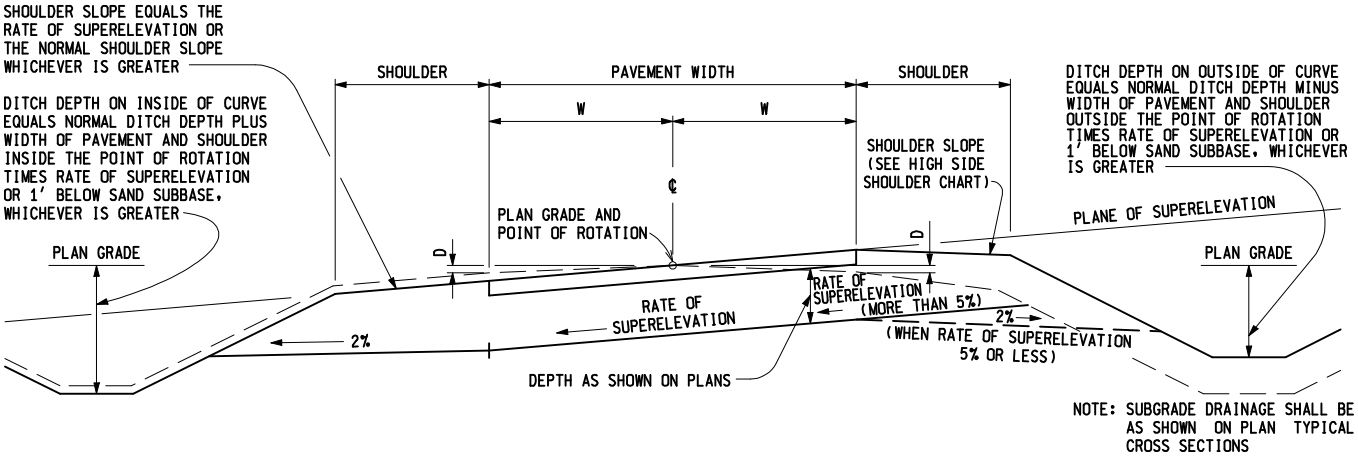
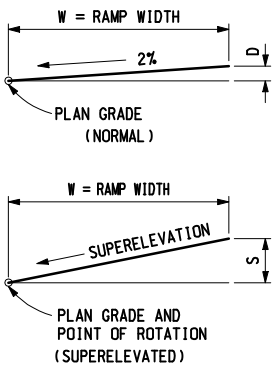


SUPERELEVATED FINISHED SECTION

(TWO-WAY SHOWN)



RAMPS

LEGEND

NC = NORMAL CROWN RATE

W = DISTANCE IN FEET FROM POINT OF ROTATION TO FARTHEST OUTSIDE EDGE

D = W × NC

e = RATE OF SUPERELEVATION

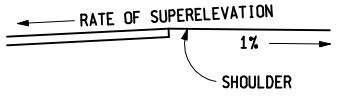
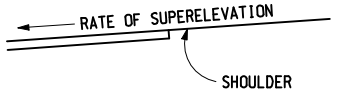
S = W × e

C = CROWN RUNOUT / TANGENT RUNOUT (ADVERSE CROWN REMOVED)

L = TRANSITION LENGTH OR SUPERELEVATION RUNOFF OF INSIDE OR OUTSIDE EDGE OF PAVEMENT

Δ% = SUPERELEVATION TRANSITION SLOPE OF PAVEMENT EDGES

HIGH SIDE SHOULDER CHART

WHEN RATE OF FULL SUPERELEVATION IS	SHOULDER SLOPE AT FULL SUPERELEVATION EQUALS
FROM 2% TO 3%	RATE OF SUPERELEVATION MINUS NORMAL SHOULDER SLOPE
3% TO AND INCLUDING 5%	
OVER 5%	

NOTES:

THE CROWN POINT AND POINT OF ROTATION WILL NORMALLY BE AT THE CENTER OF TWO-LANE AND FOUR-LANE UNDIVIDED PAVEMENTS AND AT THE EDGE OF AN INSIDE LANE OF FIVE-LANE UNDIVIDED PAVEMENTS. THE POINT OF ROTATION WILL NORMALLY BE AT THE INSIDE EDGES OF DIVIDED PAVEMENTS.

THE CROWN IS TO BE REMOVED IN SUPERELEVATION SECTIONS.

ON URBAN SERVICE ROADS AND URBAN FREE ACCESS TRUNKLINE CURVES WHERE DRIVEWAYS ARE PREVALENT, AND WHERE NORMAL SUPERELEVATION CANNOT BE OBTAINED, A MINIMUM OF 1.5% TO 2% SUPERELEVATION IN THE DIRECTION OF THE CURVE MAY BE USED TO REMOVE THE ADVERSE CROWN.

