. The three most important sight distance considerations are: distance required for stopping, distance required for operation at intersections and distance required for passing overtaken vehicles.

Stopping Sight Distance (SSD) is the distance a motorist must be able to see ahead so that he will be able to stop from a given speed, short of an obstruction.

Intersection Sight Distance (ISD) is the distance a motorist must be able to see other traffic operating on the intersected highway so that he can enter or cross the highway safely.

Passing sight distance (PSD) is the distance a motorist must be able to observe oncoming traffic on a two-lane, two-way road so that he can pass an overtaken vehicle safely. Details regarding SSD and PSD can be found in the AASHTO publications "A Policy on Design of Urban Highways and Arterial Streets" (Red Book) and "A Policy on Geometric Design of Rural Highways" (Blue Book).

601.2 STOPPING SIGHT DISTANCE (SSD)

This distance includes the drivers perception-reaction distance and the distance travelled while the brakes are applied on wet pavement. The total distance travelled varies with the initial speed. Two initial speed conditions are assumed for determining the distance needed to stop. One speed condition assumes that cars operate at reduced speeds during wet pavement conditions. The distances computed under this condition are referred to as Minimum Stopping Sight Distance (MSSD). The other speed condition assumes no speed reduction during wet pavement conditions and the distances computed under this condition are referred to as Desirable Stopping Sight Distance (DSSD).

Table 601-1 lists the various distances needed to stop a vehicle from a given design speed for both DSSD and MSSD. The designer should attempt to provide the distances listed in the DSSD column whenever possible, especially for freeway design, and use the MSSD column only under restrictive design conditions such as low budget salvage projects.

.21 SSD CREST VERTICAL CURVES Shown in Figures 601-1, 2, 3 and 4 are charts showing the required length of vertical curve depending on A (algebraic difference of grades in percent). For each of the design speeds, a line for determining the length of crest vertical curve for MSSD and DSSD for a given A are presented. When A exceeds the range of the chart, the length of vertical curve can be found by multiplying A times the K factor for the sight distance condition being provided.

The length of these curves were calculated using the AASHTO criteria of height of eye at 3.75' and height of object of 0.5'. Using this height criteria, (S) the sight distance, can be found for any length (L) and algebraic difference in grade (A) by the following two formulas.

$$S<L \quad S = \sqrt{1398\ L/A}$$
$$S>L \quad S = L/2 + 699/A$$

.211 RAMP TERMINAL ON CREST VERTICAL CURVES Where an exit ramp or diverging roadway terminal is located on a crest vertical curve, sight distance to the pavement surface is restricted by the curve. In areas such as this the sight distance to the terminal nose needs to be as long as feasible. A minimum sight distance of 1,000 feet, measured from the driver's eye height of 3.75' to the road surface, is desirable. It may be impractical to design crest vertical curves to provide the above 1,000' sight distance. However, DSSD shall be considered as the minimum allowable mainline sight distance design in the area of these terminals.

.22 LENGTH OF CREST VERTICAL CURVES The designer should always use the DSSD line of Figures 601,1, 2, 3, 4 and 5 to determine the proper length of vertical curve. Whenever this length cannot be provided, a statement must be submitted that contains an explanation of why this curve cannot be longer, and why the designer feels it is not necessary or feasible to provide the DSSD length. These statements must be furnished and accompany any profile submissions in the Preliminary Development Phase.

.23 MSSD TO PAVEMENT SURFACE Shown on the upper part of Figure 601-4 is a chart of MSSD to pavement surface for several design speeds. These charts are used to check available sight distance to pavement markings, such as stop bars at intersection, 601-4 can be used to determine the available sight distance for any L and A combination.

.24 SAG VERTICAL CURVES For sag vertical curves the primary design criteria is SSD. Further, SSD is applied for night conditions where the only illumination is provided by the vehicles headlights. The design criteria assumes headlight height of 2 feet and an upward divergence of the light beam of 1^{o}. The point where the light beam strikes the pavement is regarded as the available sight distance.

.241 MSSD AND DSSD AT SAG VERTICAL CURVES Figure 601-5 shows both MSSD AND DSSD for design speeds from 30 MPH to 80 MPH. For values of A, outside the range of the chart, the appropriate length of sag vertical curve can be found by multiplying A times the K factor for the sight distance condition being provided.

.25 COMFORT SAG VERTICAL CURVES Another design criteria for sag vertical curves is comfort. The length of a curve, determined by this criteria, relates to acceleration forces that makes driving a sag vertical curve uncomfortable if the rate of slope change is too rapid. Lengths of sag vertical curves that are comfortable to most motorists are approximately 75% of the length required for MSSD. Sag vertical curves designed to comfort criteria should only be used in areas where highway lighting is present, as the headlights of the vehicle will not provide the illumination needed for SSD on these sag vertical curves. Extreme caution should be exercised by the designer in using sag vertical curves based on comfort criteria because a motorist's sight distance decreases during inclement weather conditions and highway lighting may fail due to lightning, wind, rain, sleet, etc.

.26 HORIZONTAL CURVES The sight distance on horizontal curves may be obstructed by objects on the inside of a curve, such as bridge piers, buildings, median barriers, cut slopes, etc. Figure 601-6 shows the relation of sight distance, horizontal curve, and obstruction offset. In using this figure, the designer enters the figure using the desired design speed (note speed on left of figure are for DSSD, and on right for MSSD) and the degree of curve or radius. Where these two lines intersect, the distance to the obstruction may be read from the curved lines.

.261 CUT SLOPE OBSTRUCTIONS This type of obstruction requires special attention in that vegetation on the cut slope will be the obstruction. For design, it is recommended that a 2 ft. height of vegetation be used for all cut slopes.

601.3 INTERSECTION SIGHT DISTANCE (ISD)

When a motorist attempts to enter or cross a highway, he must be able to observe the traffic at a distance that will allow him to make his desired movement safely. The distance required varies with the speed of the traffic on the highway about to be entered or crossed. Table 601-1 lists the distances required for the various design speeds.

.31 ISD CREST VERTICAL CURVES Also shown on Figure 601-1, 2, 3 and 4 are lines for ISD curve length. The length of these curves was computed using the height of eye as 3.75' and height of object (vehicle) as 4.5'. If a road or drive intersection occurs on or near a crest vertical curve, the length of curve should be at least as long as indicated by the ISD line. Using the above height criteria, S can be found by using the following two formulas.

$$S<L \text{ than } S = \sqrt{3295\ L/A}$$
$$S>L \text{ than } S = L/2 + 1647.5/A$$

In some areas, the sight distance will be limited due to projections above the pavement surface, such as raised medians, curb and sidewalks. An illustration of this type of obstruction is shown in Figure 601-7, diagram B, where the left sight distance is limited by a safety curb on a structure. To provide for these raised projections in the line of sight, the indicated vertical curve length should be increased 30%. For example, L (chart) x 1.3 = L (curbed).

.32 HORIZONTAL ISD The horizontal controls for ISD are applied as shown in Figure 601-7. The driver of the waiting vehicle is assumed to be 15 ft. off of the through road edge of pavement. The moving vehicle on the through road is assumed to be 6 ft. from the edge of pavement. The design speed of the through road is used to select the appropriate ISD length shown in Table 601-1 and also in Table A of Figure 601-7.

.321 TANGENT THROUGH ROAD When the through road is on tangent, the distance the waiting vehicle at the intersection must be from an obstruction for various distances from the pavement, and for various design speeds, is provided by Table A. For instance, if the parapet of a structure is located 10 ft. off the edge of pavement and the design speed is 60 miles per hour, the intersection must be located so that the waiting vehicle is 185 ft. from the end of the structure.

.322 CURVED THROUGH ROAD Where the through road is on curving horizontal alignment at an intersection or near the intersection, a graphic solution is required. In this case, the ISD distance from Table A of Figure 601-7 is used directly.

.33 GUARD RAIL When the intersection is located on a crest vertical curve of the through road, the guard rail must be offset 15 ft. as shown in Diagram C of Figure 601-7. To return the guard rail to its normal location, the appropriate flare ratio for the design speed can be found in Table A.

.34 SPECIAL CONSIDERATIONS When, because of right-of-way or other valid considerations, the cost of design could be substantially reduced, the values for intersection sight distance shown in Table A may be reduced up to 15%. Each situation, however, should be individually justified.

601.4 PASSING SIGHT DISTANCE (PSD)

Table 601-1 lists the distance required for passing an overtaken vehicle at various design speeds. These distances are applicable to two-lane roads only. It is important to provide passing sight distance for much longer lengths than these distances whenever feasible, as one oncoming car can eliminate the opportunity to pass for a very long distance.

.41 PSD CREST VERTICAL CURVE The line designated PSD on Figure 601-1, 2, 3 and 4 is the line used to provide passing sight distance on two-lane, two-way highways. The height of eye is 3.75 feet and height of object is 4.5 feet. S can be found by using the following two formulas.

