Chapter 1130  Modified Design Level

1130.01  General

Modified design level (M) preserves and improves existing roadway geometrics, safety, and operational elements. This chapter provides the design criteria that are unique to the modified design level.

Modified design level criteria have been developed to apply to all applicable functional classes. As a result, for the lower volumes and urban highways, modified design level criteria might exceed full design level criteria. In these cases, full design level criteria may be used.

For projects developed to correct a deficiency, address all design elements contributing to that deficiency, even when those elements meet modified design level criteria.

Design elements that do not have modified design level guidance include:

- Access control (see Chapter 520)
- Basic safety (see Chapter 1120)
- Clear zone (see Chapter 1600)
- Intersection sight distance (see Chapter 1310)
- Lane transitions (see Chapter 1210)
- On- and off-connections (see Chapter 1360)
- Signing, delineation, and illumination (see Chapters 1020, 1030, and 1040)
- Structural capacity (see Chapter 720)
- Traffic barriers (see Chapter 1610)
- Vertical clearance (see Chapter 720)

Depending on the project context, guidance on context and modally integrated design may apply; see Chapter 1150 for more information about this guidance, and how to determine where it applies.
1130.02  Design Speed

When applying modified design level to a project, select a design speed for use in the design process that reflects the character of the terrain and the type of highway. The desirable design speed for modified design level is one that is consistent with both the operating speed and posted speed limit within the project limits, while also remaining consistent with design, operating, and posted speeds in the corridor. The minimum design speed is not less than the posted speed or the proposed posted speed. Document the speed used, including any supporting studies and data. (See Chapter 1140 for additional information on design speed.)

Vacant

Exhibit 1130-1

When the posted speed exceeds the design speed for existing geometric features that are to remain in place (curve radius, superelevation, sight distance, or other elements that the design speed controls), make one of the following two choices:

- When appropriate, work with the region Traffic Office to lower the posted speed to be consistent with the existing design speeds for the geometric features on the facility.

- Complete a corridor analysis in order to leave the posted speed unchanged and identify design elements that do not meet the criteria for the existing posted speed. Identify each appropriate location for cautionary signing, including road approach sight distance, and work with the region Traffic Office to install the cautionary signing as provided for in the MUTCD, either by contract or region sign personnel. Consult with and obtain guidance from region project development leadership prior to progressing with the corridor analysis and the design.

1130.03  Alignment

(1)  Horizontal Alignment

Consideration of horizontal alignment for modified design level is normally limited to curves. Curve design is controlled by the design speed (see 1130.02), superelevation (see 1130.03(4)), and stopping sight distance (see 1130.03(3)). Identify major modifications to horizontal alignment in the Project Summary. (Examples of major modifications are total removal of pavement and reconstruction of the subgrade.)

(2)  Vertical Alignment

Vertical alignment consists of a series of profile grades connected by vertical curves.

(a)  Vertical Curves

- Stopping sight distance controls crest vertical curves. Exhibit 1130-8 gives the minimum curve length for crest vertical curves to remain in place for modified design level stopping sight distance. (See 1130.03(3) for additional information on modified design level stopping sight distance.)
When modified design level criteria are being applied, existing sag vertical curves are not normally addressed.

When either a crest or a sag vertical curve is to be reconstructed, use full design level criteria (see Chapters 1220 and 1260).

(b) **Profile Grades**

When applying modified design level, profile grades generally are not revised. However, realignment may be justified for combinations of steep grades and restricted horizontal or vertical curvature. Identify major modifications to vertical alignment in the Project Summary. (Examples of major modifications are total removal of pavement and reconstruction of the subgrade.) When changing the profile grade, see Chapter 1140 for the maximum grade for the functional class of the route.

(3) **Stopping Sight Distance**

Stopping sight distance is a controlling factor for both vertical and horizontal alignment. A 2-foot object height is used for modified design level stopping sight distance evaluation. Exhibit 1130-2 gives the minimum stopping sight distances allowed to remain in place.