DESIGN MODIFICATION OF TRANSITIONS, POINT OF ROTATION, AND CROWNS MAY BE NECESSARY TO IMPROVE RIDING QUALITY AND APPEARANCE.

THE LOCATION, LENGTH OF SUPERELEVATION TRANSITIONS, CROWN RUNOFF LENGTHS, SUPERELEVATION RATES, AND POINT OF ROTATION WILL BE AS SPECIFIED ON THE PLANS.

SPIRAL LENGTHS WILL BE EQUAL TO OR LONGER THAN TRANSITION SLOPE LENGTHS.

SPIRAL TRANSITIONS SHOULD BE USED ON NEW ALIGNMENTS, BASED ON THE DESIGN SPEED OF THE CURVE AND THE RADIUS AS SHOWN IN THE TABLE. THE TABLE GIVES THE MAXIMUM RADIUS IN WHICH A SPIRAL SHOULD BE USED.

BEGIN THE HIGH SIDE SHOULDER TRANSITION AT THE PAVEMENT CROWN RUN OUT POINT (CROWN REMOVED). TRANSITION THE SHOULDER IN THE DISTANCE "L" TO THE SHOULDER SLOPE RATE REQUIRED AT FULL PAVEMENT SUPERELEVATION.

IF THE RATE OF FULL PAVEMENT SUPERELEVATION IS GREATER THAN THE NORMAL SHOULDER SLOPE, BEGIN THE LOW SIDE SHOULDER TRANSITION WHEN THE PAVEMENT REACHES THE SAME PLANE AND SLOPE RATE AS THE NORMAL SHOULDER.

WHEN TRANSITIONING THE SHOULDER SLOPE TO/FROM A BRIDGE SECTION, CALCULATE THE TRANSITION DISTANCE USING THE SUPERELEVATION TRANSITION SLOPE (Δ%) REQUIRED FOR THE CURVE, OR IN TANGENT SECTIONS, USE THE MINIMUM VALUE FOR SUPERELEVATION TRANSITION SLOPE (Δ%) GIVEN IN THE TABLE, IN THE COLUMN FOR THE SPEED OF THE ROADWAY. (TRANSITION DISTANCE = SHOULDER WIDTH x (RATE OF BRIDGE SHOULDER SUPERELEVATION MINUS RATE OF ROAD SHOULDER SUPERELEVATION) x 100 / Δ%)

MDOT Michigan Department of Transportation

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MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

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RATE OF SUPERELEVATION AND SUPERELEVATION TRANSITION SLOPE

RADIUS (FEET)	30 MPH		35 MPH		40 MPH		45 MPH		50 MPH		55 MPH		60 MPH		65 MPH		FREEWAYS				URBAN FREEWAYS AND URBAN RAMPS	
																	70 MPH		75 MPH		60 MPH	
	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%	e %	Δ%
23000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----
20000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----
17000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----
14000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	2.0	0.31	2.0	0.30	NC	----
12000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	2.0	0.32	2.0	0.31	2.0	0.30	NC	----
10000	NC	----	NC	----	NC	----	NC	----	NC	----	NC	----	2.0	0.36	2.0	0.32	2.1	0.31	2.3	0.31	2.0	0.34
8000	NC	----	NC	----	NC	----	NC	----	2.0	0.40	2.0	0.38	2.1	0.36	2.3	0.33	2.6	0.32	2.9	0.31	2.0	0.34
6000	NC	----	NC	----	NC	----	2.0	0.40	2.0	0.40	2.3	0.39	2.7	0.37	3.0	0.34	3.3	0.33	3.7	0.33	2.4	0.36
5000	NC	----	NC	----	2.0	0.40	2.0	0.40	2.3	0.41	2.7	0.39	3.1	0.38	3.5	0.35	3.9	0.34	4.4	0.34	2.8	0.37
4000	NC	----	2.0	0.45	2.0	0.40	2.4	0.41	2.8	0.42	3.3	0.40	3.8	0.39	4.2	0.37	4.7	0.36	5.3	0.35	3.3	0.39
3500	NC	----	2.0	0.45	2.2	0.41	2.6	0.42	3.1	0.42	3.6	0.41	4.2	0.40	4.7	0.38	5.2	0.37	5.9	0.36	3.5	0.40
3000	2.0	0.50	2.0	0.45	2.5	0.42	3.0	0.43	3.5	0.43	4.1	0.42	4.7	0.41	5.2	0.39	5.9	0.38	6.5	0.37	3.8	0.41
2500	2.0	0.50	2.4	0.46	2.9	0.43	3.5	0.44	4.1	0.44	4.7	0.43	5.3	0.42	5.9	0.41	6.5	0.39	7.0	0.38	4.2	0.42
2000	2.3	0.51	2.9	0.48	3.5	0.45	4.1	0.46	4.7	0.45	5.4	0.44	6.1	0.43	6.6	0.42	7.0	0.40	R MIN.= 2344′		4.6	0.44
1800	2.5	0.52	3.1	0.49	3.8	0.46	4.4	0.47	5.1	0.46	5.7	0.45	6.4	0.44	6.9	0.43	R MIN.= 1922′				4.8	0.44
1600	2.7	0.52	3.4	0.50	4.1	0.48	4.8	0.48	5.4	0.47	6.1	0.45	6.7	0.44	7.0	0.43					4.9	0.45
1400	3.0	0.53	3.7	0.51	4.5	0.49	5.1	0.49	5.8	0.48	6.5	0.46	6.9	0.45	R MIN.= 1565′						R MIN.= 1412′	
1200	3.4	0.54	4.1	0.52	4.9	0.50	5.6	0.50	6.3	0.49	6.8	0.47	R MIN.= 1263′									
1150	3.5	0.55	4.3	0.53	5.0	0.51	5.7	0.50	6.4	0.49	6.9	0.47										
1000	3.8	0.56	4.6	0.54	5.4	0.52	6.1	0.52	6.7	0.49	R MIN.= 1008′											
900	4.1	0.57	4.8	0.55	5.7	0.53	6.4	0.52	6.9	0.50												
820	4.3	0.57	5.1	0.55	5.9	0.54	6.6	0.53	7.0	0.50												
800	4.4	0.58	5.1	0.56	6.0	0.54	6.7	0.53	7.0	0.50												
720	4.6	0.58	5.4	0.57	6.3	0.55	6.9	0.54	R MIN.= 794′													
700	4.7	0.59	5.5	0.57	6.3	0.56	6.9	0.54														
600	5.0	0.60	5.9	0.58	6.7	0.57	R MIN.= 614′															
500	5.4	0.61	6.4	0.60	7.0	0.58																
450	5.7	0.62	6.6	0.61	R MIN.= 464′																	
400	6.0	0.63	6.8	0.61																		
350	6.3	0.64	7.0	0.62																		
300	6.7	0.65	R MIN.= 327′																			
265	6.9	0.66																				
225	7.0	0.66																				
	R MIN.= 222′																					