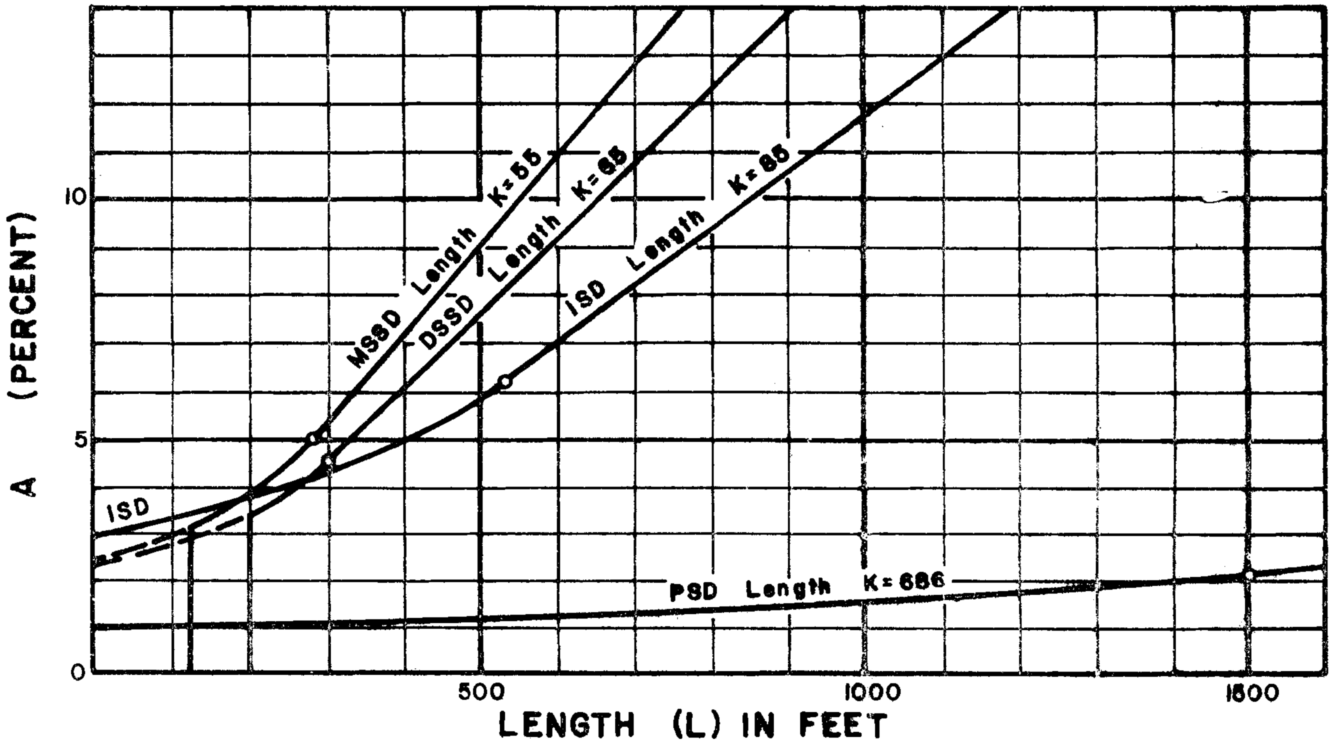
$$S<L \text{ than } S = \sqrt{3295\ L/A}$$
$$S>L \text{ than } S = L/2 + 1647.5/A$$

Table 601-1

Design Speed	Stopping Sight Distance		Passing Sight Distance	Intersection Sight Distance
	Desirable (DSSD)	Minimum (MSSD)		
80	1050	750	2700	-
70	850	600	2500	900
60	650	475	2100	775
50	450	350	1800	650
45	375	315	1700	575
40	300	275	1500	525
30	200	200	1100	375

brl

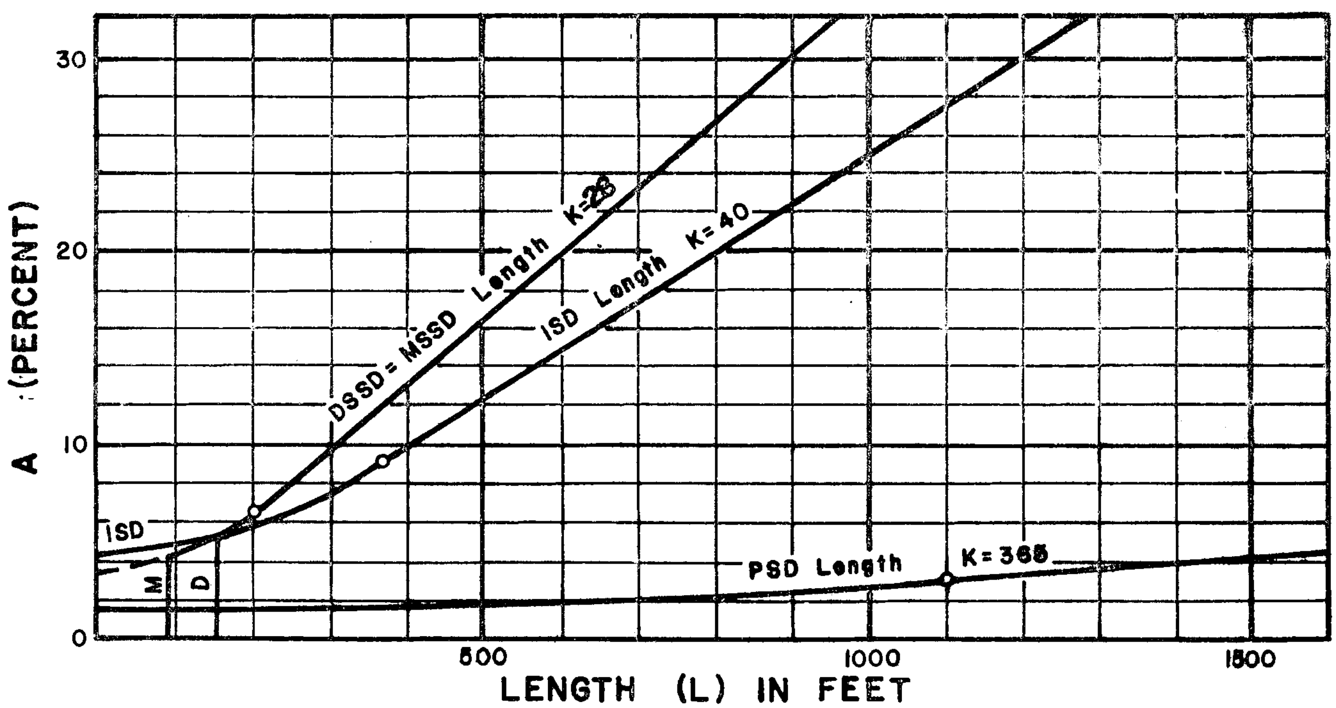
CREST VERTICAL CURVES



40 MPH

	MSSD	DSSD	ISD	PSD
Height of Object	6"	6"	4.5'	4.5'
Height of Eye	3.75'	3.75'	3.75'	3.75'