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Design Stopping Sight Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 or less</td>
<td>155</td>
</tr>
<tr>
<td>45</td>
<td>200</td>
</tr>
<tr>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td>55</td>
<td>305</td>
</tr>
<tr>
<td>60</td>
<td>360</td>
</tr>
<tr>
<td>65</td>
<td>425</td>
</tr>
<tr>
<td>70</td>
<td>495</td>
</tr>
<tr>
<td>75</td>
<td>570</td>
</tr>
<tr>
<td>80</td>
<td>645</td>
</tr>
</tbody>
</table>

**Stopping Sight Distance: Modified Design Level**  
Exhibit 1130-2

(a) **Stopping Sight Distance for Horizontal Curves**

For modified design level, use the existing lateral clearance to the sight obstruction and the curve radius to compare the existing condition to Exhibit 1130-9a. When reconstructing a horizontal curve, apply full design level criteria for sight distance (see Chapter 1260).

For Exhibit 1130-9a, an obstruction is any object with a height of greater than 2.75 feet above the roadway surface on the inside of a curve. Examples of possible obstructions are median barrier, guardrail, bridges, walls, cut slopes, wooded areas, and buildings. Objects between 2.75 feet and 2.00 feet above the roadway surface within the M distance might be a sight obstruction (see Exhibit 1130-9b for guidance) depending on the distance from the roadway.
(b) **Stopping Sight Distance for Vertical Curves**

For existing crest vertical curves, use the algebraic difference in grades and the length of curve to compare the existing condition to the modified design level stopping sight distances from Exhibit 1130-2. Use the equations in Exhibit 1130-3 or use Exhibit 1130-8 to evaluate the existing curve.

When a crest vertical curve is lengthened, the minimum sight distance is increased; however, the length of the roadway that has the minimum sight distance is also increased. This results in a questionable benefit when the new sight distance is less than for full design level. Therefore, when the existing roadway is reconstructed to improve stopping sight distance, apply full design level criteria (see Chapter 1260).

![Table showing formulas for minimum crest vertical curve length](table.png)

Where:

\[
\begin{align*}
L &= \text{Length of vertical curve (ft)} \\
s &= \text{Sight distance from Exhibit 1130-2 (ft)} \\
A &= \text{Absolute value of the algebraic difference in grades (\%)} \\
\end{align*}
\]

### Minimum Crest Vertical Curve Length:
**Modified Design Level**

*Exhibit 1130-3*

(4) **Superelevation**

Evaluate existing superelevation using the equation in Exhibit 1130-4 with the friction factors from Exhibit 1130-5 or with a ball banking analysis. When the existing superelevation equals or exceeds the value from the equation or when the maximum speed determined by a ball banking analysis equals or exceeds the design speed, the modified design level criteria are met.

When modifying the superelevation of an existing curve where the existing pavement is to remain in place, the equation in Exhibit 1130-4 may be used to determine the superelevation.

For curves on realigned roadways or where the roadway is to be rebuilt, provide full design level superelevation (see Chapter 1250).

The “minimum radius for normal 2% crown” values from Exhibit 1130-5 are the radii that, with the design speed and side friction factor, result in a 2% adverse crown (e=2%) (see the equation in Exhibit 1130-4). The modified design level criteria are met when a roadway has not more than 2% crown in both directions and a radius equal to or greater than the minimum radius for normal 2% crown.
Where:

\[ e = \left( \frac{6.69V^2}{R} \right) - f \]

Where:

- \( R \) = Existing curve radius (ft)
- \( V \) = Design speed from 1130.02 (mph)
- \( e \) = Superelevation rate (%)
- \( f \) = Side friction factor from Exhibit 1130-5

### Minimum Superelevation: Modified Design Level

**Exhibit 1130-4**

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Side Friction Factor (f)</th>
<th>Minimum Radius for Normal 2% Crown (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>32</td>
<td>51</td>
</tr>
<tr>
<td>20</td>
<td>27</td>
<td>107</td>
</tr>
<tr>
<td>25</td>
<td>23</td>
<td>199</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
<td>335</td>
</tr>
<tr>
<td>35</td>
<td>18</td>
<td>512</td>
</tr>
<tr>
<td>40</td>
<td>16</td>
<td>764</td>
</tr>
<tr>
<td>45</td>
<td>15</td>
<td>1041</td>
</tr>
<tr>
<td>50</td>
<td>14</td>
<td>1392</td>
</tr>
<tr>
<td>55</td>
<td>13</td>
<td>1838</td>
</tr>
<tr>
<td>60</td>
<td>12</td>
<td>2405</td>
</tr>
<tr>
<td>65</td>
<td>11</td>
<td>3137</td>
</tr>
<tr>
<td>70</td>
<td>10</td>
<td>4092</td>
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<tr>
<td>75</td>
<td>9</td>
<td>5369</td>
</tr>
<tr>
<td>80</td>
<td>8</td>
<td>7126</td>
</tr>
</tbody>
</table>

**Side Friction Factor**

**Exhibit 1130-5**

### 1130.04 Roadway Widths

Review route continuity and roadway widths. Select widths on the tangents to be consistent throughout a given section of the route. Make any changes where the route characteristics change. Do not provide a design that decreases the existing roadway width.