NOTES:

LOOP RAMPS SHALL HAVE A 7% RATE OF SUPERELEVATION.

THE RATE OF SUPERELEVATION FOR CURVES APPROACHING RAMP TERMINALS (STOPPING CONDITION) SHOULD BE LIMITED TO 5% MAX.

IF DELTA VALUES FROM THE CHART CANNOT BE OBTAINED FOR THE DESIGN RADIUS, USE THE MAXIMUM DELTA VALUE FOR THE CORRESPONDING SPEED.

FOR RADII LESS THAN THOSE TABULATED, (BUT NOT LESS THAN R MIN.), USE e_{max}. MAXIMUM SUPERELEVATION FOR URBAN FREEWAYS AND URBAN RAMPS (WITH A 60 MPH DESIGN SPEED) IS 5%, OTHERWISE e_{max} = 7% .

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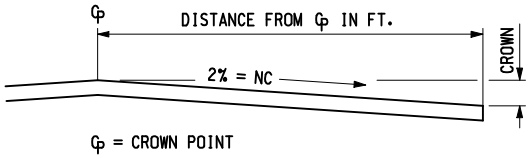
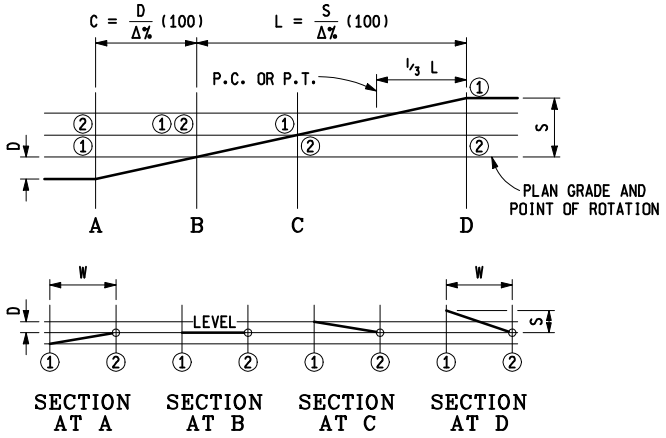
ABBREVIATIONS FOR
SPIRALED RAMPS AND ROADWAYS:

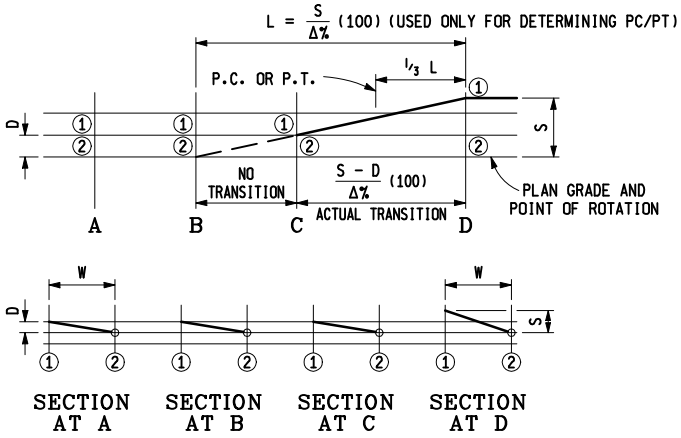
T.S. = TANGENT TO SPIRAL
S.T. = SPIRAL TO TANGENT
C.S. = CURVE TO SPIRAL
S.C. = SPIRAL TO CURVE



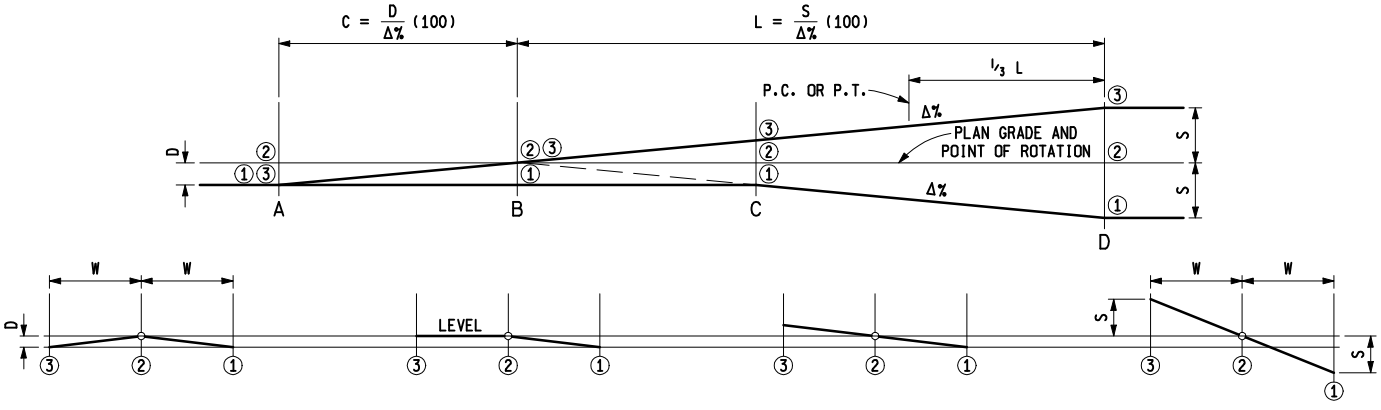
SPIRAL CURVE TRANSITIONS			
DESIGN SPEED (MPH)	MAXIMUM RADIUS (FEET)	DESIGN SPEED (MPH)	MAXIMUM RADIUS (FEET)
30	456	60	1822
35	620	65	2138
40	810	70	2479
45	1025	75	2846
50	1265	80	3238
55	1531		



UNSPIRALED RAMP (CROWN ADVERSE TO SUPER)



UNSPIRALED RAMP (CROWN SAME DIRECTION AS SUPER)