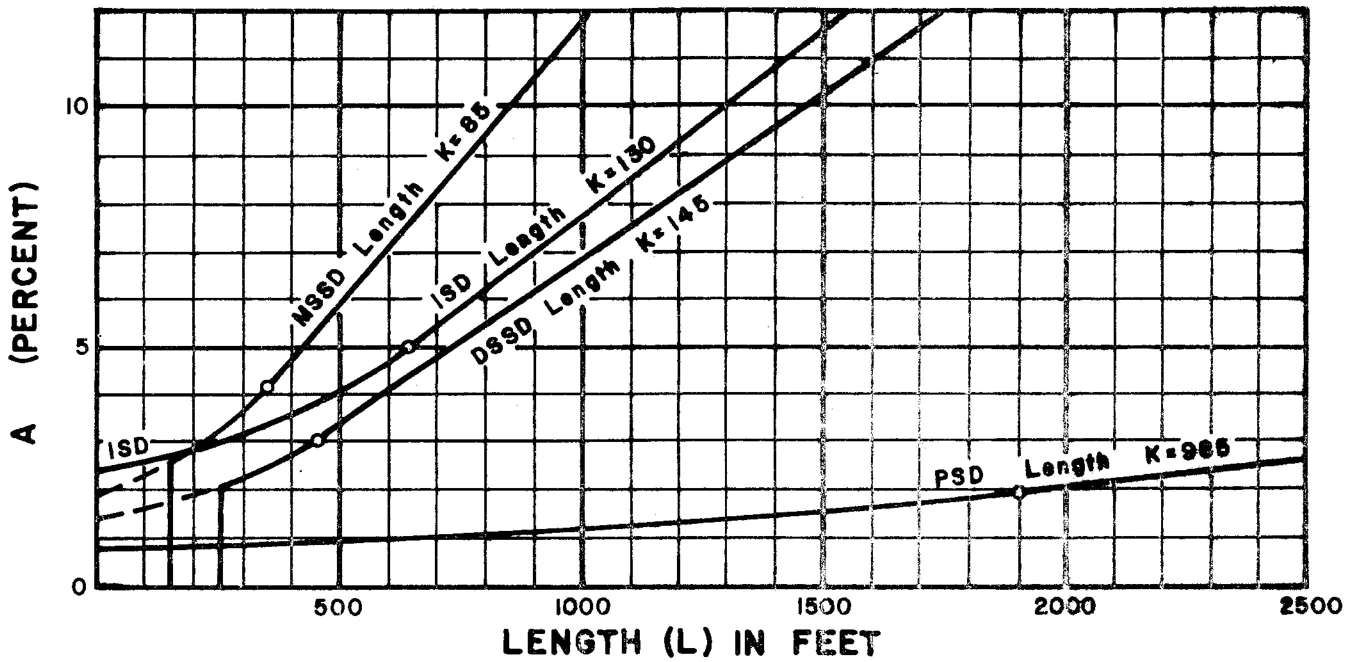
S > L S < L



30 MPH

Figure 601-1

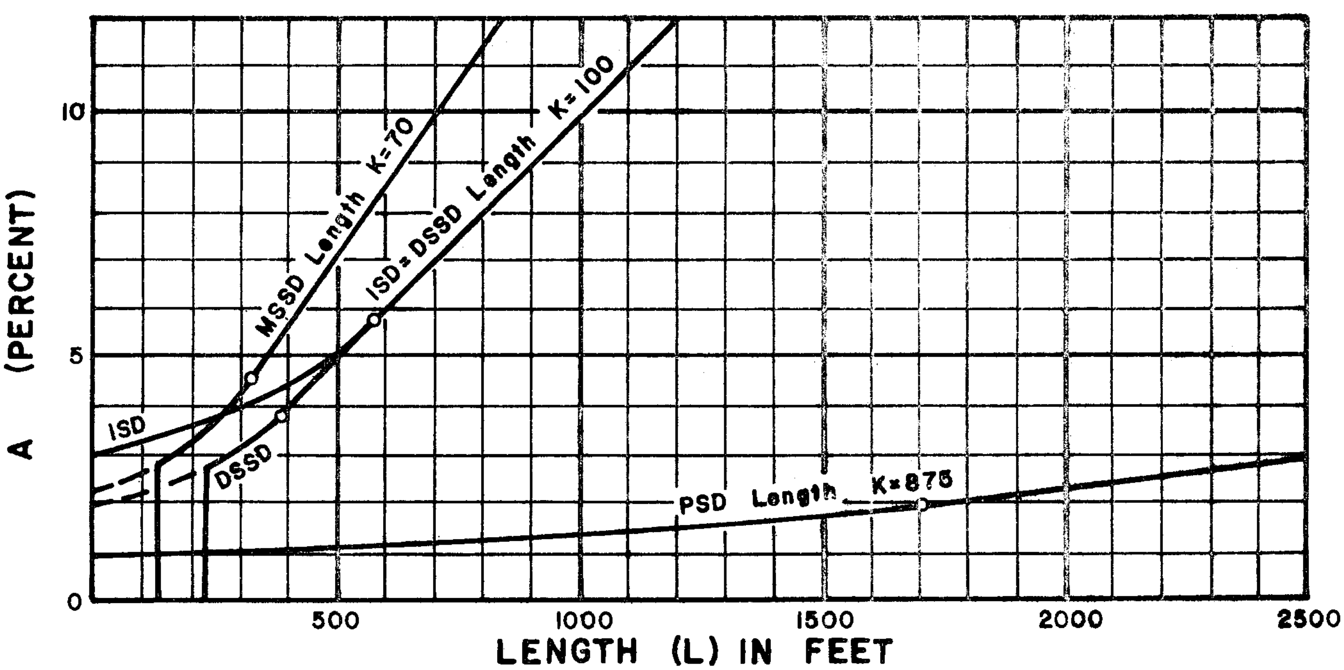
CREST VERTICAL CURVES



50 MPH

	MSSD	DSSD	ISD	PSD
Height of Object	6"	6"	4.5'	4.5'
Height of Eye	3.75'	3.75'	3.75'	3.75'

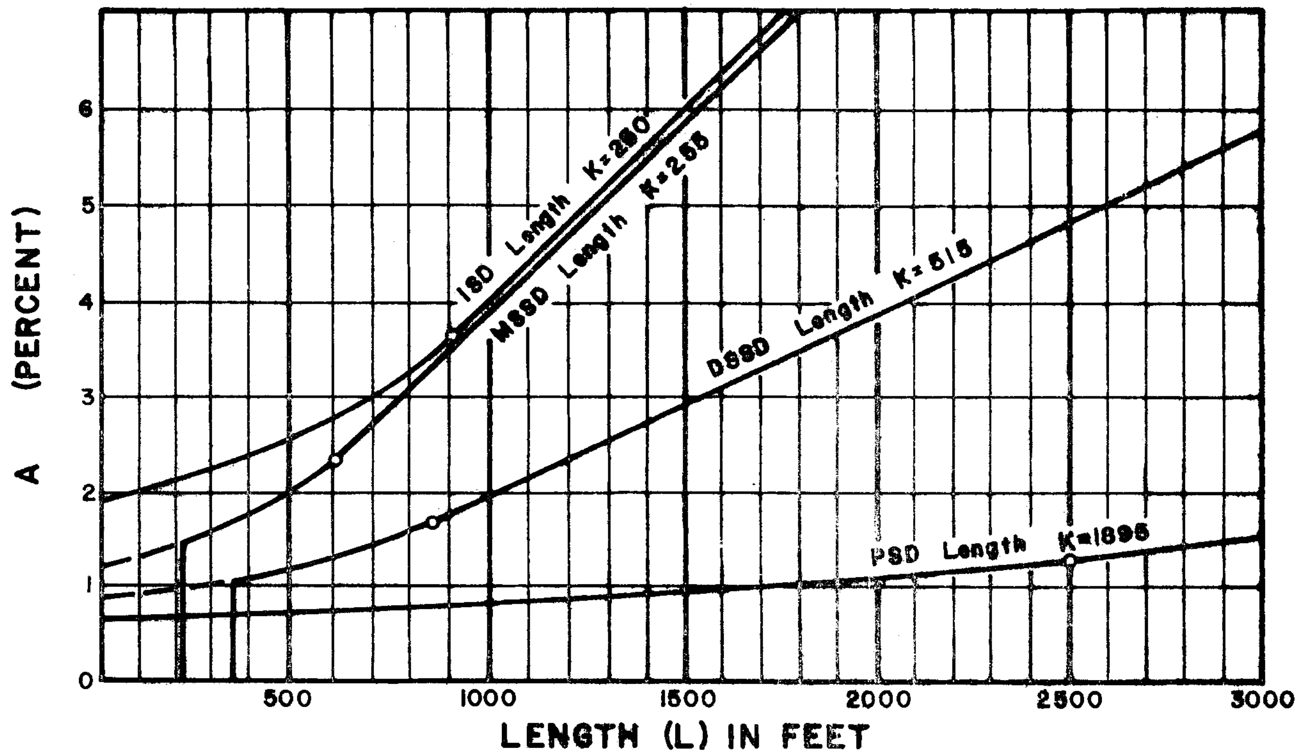
S > L S < L



45 MPH

Figure 601-2

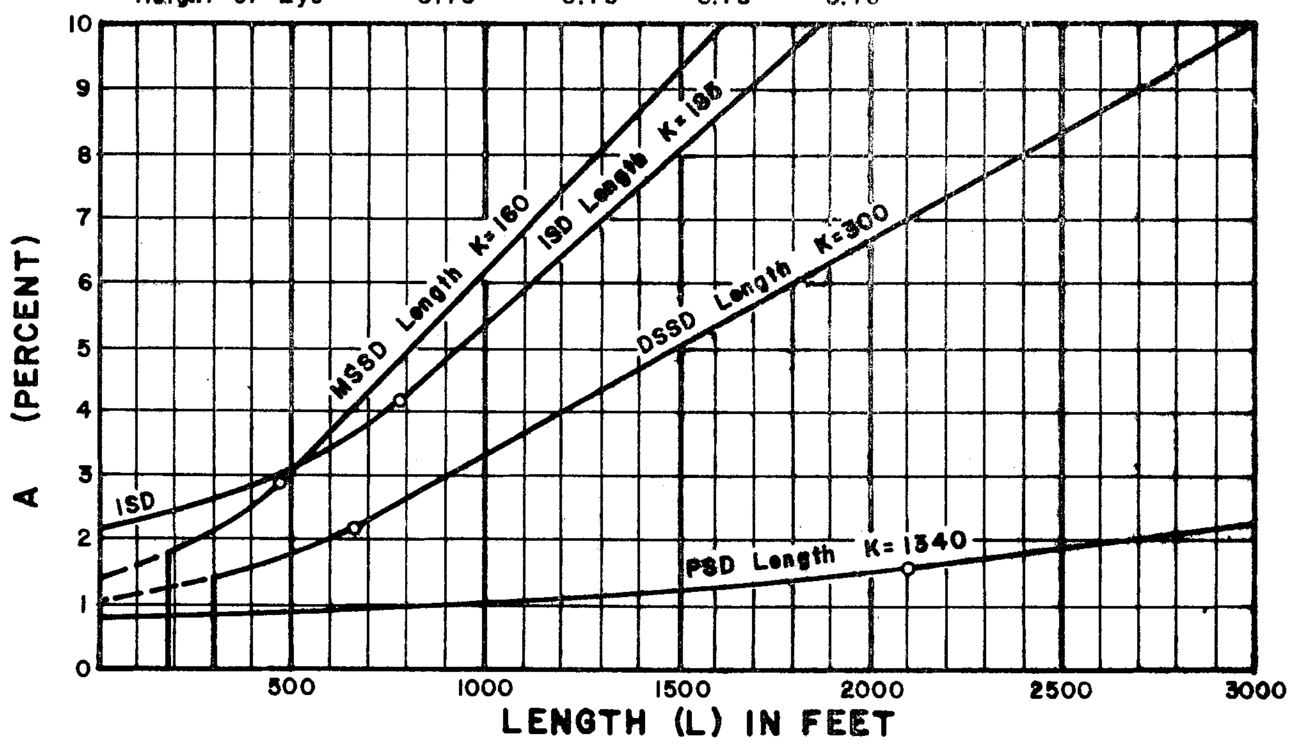
CREST VERTICAL CURVES



70 MPH

	MSSD	DSSD	ISD	PSD
Height of Object	6"	6"	4.5'	4.5'
Height of Eye	3.75'	3.75'	3.75'	3.75'