**1 Lane and Shoulder Width**

Lane and shoulder widths are shown in Exhibits 1130-10 and 1130-11. Consider joint use with other modes of transportation in shoulder design.

Minimum ramp lane and shoulder widths are shown in Exhibit 1130-14. Use full design level lane and shoulder widths (see Chapter 1360) for new and rebuilt ramps.
(2) **Turning Roadway Widths**

The roadway might need to be widened on curves to accommodate large vehicles. The minimum roadway width for a curve is not less than that of the adjacent tangent sections.

Widening of the total roadway width of a curve by less than 2 feet may be omitted for existing two-lane roadways that are to remain in place.

(a) **Two-Lane Two-Way Roadway**

The width of a curve may not be less than that shown in Exhibit 1130-12a or, if the internal angle (delta) is less than 90°, Exhibit 1130-12b. The minimum total roadway width from Exhibit 1130-12a or 1130-12b may include the shoulder. When the shoulder is included, provide full-depth pavement.

(b) **One-Way Roadway and Ramp**

Widths on a curve are shown in Exhibit 1130-6 for existing roadways that are to remain in place. Use full design level width (see Chapters 1240 and 1360) for new and rebuilt ramps.

(3) **Median Width**

Minimum median widths are given in Exhibit 1130-10.

<table>
<thead>
<tr>
<th>Curve Radius (ft)</th>
<th>One-Lane[1]</th>
<th>Two-Lane[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangent to 1001</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>500</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>400</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>300</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>200</td>
<td>22</td>
<td>26</td>
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<tr>
<td>150</td>
<td>23</td>
<td>26</td>
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<td>100</td>
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<td>27</td>
<td>29</td>
</tr>
<tr>
<td>50</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

Notes:

[1] Includes the shoulder width.


**One-Way Roadway and Ramp Turning Roadway Widths:**

*Modified Design Level*

*Exhibit 1130-6*
1130.05 Cross Slopes

On tangent sections, the normal cross slopes of the traveled way are 2%.

If a longitudinal contiguous section of pavement is to be removed or is on a reconstructed alignment, or if a top course is to be placed over existing pavement, design the restored pavement cross slope to full design level criteria (see Chapter 1230).

The algebraic difference in cross slopes is an operational factor during a passing maneuver on a two-lane two-way roadway. Its influence increases when increased traffic volumes decrease the number and size of available passing opportunities.

A somewhat steeper cross slope may be desirable to facilitate pavement drainage in areas of intense rainfall, even though this might be less desirable from the operational point of view. In such areas, the design cross slopes may be increased to 2.5% with an algebraic difference of 5%.

For existing pavements, cross slopes within a range of 1% to 3% may remain if there are no operational or drainage concerns and, on a two-lane two-way roadway, the following conditions are met:

- The algebraic difference is not greater than 4% where the ADT is greater than 2000.
- The algebraic difference is not greater than 5% where the ADT is 2000 or less.
- The algebraic difference is not greater than 6% and the road is striped or signed for no passing.

For a two-lane two-way roadway, provide an algebraic difference to meet the appropriate conditions stated above except when facilitating drainage in areas of intense rainfall. When applying modified design level to a road with bituminous surface treatment (BST), the existing cross slope algebraic differences may remain.

To maintain or restore curb height, consider lowering the existing pavement level and improving cross slope by grinding before an asphalt overlay. The cross slope of the shoulder may be steepeened to maximize curb height and minimize other related impacts. The shoulder may be up to 6% with a rollover between the traveled way and the shoulder of no more than 8% (see Chapter 1230).

1130.06 Sideslopes

(1) Fill/Ditch Slopes

Foreslopes (fill slopes and ditch inslopes) and cut slopes are designed as shown in the Fill and Ditch Slope Selection Table in Exhibit 1130-13 for modified design level main line roadway sections. After the foreslope has been determined, use the guidance in Chapter 1600 to determine the need for a traffic barrier.