UNSPIRALED TWO-WAY ROADWAY

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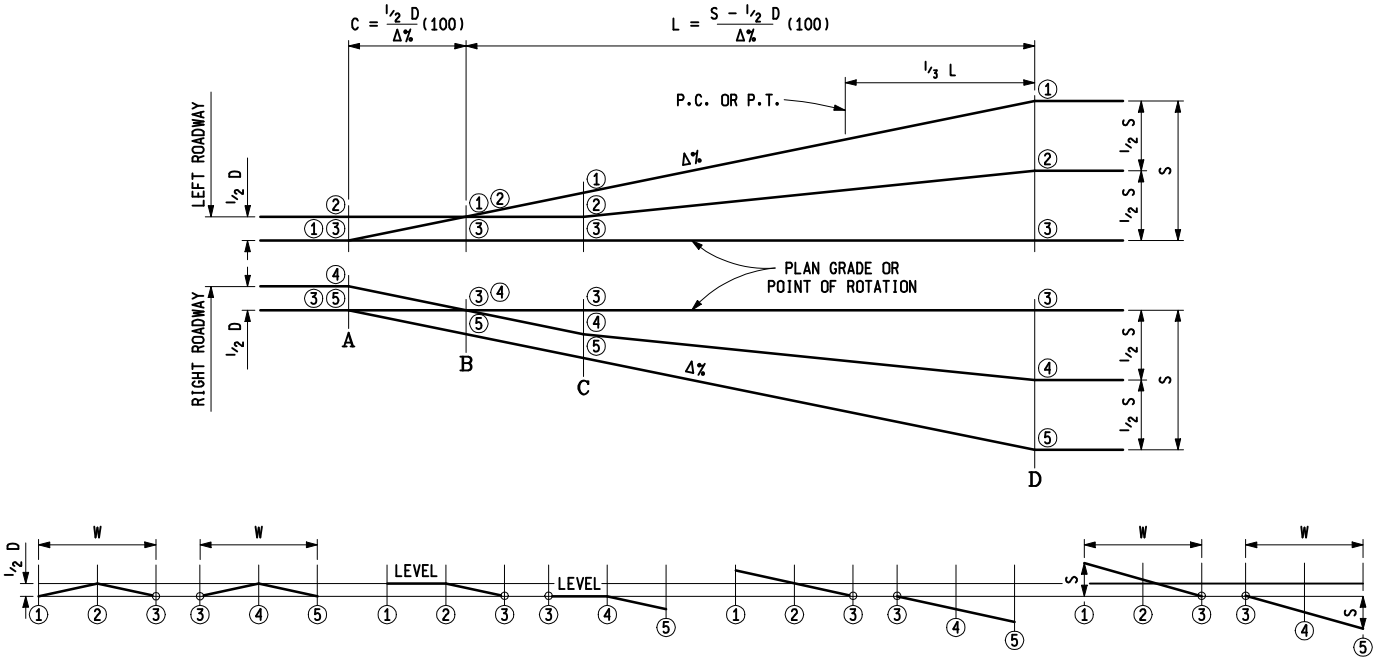
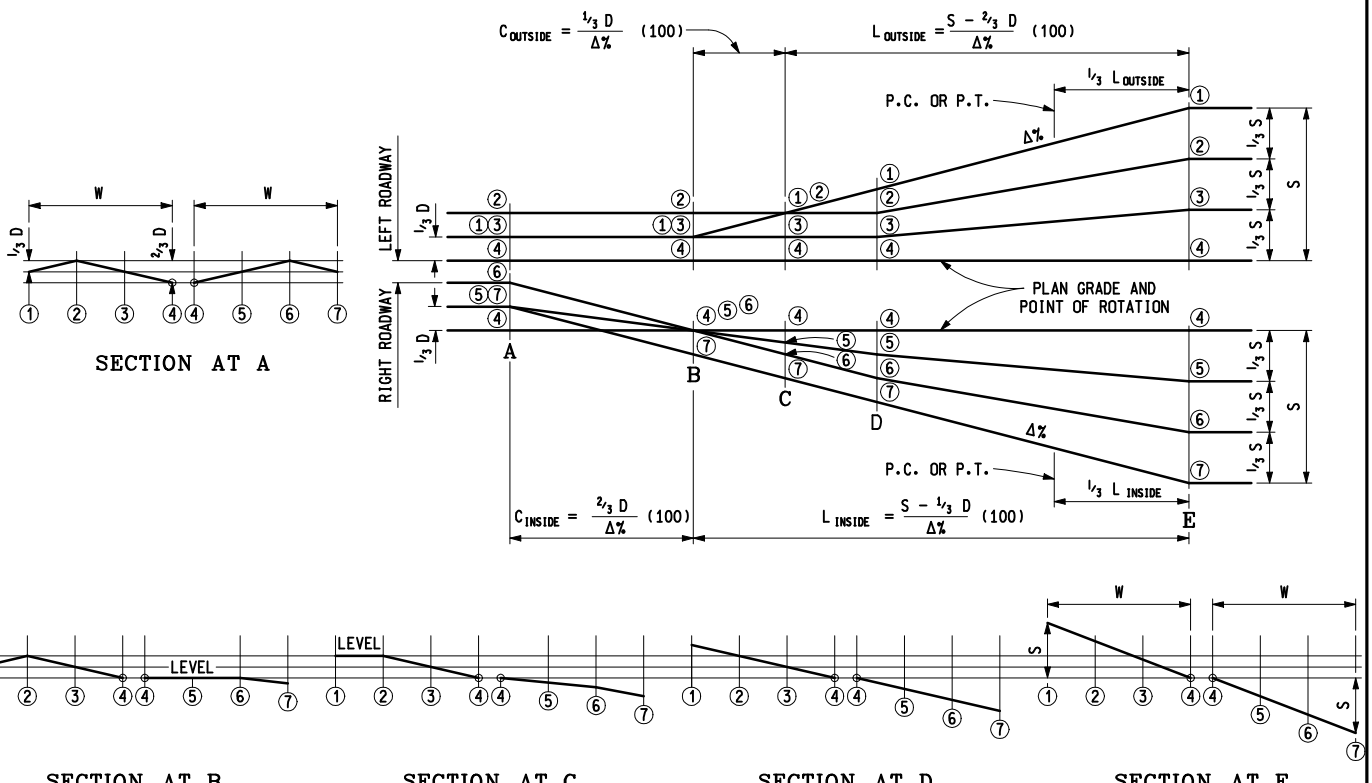