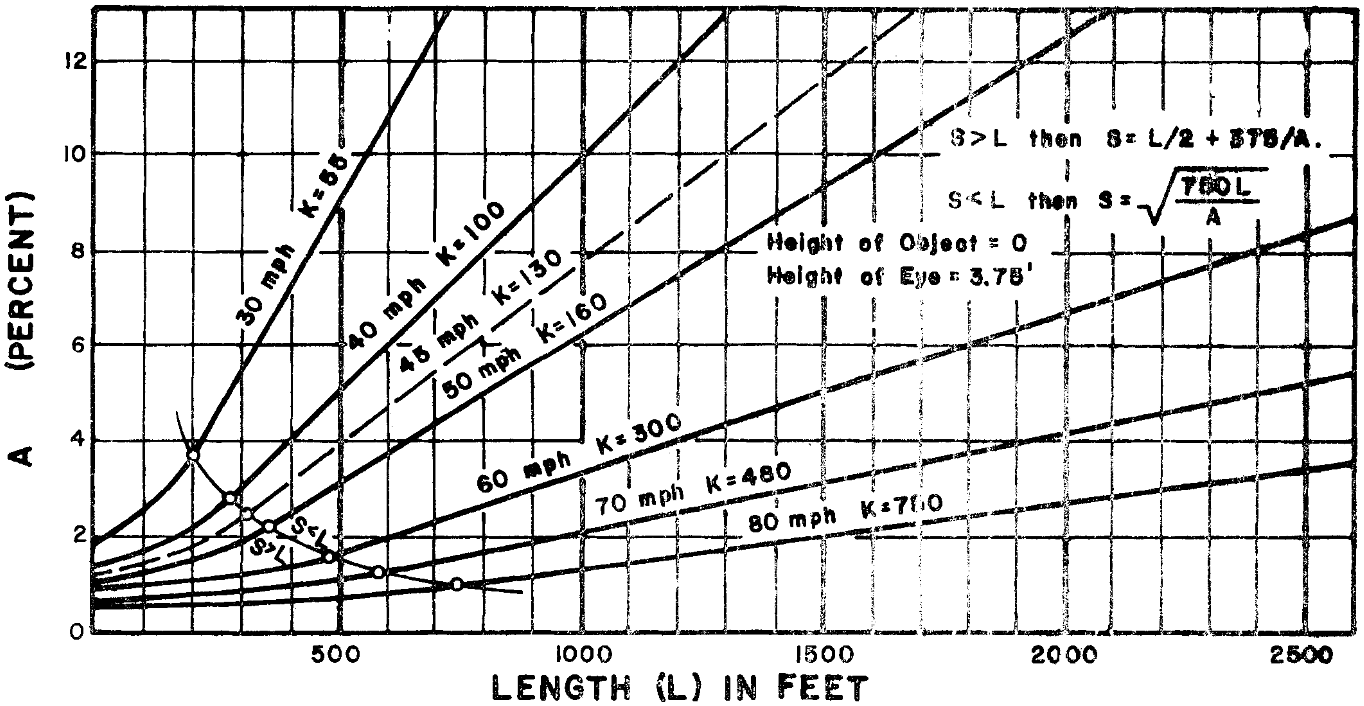
S > L S < L



60 MPH

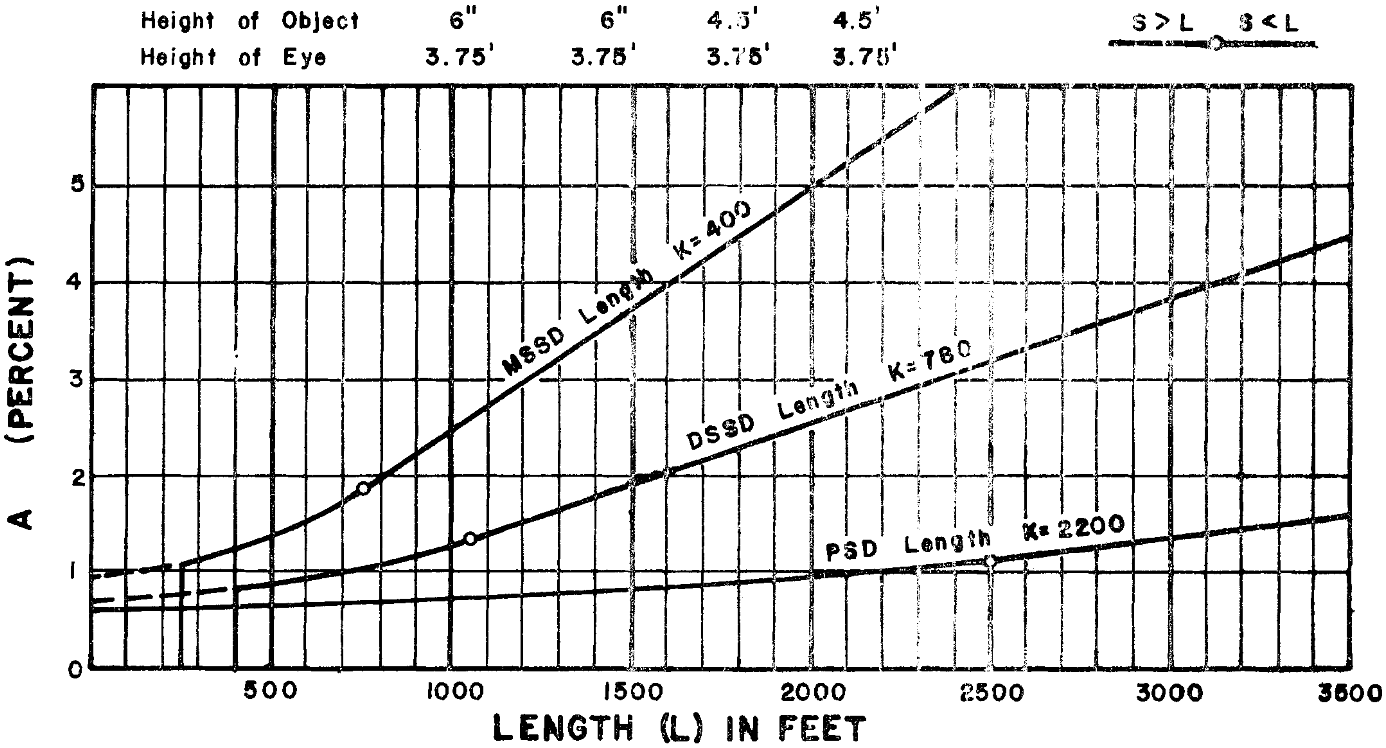
Figure 601-3

CREST VERTICAL CURVES



MSSD TO PAVEMENT SURFACE

	MSSD	DSSD	ISD	PSD
Height of Object	6"	6"	4.5'	4.5'
Height of Eye	3.75'	3.75'	3.75'	3.75'

