**SUPERELEVATION AND PAVEMENT CROWNS**

Super elevation equals the rate of super elevation or the normal shoulder slope whichever is greater.

Ditch depth on inside of curve equals normal ditch depth plus width of pavement and shoulder inside the point of rotation times rate of super elevation or 1' below sand subbase, whichever is greater.

Rate of super elevation = rate of super elevation minus normal shoulder slope.

**Legend**

- **W** = ramp width
- **PLAN GRADE** (NORMAL)
- **SUPERELEVATION**
- **PLAN GRADE AND POINT OF ROTATION (SUPERELEVATED)**
- **RAMPS**
- **SHOULDER**
- **PAVEMENT WIDTH**

**High Side Shoulder Chart**

- Recommended shoulder slope at full super elevation is 3% to and including 5%.
- Shoulder slope at full super elevation equals normal shoulder slope.
- Shoulder slope under 5%.
- Shoulder slope 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 super elevation sections.
- On urban service roads and urban free access trunkline curves where driveways are prevalent, and where normal super elevation cannot be obtained, a minimum of 1.5% to 2% super elevation 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 super elevation transitions, crown runoff lengths, super elevation rates, and point of rotation will be as specified on the plans.
- Spiral lengths will be equal or longer than transition slope lengths.

**Spiral Transitions:**

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.

**Transition**

Begin the high side shoulder transition at the pavement crown runout point (crown removed). Transition the shoulder in the distance L to the shoulder slope rate required at full pavement super elevation.

If the rate of full pavement super elevation 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 super elevation transition slope (% required for the curve, or in tangent sections, use the minimum value for super elevation transition slope (% given in the table). In the column for the speed of the roadway, transition distance = shoulder width x (rate of bridge shoulder super elevation minus rate of road shoulder super elevation) x 100 / (%)

**DESIGNATION:**

- MDOT: Michigan Department of Transportation
- BUREAU OF HIGHWAY DEVELOPMENT
- STANDARD PLAN FOR

**SUPERELEVATION AND PAVEMENT CROWNS**

**PREPARED BY:**
- B.L.T.
- Design Division

**CHECKED BY:**
- B.L.T.

**APPROVED BY:**
- John C. Frisch
- Engineer of Delivery

**DEPARTMENT DIRECTOR:**
- Kirk T. Dobbs
- Michigan Department of Transportation

**ENGINEER OF DELIVERY:**
- Mark A. Van Pelt

**APPROVED BY:**
- Michigan Department of Transportation

**PLAN DATE:**
- 10-19-2009

**F.H.W.A. APPROVAL:**
- 10-19-2009

**SHEET:**
- 1 of 7
# Rate of Superelevation and Superelevation Transition Slope

<table>
<thead>
<tr>
<th>Radius (Feet)</th>
<th>30 MPH</th>
<th>35 MPH</th>
<th>40 MPH</th>
<th>45 MPH</th>
<th>50 MPH</th>
<th>55 MPH</th>
<th>60 MPH</th>
<th>65 MPH</th>
<th>Freeways</th>
<th>Urban Freeways and Urban Ramps</th>
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<tbody>
<tr>
<td>e</td>
<td>%</td>
<td>e</td>
<td>%</td>
<td>e</td>
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<td>2.7</td>
<td>0.37</td>
<td>3.0</td>
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**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 1, use e = 8% maximum superelevation for urban freeways and urban ramps (with a 60 MPH design speed) is 5% otherwise e = 7%.
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

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Maximum Radius (FEET)</th>
<th>Design Speed (MPH)</th>
<th>Maximum Radius (FEET)</th>
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MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT
STANDARD PLAN FOR
R-107-H

SUPERELEVATION AND PAVEMENT CROWNS

9-10-2010  10-19-2009 R-107-H SHEET 5 OF 7
SUPERELEVATION AND PAVEMENT CROWNS

\[ C = \frac{h_1 D}{\Delta S} \times 100 \]

\[ L = \frac{s - h_2 D}{\Delta S} \times 100 \]

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

UNSPIRALED FOUR LANE DIVIDED ROADWAY

\[ C_{\text{BURNSIDE}} = \frac{h_1 D}{\Delta S} \times 100 \]

\[ L_{\text{INSIDE}} = \frac{s - h_2 D}{\Delta S} \times 100 \]

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

UNSPIRALED SIX LANE DIVIDED ROADWAY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT
STANDARD PLAN FOR
SUPERELEVATION AND PAVEMENT CROWNS

9-10-2010
F.H.W.A. APPROVAL
10-19-2009
PLAN DATE
10-19-2010
R-107-H SHEET
4 OF 7
SPIRALED TWO-WAY ROADWAY

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

SPIRALED RAMP (CROWN ADVERSE TO SUPER)  SPIRALED RAMP (CROWN SAME DIRECTION AS SUPER)
SUPERELEVATION AND PAVEMENT CROWNS

\[
C = \frac{\frac{1}{2} D}{\Delta x} \times 100
\]

\[
L = \frac{S - \frac{1}{2} D}{\Delta x} \times 100
\]

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

SPIRALED FOUR LANE DIVIDED ROADWAY

\[
C_{outside} = \frac{\frac{1}{2} D}{\Delta x} \times 100
\]

\[
L_{outside} = \frac{S - \frac{1}{2} D}{\Delta x} \times 100
\]

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

SPIRALED SIX LANE DIVIDED ROADWAY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SUPERELEVATION AND PAVEMENT CROWNS

9-10-2010  10-19-2009  10-19-2010
R-107-H  SHEET 6 OF 7
Z VALUES FOR UNSPIRALED TWO WAY ROADWAYS WITH AN ODD NUMBER OF LANES

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<th>NUMBER OF LANES</th>
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<tr>
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<td>2/4</td>
</tr>
<tr>
<td>7</td>
<td>3/4</td>
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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)