SECTION AT A SECTION AT B SECTION AT C SECTION AT D

UNSPIRALED FOUR LANE DIVIDED ROADWAY



SECTION AT A

SECTION AT B SECTION AT C SECTION AT D SECTION AT E

UNSPIRALED SIX LANE DIVIDED ROADWAY

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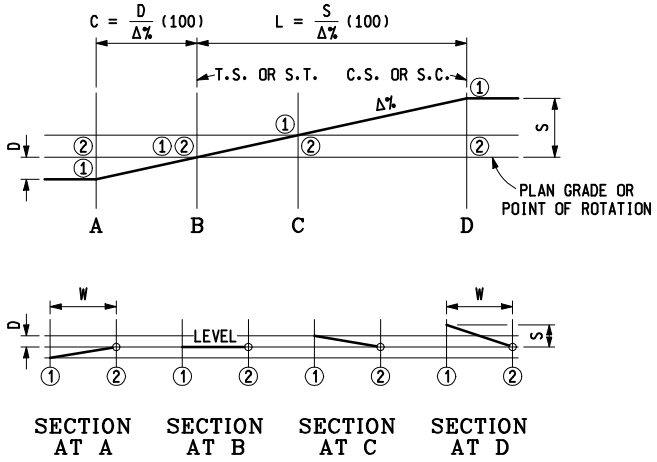
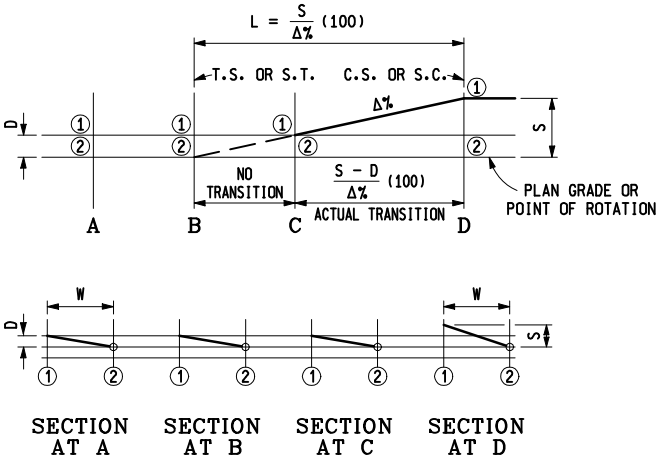
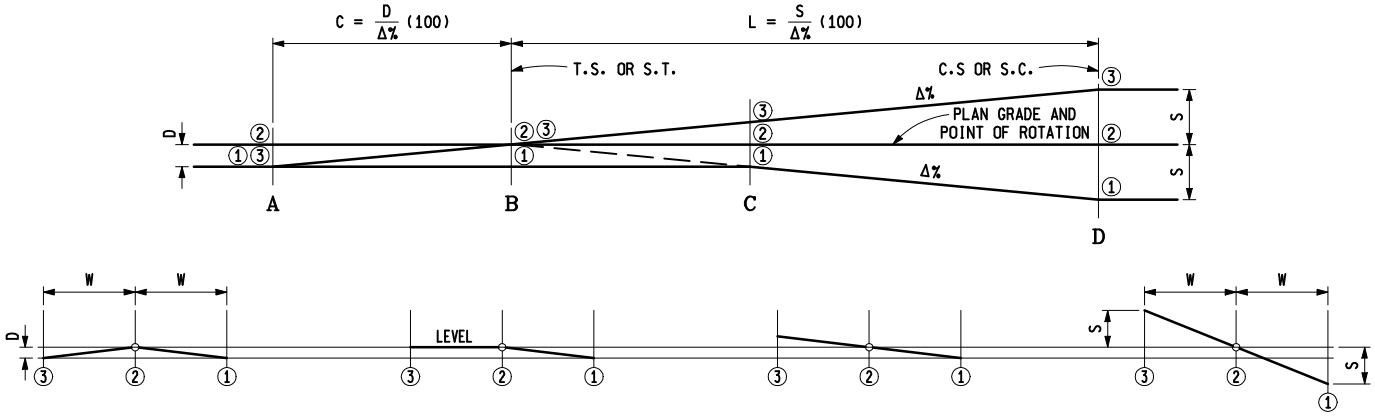


SPIRALED RAMP (CROWN ADVERSE TO SUPER)



SPIRALED RAMP (CROWN SAME DIRECTION AS SUPER)