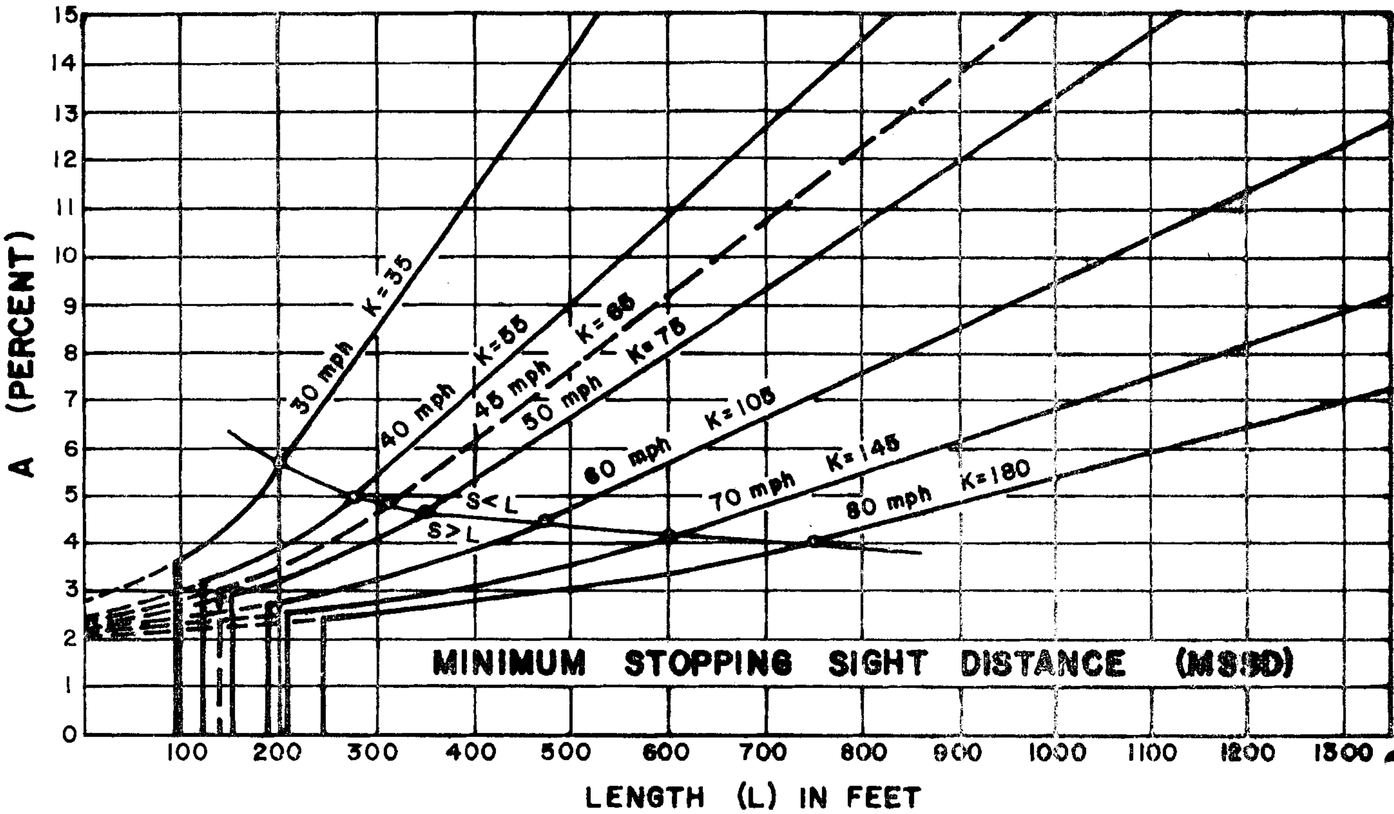


80 MPH

Figure 601-4

Fig. 601-5
Feb. 1978

SAG VERTICAL CURVES

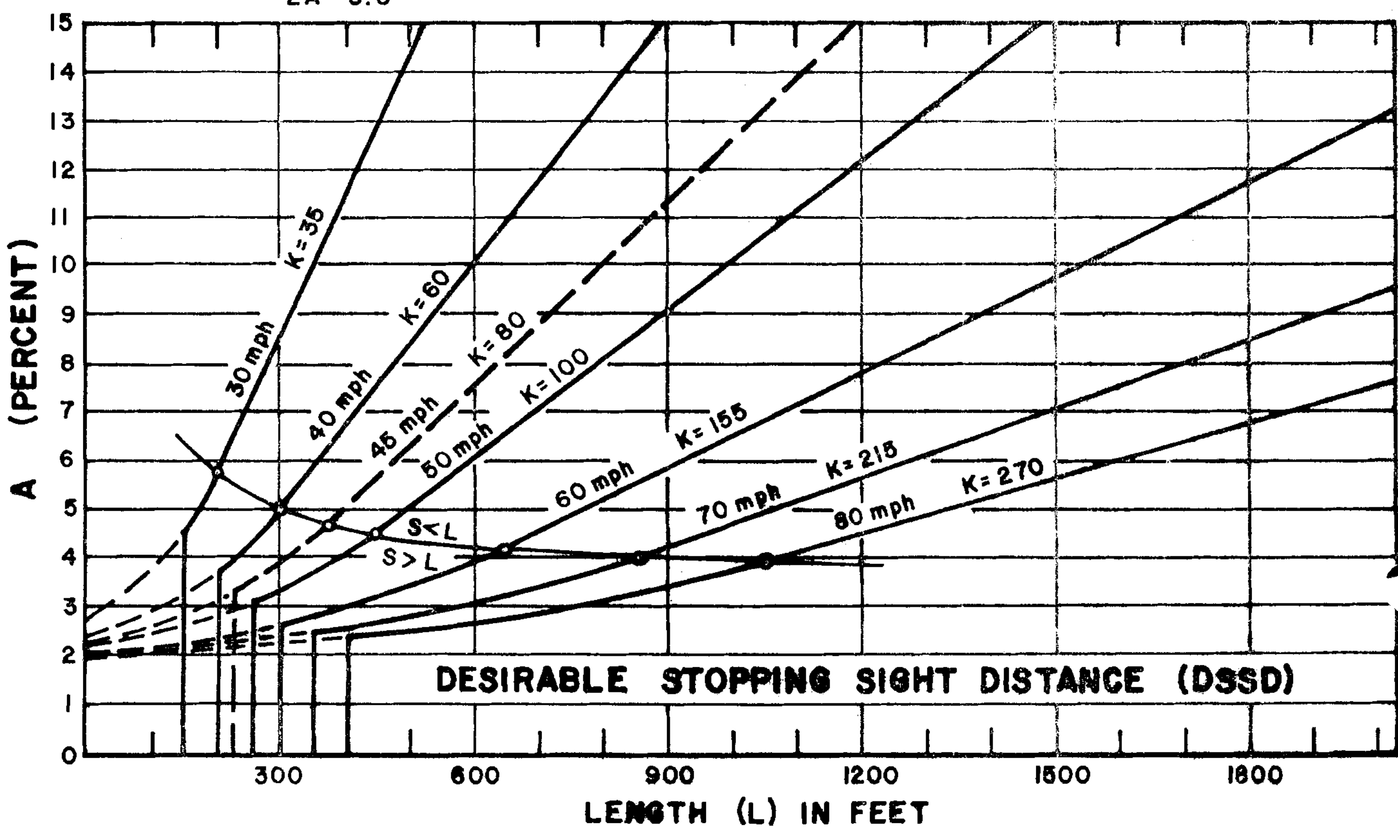


S< L, then $S = \frac{3.5L + \sqrt{12.25L^2 + 1600AL}}{2A}$

Height of object = 0"

Height of eye = 3.75'