Where a crossroad or road approach has steep foreslopes, there is the possibility that an errant vehicle could become airborne. Therefore, flatten crossroad and road approach foreslopes to 6H:1V where feasible and at least to 4H:1V. Provide smooth transitions between the main line foreslopes and the crossroad or road approach foreslopes. Where possible, move the crossroad or road approach drainage away from the main line. This can locate the pipe outside the Design Clear Zone and reduce the length of pipe.
(2) Cut Slopes

Existing stable backslopes (cut slopes) are to remain undisturbed unless disturbed by other work. When changes are planned to a cut slope, design them as shown in the Cut Slope Selection Table in Exhibit 1130-13.

1130.07 Bike and Pedestrian

The Americans with Disabilities Act of 1990 (ADA) requires all pedestrian facilities located within public rights of way to be ADA-compliant. The Design Matrices in Chapter 1100 identify that the modified design level applies to bike and pedestrian design elements on specific project types. For those projects, the following guidance applies to pedestrian facilities:

- Evaluate pedestrian facilities within the project limits for compliance with the ADA.
- Address pedestrian facilities that are altered in any way by the project.
- Evaluate and make ADA-compliant the curb ramps and crosswalks on projects that use hot mix asphalt or Portland cement concrete pavement overlays or inlays.
- Evaluate and make ADA-compliant the curb ramps and crosswalks on projects that alter pavement markings. Note: Lane restriping that does not involve modal changes (such as changing a shoulder to a bikeway) or lane configuration changes are not considered alterations.

For pedestrian facility design guidance, including jurisdictional responsibilities when city streets form part of the state highway system, see Chapter 1510, and for the definition of alterations, see the Glossary.

Bicycle elements are design exceptions on HMA or PCCP overlays or inlays on Interstate ramps or crossroads.

1130.08 Bridges

Design new and replacement bridges to full design level (see Chapter 1140) unless a corridor or project analysis justifies the use of modified design level lane and shoulder widths. Evaluate bridges to remain in place using Exhibits 1130-10 and 1130-11. Whenever possible, continue the roadway lane widths across the bridge and adjust the shoulder widths.

Consider joint use with other modes of transportation in lane and shoulder design (see Chapters 1410, 1430, 1510, 1515, and 1520).
1130.09  Intersections

Except as provided below, design intersections to meet the guidance in Chapters 1300 and 1310.

(1)  Turn Radii

The intersection turn radii (or right-turn corners) are controlled by the design vehicle. Exhibit 1130-7 is a guide for determining the design vehicle for modified design level. Perform a field review to determine intersection type, types of vehicles that use the intersection, and adequacy of the existing geometrics. Where the crossroad is a city street or county road, consider the city or county design criteria when selecting a design vehicle.

Design right-turn corners to meet the guidance of Chapter 1310 using the design vehicle selected from Exhibit 1130-7 or from the field review.

(2)  Angle

The allowable angle between any two respective legs is between 60° and 120° with 90° being desirable.

<table>
<thead>
<tr>
<th>Intersection Type</th>
<th>Design Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction of Major Truck Routes</td>
<td>WB-67</td>
</tr>
<tr>
<td>Junction of State Routes</td>
<td>WB-40</td>
</tr>
<tr>
<td>Ramp Terminals</td>
<td>WB-40</td>
</tr>
<tr>
<td>Other Rural</td>
<td>SU-30[^1]</td>
</tr>
<tr>
<td>Urban Industrial</td>
<td>SU-30[^1]</td>
</tr>
<tr>
<td>Urban Commercial</td>
<td>P[^1]</td>
</tr>
<tr>
<td>Residential</td>
<td>P[^1]</td>
</tr>
</tbody>
</table>

Note:

[^1] Where the intersection is on a transit or school bus route, use the CITY-BUS design vehicle. (See Chapter 1430 for additional guidance on transit facilities and for the CITY-BUS turning path templates.)

Design Vehicles: Modified Design Level

Exhibit 1130-7

1130.10  Documentation

Refer to Chapter 300 for design documentation requirements.
Note:
When the intersection of the algebraic difference of grade (A) with the length of vertical curve (L) is below the selected design speed line, modified design level criteria are met.
M is the distance in ft from the centerline of the inside lane to the obstruction. The obstruction is a cut slope or other object 2.75 ft or more above the inside lane. Objects between 2.75 ft and 2.00 ft above the roadway surface within the M distance might be a sight obstruction, depending on the distance from the roadway (see Exhibit 1130-9b).