SPIRALED TWO-WAY ROADWAY

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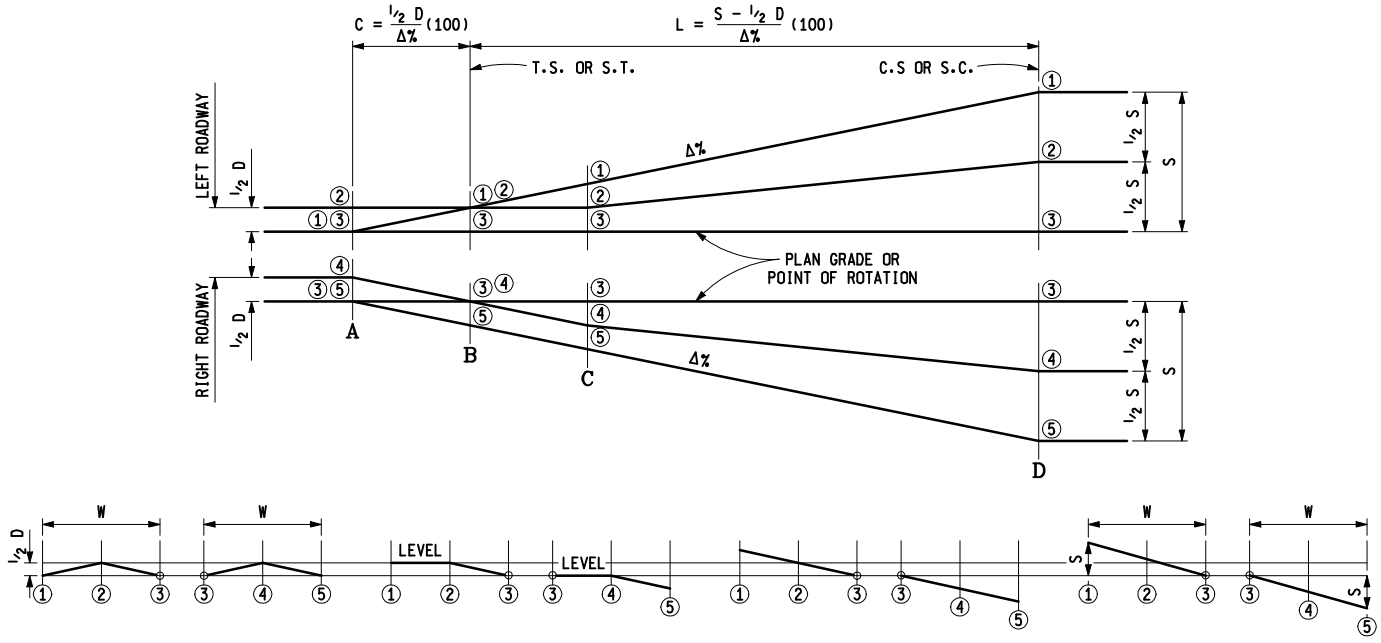
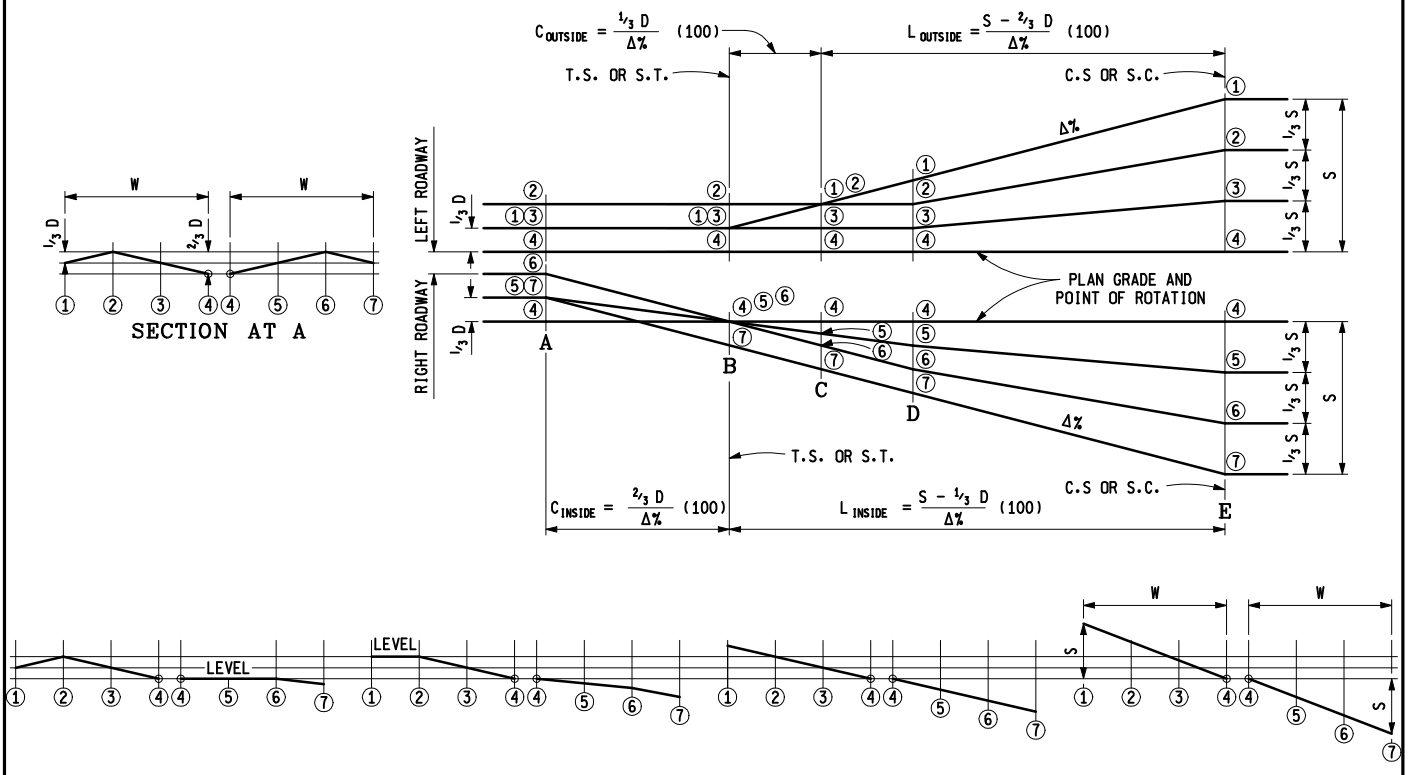