S>L, then $S = \frac{LA + 400}{2A - 3.5}$



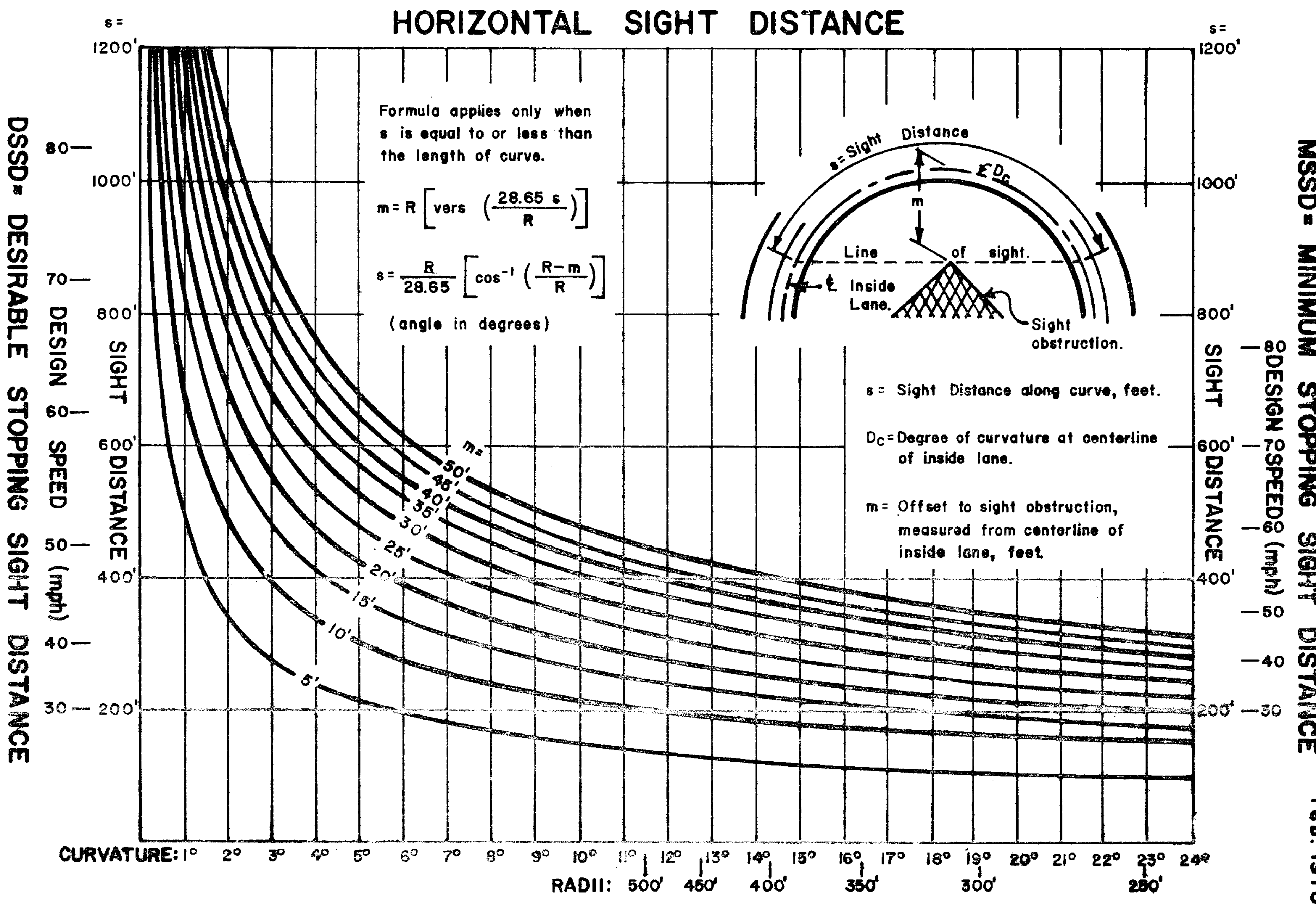


Fig. 601-6

Fig. 601-6
Feb. 1978

TYPICAL INTERSECTION SIGHT DISTANCE CONDITIONS

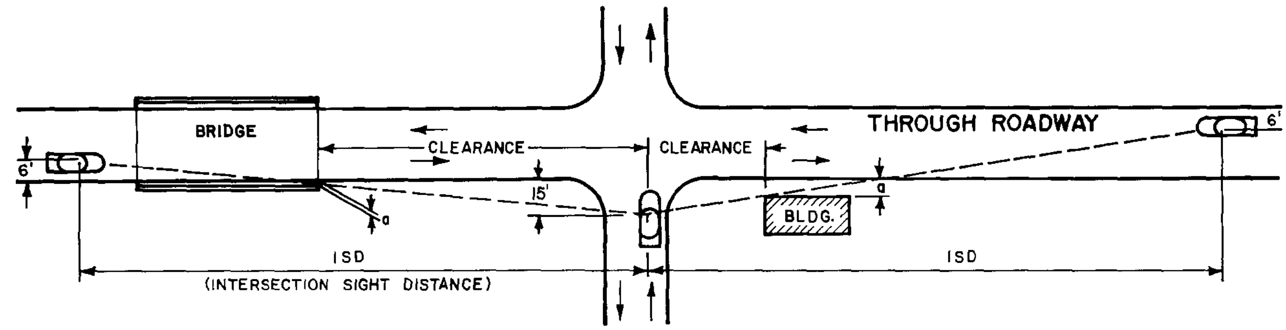


DIAGRAM A - HORIZONTAL COMPONENTS

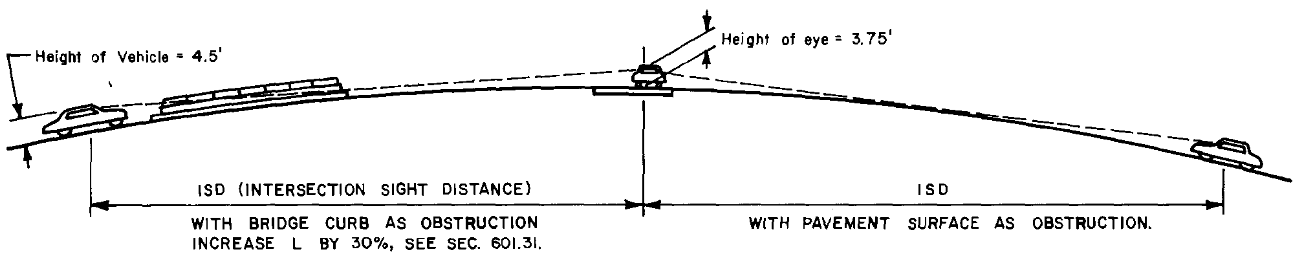


DIAGRAM B - VERTICAL COMPONENTS

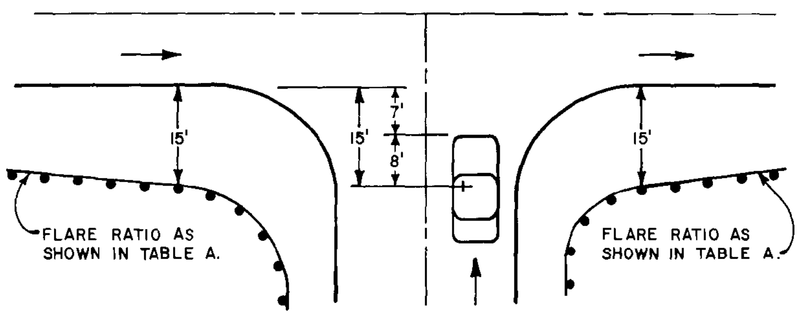


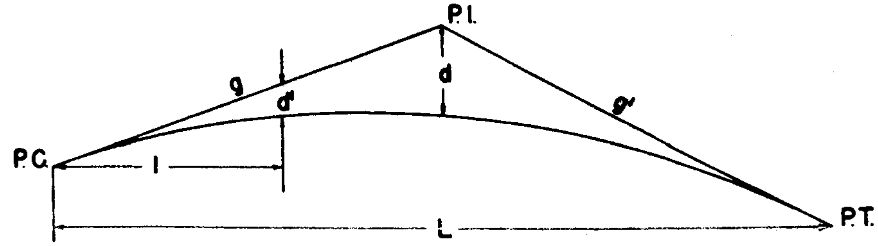
DIAGRAM C - WAITING VEHICLE

TABLE A

DESIGN SPEED	ISD	Offset a = 2'	4'	6'	8'	10'	12'	FLARE RATIO
70	900'	565'	470'	385'	300'	215'	130'	45:1
60	775'	480'	405'	330'	260'	185'	110'	40:1
50	650'	400'	340'	280'	215'	155'	90'	35:1
40	525'	325'	275'	225'	175'	125'	75'	30:1
30	375'	230'	195'	160'	125'	90'	55'	25:1

TANGENT OFFSETS FOR VERTICAL CURVES

Basic Formulae are $d = \frac{L}{8}(g-g')$
and $d' = \frac{l^2}{(\frac{L}{2})^2} \times d$



To find offset from tangent for any 25' interval from P.C. or P.T., use factor from table for l and multiply by g−g'

Example: Given L = 1200'
l = 225'
g = +2%
g' = −4%
g−g' = 6

Then factor for 225', L = 1200' is 0.2109 and offset = 0.2109 x 6 or d' = 1.265'

LENGTH OF VERTICAL CURVE IN FEET	L/8	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750
200	.2500	.0156	.0625	.1406	.2500																										
250	.3125	.0125	.0500	.1125	.2000	.3125																									
300	.3750	.0104	.0417	.0937	.1666	.2604	.3750																								
350	.4375	.0089	.0357	.0803	.1428	.2232	.3214	.4375																							
400	.5000	.0078	.0313	.0703	.1250	.1953	.2812	.3828	.5000																						
450	.5625	.0069	.0278	.0625	.1111	.1736	.2500	.3403	.4444	.5625																					
500	.6250	.0063	.0250	.0563	.1000	.1563	.2250	.3063	.4000	.5063	.6250																				
600	.7500	.0052	.0208	.0469	.0833	.1302	.1875	.2552	.3333	.4219	.5208	.6302	.7500																		
700	.8750	.0045	.0179	.0402	.0714	.1118	.1607	.2188	.2360	.3616	.4464	.5401	.6429	.7544	.8750																
800	1.000	.0039	.0156	.0352	.0625	.0976	.1406	.1914	.2500	.3164	.3906	.4725	.5625	.6602	.7656	.8789	1.000														
900	1.125	.0035	.0139	.0313	.0556	.0869	.1250	.1701	.2222	.2813	.3472	.4202	.5000	.5868	.6806	.7812	.8889	1.0035	1.1250												
1000	1.250	.0031	.0125	.0281	.0500	.0781	[illegible]	.1531	.2000	.2531	.3125	.3781	.4500	.5281	.6125	.7031	.8000	.9031	1.0125	1.1281	1.2500										
1100	1.375	.0028	.0114	.0255	.0455	.0710	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.5063	[illegible]	.7273	[illegible]	.8203	[illegible]	[illegible]	[illegible]	1.3750								
1200	1.500	.0025	.0104	.0234	.0417	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.3750	[illegible]	[illegible]	[illegible]	.6667	[illegible]	[illegible]	.9401	1.0417	1.1484	1.2604	1.3776	1.5000						
1300	1.625	.0024	.0096	.0216	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.6154	[illegible]	[illegible]	[illegible]	[illegible]	1.0601	1.1635	1.2716	1.3846	1.5024	1.6250				
1400	1.750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.6272	1.7500		
1500	1.875	.0021	.0083	.0187	.0333	[illegible]	.0750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.3000	[illegible]	.4083	[illegible]	.5333	.6021	.6750	[illegible]	.8333	.9187	1.0083	1.1021	1.2000	1.3021	1.4083	1.5187	1.6333	1.7521	1.8750

INTERMEDIATE DISTANCES FROM P.C. OR P.T. IN FEET

Figure 601-8

(602) SUPERELEVATION

602.1 GENERAL

The superelevation rates, transitions and spiral treatment for rural and urban highways are detailed herein. For superelevation rates, transition and spiral treatment of interchange ramps see Section 500.

602.2 SUPERELEVATION RATE

Pavement superelevation rates for horizontal curves are as shown in Tables 602-1, Table 602-2.

The rates in Table 602-1 apply to all rural highways and urban freeways. These rates were calculated by using the formula shown in the lower right corner of the table. Superelevation rates for speeds and curves not listed in the table may be interpolated or obtained directly from the formula.

The rates shown in Table 602-2 apply to urban streets other than freeways. These rates are also applicable for superelevating temporary roadways for maintenance of traffic.

602.3 TRANSITIONS

.31 METHOD The transition from the normal crown pavement of the tangent alignment to the superelevated pavement of the horizontal curve will be as shown on Figure 602-1. Normally the center figure, "Pavement Revolved About Inner Edge", will be used for the transition. The figure titled "Pavement Revolved About Outside Edge" is used on divided highways so that the median drainage is not affected by the curve superelevation. The figure titled "Pavement Revolved About Centerline" may be used in areas where a shorter transition length is desired, but care should be exercised in using this method as road side ditch design is often adversely affected in areas where the profile grade is relatively flat.

Shown schematically on Figure 602-2 are treatments of superelevation for two commonly occurring divided highway curve conditions. The four cross sections shown for each divided highway relate in location to the four cross sections shown on Figure 602-1.

.32 TRANSITION LENGTH In Table 602-1, lengths of transition are listed for the most often used method of transition, "Pavement Revolved About Inner (or Outer) Edge". The length of transition (See "L" Figure 602-1) shown in the table is based on two-lane pavement width and does not include crown removal. Where the pavement width is wider than two-lanes, the transition length shall be determined upon the basis of a slope between superelevated and normal edge of pavement of 1:200 for design speeds of 50 mph and over, and 1:175 for design speeds less than 50 mph.

602.4 SPIRALS

Spirals will be used on all curves having a degree of curve equal to 1°30' or over for design speeds of 50 mph and over. The length of the spiral will be equal to or greater than the pavement transition length (L), see Figure 602-1. Where spirals are not used the transition will be located so that one half of the required superelevation rate will occur at the PC or PT of the curve.

602.5 PAVEMENT WIDENING

Pavement widening will not be required on pavements 24' or more in width. Curve widening should be placed on the inside edge of the curve and should begin at the T.S. and reach maximum width at the S.C. Intermediate points shall be widened proportionally to the distance from the T.S. The longitudinal center joint shall be placed equal distance from the pavement edges.