SECTION AT A SECTION AT B SECTION AT C SECTION AT D

SPIRALED FOUR LANE DIVIDED ROADWAY



SECTION AT B SECTION AT C SECTION AT D SECTION AT E

SPIRALED SIX LANE DIVIDED ROADWAY

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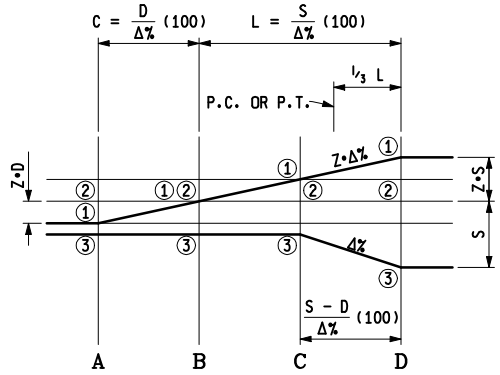
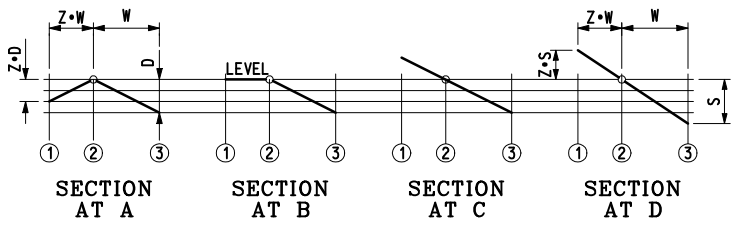
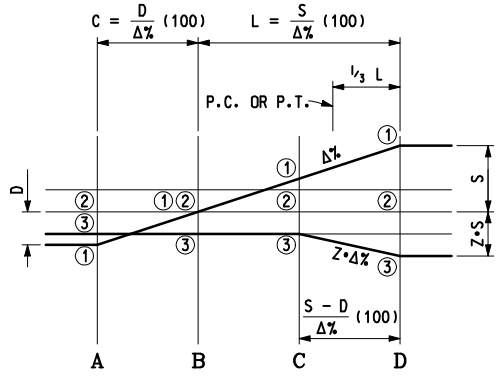
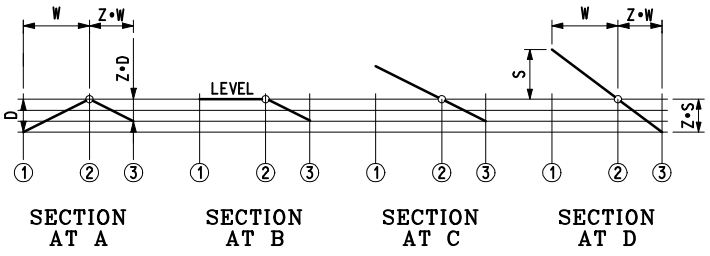


Z VALUES FOR UNSPIRALED TWO WAY ROADWAYS WITH AN ODD NUMBER OF LANES	
NUMBER OF LANES	Z
3	1/2
5	2/3
7	3/4



UNSPIRALED TWO WAY ROADWAY WITH ODD NUMBER OF LANES
(FARTHEST EDGE ON LOW SIDE)





UNSPIRALED TWO WAY ROADWAY WITH ODD NUMBER OF LANES
(FARTHEST EDGE ON HIGH SIDE)

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