602.6 PROFILES AND ELEVATIONS

Pavement edge profiles shall be plotted to a distorted scale within the limits of the transition as a check against calculations and location of drainage basin and adjustments made where necessary. These curves plotted to an exaggerated scale should be available on request during the review of the F. & O.C. submission. Special care shall be used in determining edge elevations in a transition area when the profile grade is on a vertical curve.

602.7 PROFILE GRADE

The combination of profile grade and superelevation rate from Table 602-1 can result in the pavement surface having a slope steep enough to cause traffic operation problems in snow or icy conditions. Therefore, on profile grades 3% or greater, the superelevation shall not exceed 0.06 ft/ft. The curvature listed below can be used with 0.06 ft/ft superelevation. The maximum curvature listed does not exceed the normal side friction factors permitted with the given design speed.

PROFILE GRADES 3% OR GREATER
0.06 ft/ft Superelevation

Design Speed	Curvature
30	10°-30' to 20°-45'
40	5°-45' to 11°-15'
50	3°-30' to 6°-45'
60	2°-30' to 4°-30'
70	1°-45' to 3°-00'
80	1°-30' to 2°-15'

RLH:brl

SUPERELEVATION, WIDENING AND TRANSITION TABLE

D_c	Radius	30 MPH				40 MPH				50 MPH				60 MPH		70 MPH		80 MPH		D_c
		S	Pavement Width 20' L	20' W	24' L	S	Pavement Width 20' L	20' W	24' L	S	Pavement Width 20' L	20' W	24' L	S	Pav't. Width 24' L	S	Pav't. Width 24' L	S	Pav't. Width 24' L	
0°-15'	22,918.31	N.C.	0	0	0	N.C.	0	0	0	N.C.	0	0	0	.016	100	.016	100	.016	100	0°-15'
0°-30'	11,459.16	N.C.	0	0	0	N.C.	0	0	0	.016	100	0	100	.016	100	.016	100	.021	100	0°-30'
0°-45'	7,639.44	N.C.	0	0	0	.016	100	0	100	.016	100	0	100	.018	100	.024	100	.032	150	0°-45'
1°-00'	5,729.58	N.C.	0	0	0	.016	100	0	100	.016	100	0	100	.024	100	.032	150	.042	200	1°-00'
1°-30'	3,819.72	.016	100	0	100	.016	100	0	100	.025	100	0	100	.036	150	.048	200	.063	300	1°-30'
2°-00'	2,864.79	.016	100	0	100	.021	100	0	100	.033	100	0	150	.047	200	.064	300	.083	400	2°-00'
2°-30'	2,291.83	.016	100	0	100	.026	100	0	100	.041	150	0	200	.059	250	.081	400	.083	400	2°-30'
3°-00'	1,909.86	.018	100	0	100	.032	100	0	150	.049	200	0	200	.071	350	.083	400			
3°-30'	1,637.02	.021	100	0	100	.037	150	0	150	.058	250	0	250	.083	400	.083	400			
4°-00'	1,432.39	.024	100	0	100	.042	150	0	150	.066	250	0	300	.083	400					
4°-30'	1,273.24	.027	100	0	100	.047	150	0	200	.074	300	0	350	.083	400					
5°-00'	1,145.92	.030	100	0	100	.053	200	0	200	.082	350	2	400	.083	400					
5°-30'	1,041.74	.033	100	0	150	.058	200	0	250	.083	350	2	400							
6°-00'	954.93	.036	100	0	150	.063	200	0	250	.083	350	4	400							
6°-30'	881.47	.038	150	0	150	.068	250	0	300	.083	350	4	400							
7°-00'	818.51	.041	150	0	150	.074	300	2	300	.083	350	4	400							
7°-30'	763.94	.044	150	0	150	.079	300	2	350	.083	350	4	400							
8°-00'	716.20	.047	150	0	150	.083	350	4	350	.083	350	4	400							
8°-30'	674.07	.050	150	0	200	.083	350	4	350											
9°-00'	636.62	.053	200	0	200	.083	350	4	350											
9°-30'	603.11	.056	200	2	250	.083	350	4	350											
10°-00'	572.96	.059	200	2	250	.083	350	4	350											
10°-30'	545.67	.062	250	4	250	.083	350	4	350											
11°-00'	520.87	.065	250	4	250	.083	350	4	350											
11°-30'	498.22	.068	300	4	300	.083	350	4	350											
12°-00'	477.46	.071	300	4	300	.083	350	4	350											
12°-30'	458.37	.074	300	4	300	.083	350	4	350											
13°-00'	440.74	.077	300	4	300	.083	350	4	350											
13°-30'	424.41	.080	350	4	350															
14°-00'	409.26	.083	350	4	350															
23°-00'	249.11	.083	350	4	350															

D = Degree of Curve

$S = \frac{.067(3/4V)^2}{R}$ = Rate of superelevation in feet per foot width

$W = N(R-\sqrt{R^2-400}) + V/\sqrt{R}$ = Widening

L = Length of transition for two lane pavement revolved about edge of pavement

V = Design Speed

R = Radius

N = Number of lanes

N.C. = Normal Crown

SUPERELEVATION TRANSITIONS

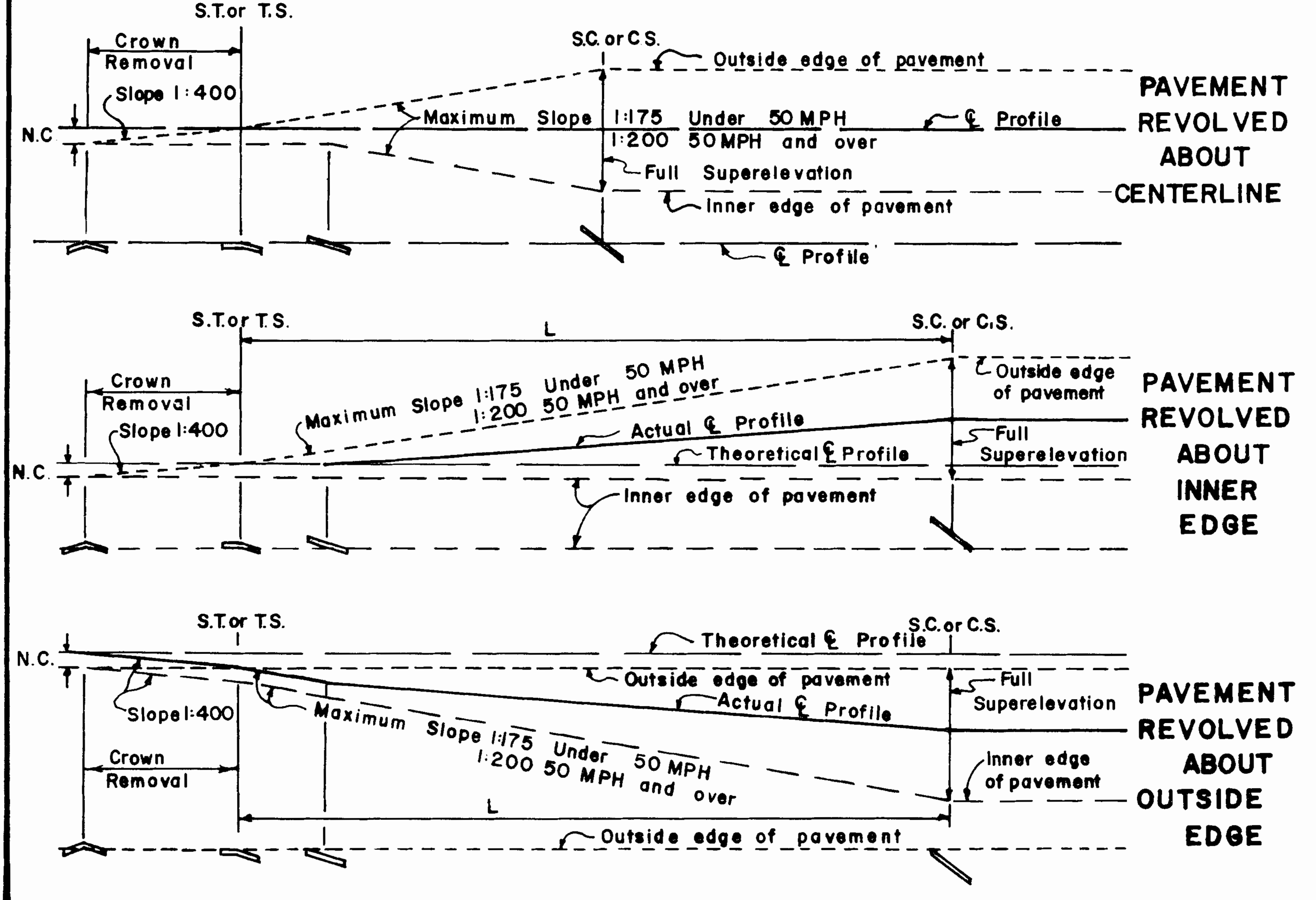
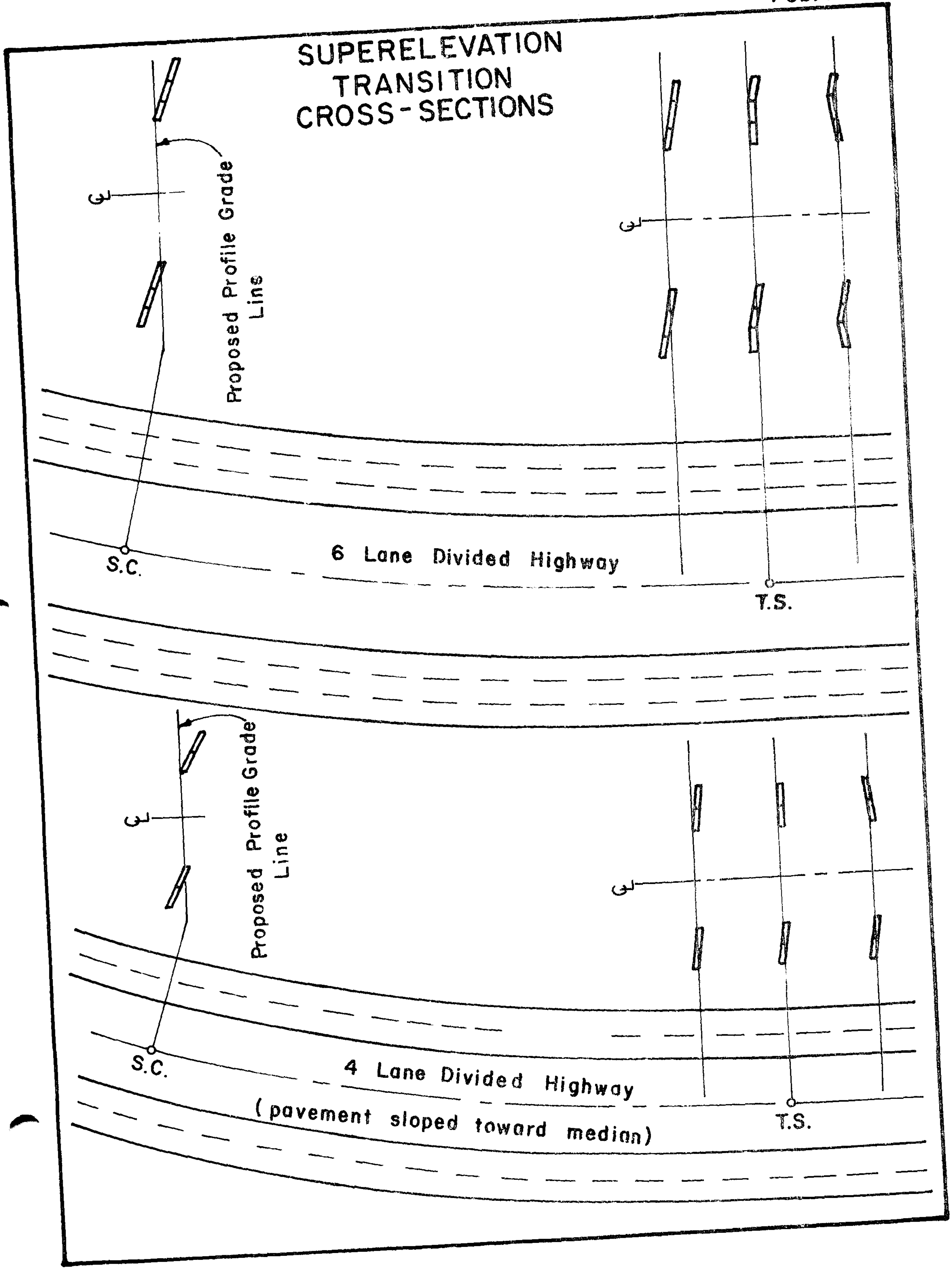


Fig. 602-2
Feb. 1978



URBAN HIGHWAYS OTHER THAN FREEWAYS AND TEMPORARY ROADWAYS USED FOR THE MAINTENANCE OF TRAFFIC

SUPERELEVATION RATES (S)

DESIGN SPEED	Less Than 5°	5°	5½°	6°	6½°	7°	7½°	8°	8½°	9°	9½°	10°	10½°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
50	NC	RC	RC	RC	.03	.04	.06																										
45	NC	NC	NC	NC	RC	RC	RC	.03	.04	.06																							
40	NC	NC	NC	NC	NC	NC	NC	RC	RC	RC	RC	.03	.04	.05	.06																		
35	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	RC	RC	RC	.03	.04	.06															
30	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	RC	RC	RC	.02	.03	.04	.05	.06									
25	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	RC	RC	RC	RC	RC	.02	.03	.04	.04	.05	.06

NC = Normal Crown
RC = Remove Crown (Continous slope across entire pavement usually 3/16 in. per ft.)

Table 602-2
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(607) U-TURN MEDIAN OPENINGS

607.1 PURPOSE

U-turn median openings shall be provided on freeways with non-barrier medians where needed for proper operation of police and emergency vehicles, and equipment engaged in physical maintenance, traffic service, and snow and ice control.

607.2 LOCATION

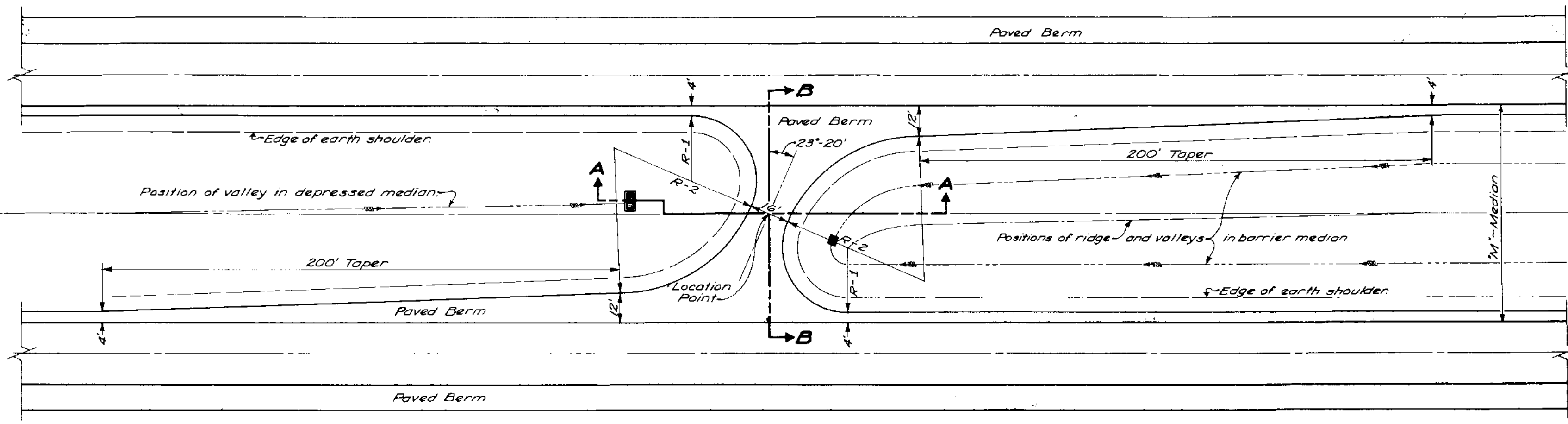
Crossings shall be located at a point approximately 1,000 feet beyond the end of each interchange speed change lane. Where the spacing of interchange crossings would be more than about 3 miles, crossings shall be provided at favorable locations such that intermediate spacings will be about equal in length but not in excess of about 3 miles. Each crossing shall be located to fit the median drainage pattern and each should be located immediately downstream from a catch basin or upon a crest. Crossings shall be located so that visibility is unrestricted by structures, vertical curves or horizontal curves. Crossings should also be located at maintenance borders, District borders and State lines.

607.3 DESIGN DETAILS

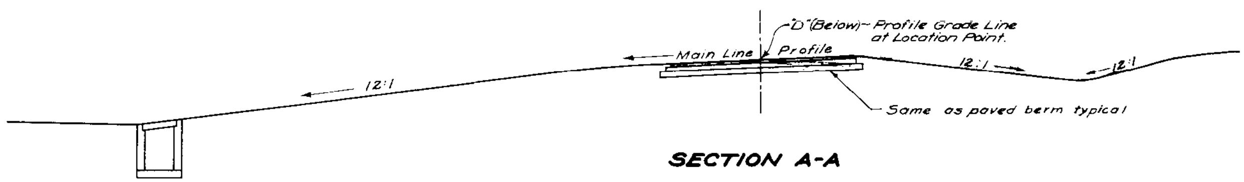
Crossings shall be constructed as shown on Figure 607-1 which indicates geometric features applicable to the design of crossings located in medians of widths ranging from 40 to 84 feet. Turning radii shall be modified proportionately for medians of varying widths. Tapers shall be 200 feet in length for all median widths. Profile grade line shall normally be an extension of the cross slope of the shoulder paving, rounded at the lowest point.

brl

STANDARD U-TURN MEDIAN OPENINGS

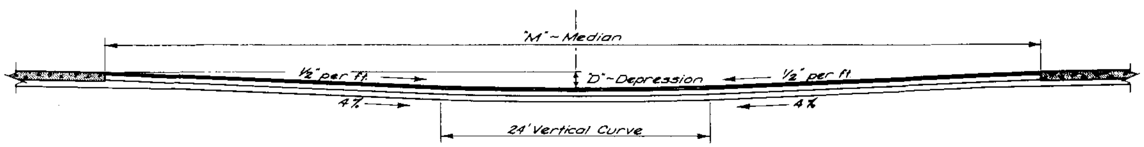


TYPICAL CROSSOVER



SECTION A-A

DIMENSIONS APPLICABLE TO VARYING MEDIAN WIDTHS			
M	D	R-1	R-2
84'	18"	25.0'	55.0'
60'	12"	16.2'	35.6'
50'	9 ½"	12.5'	27.5'
40'	7"	8.8'	19.4'



SECTION B-B

Fig. 6D7-1
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