Note:
When the intersection of the lateral clearance (M) with the curve radius (R) falls above the curve for the selected design speed, modified design level criteria are met.

Evaluation for Stopping Sight Distance for Horizontal Curves:
Modified Design Level
Exhibit 1130-9a
When:  

\[ h \leq \left( 2 + \frac{1.5X}{C_s} \right) \]

modified design level criteria are met.

Where:
- \( M \) = Lateral clearance for sight distance (ft) (see Exhibit 1130-9a)
- \( C_s \) = Stopping sight distance chord (ft)
- \( X \) = Distance from sight obstruction to end of sight distance chord (ft)
- \( h \) = Height of sight obstruction above the inside lane

Evaluation for Stopping Sight Distance Obstruction for Horizontal Curves: Modified Design Level

*Exhibit 1130-9b*
## Modified Design Level

### Multilane Highways and Bridges: Modified Design Level

#### Exhibit 1130-10

<table>
<thead>
<tr>
<th>Design Class</th>
<th>MDL-1</th>
<th>MDL-2</th>
<th>MDL-3</th>
<th>MDL-4</th>
<th>MDL-5</th>
<th>MDL-6</th>
<th>MDL-7</th>
<th>MDL-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current ADT[1]</td>
<td>Under 4000</td>
<td>Over 4000</td>
<td>Under 4000</td>
<td>Over 4000</td>
<td>Under 4000</td>
<td>Over 4000</td>
<td>Under 4000</td>
<td>Over 4000</td>
</tr>
<tr>
<td>Design Speed</td>
<td>See 1130.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traffic Lanes Number Width</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
<th>4 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Width Left[3]</td>
<td>2 ft</td>
<td>6 ft</td>
<td>2 ft</td>
<td>4 ft</td>
<td>2 ft</td>
<td>6 ft</td>
<td>4 ft</td>
<td>2 ft</td>
</tr>
<tr>
<td>Parking Lanes Urban</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>8 ft</td>
<td>8 ft[2]</td>
<td>8 ft</td>
<td>8 ft[2]</td>
</tr>
<tr>
<td>Median Width[5][13] Rural Urban</td>
<td>Existing</td>
<td>Existing</td>
<td>Existing</td>
<td>Existing</td>
<td>2 ft</td>
<td>4 ft</td>
<td>4 ft</td>
<td>4 ft</td>
</tr>
</tbody>
</table>

**Notes:**

[1] If current ADT is approaching a borderline condition, consider designing for the higher classification.

[2] Parking restricted when ADT is over 15,000.

[3] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 1140. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1520).

[4] When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 1 ft on the left.

[5] May be reduced by 2 ft under urban conditions.

[6] Width is the clear distance between curbs or rails, whichever is less.

[7] Use these widths for bridge deck treatment or thrie beam retrofit only.

[8] For bridge median guidance, see Chapter 720.


[10] Add 12 ft for each additional lane.

[11] Includes a 4-ft median, which may be reduced by 2 ft under urban conditions.

[12] Use these widths for any bridge work beyond the treatment of the deck, such as bridge rail replacement, deck replacement, or widening.

[13] Includes 6-ft shoulders; may be reduced by 2 ft on each side under urban conditions.

[14] Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.

[15] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

---

**Multilane Highways and Bridges: Modified Design Level**

*Exhibit 1130-10*
### Two-Lane Highways: Modified Design Level

<table>
<thead>
<tr>
<th>Design Class</th>
<th>MDL-9</th>
<th>MDL-10</th>
<th>MDL-11</th>
<th>MDL-12</th>
<th>MDL-13</th>
<th>MDL-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current ADT(^{[1]})</td>
<td>Under 1000</td>
<td>1000-4000</td>
<td>Over 4000</td>
<td>Under 1000</td>
<td>1000-4000</td>
<td>Over 4000</td>
</tr>
<tr>
<td>Design Speed</td>
<td>See 1130.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic Lane Width(^{[2]})</td>
<td>11 ft</td>
<td>11 ft</td>
<td>11 ft</td>
<td>11 ft</td>
<td>11 ft</td>
<td>12 ft</td>
</tr>
<tr>
<td>Shoulder Width(^{[4]})</td>
<td>2 ft</td>
<td>3 ft(^{[5]})</td>
<td>4 ft</td>
<td>2 ft</td>
<td>3 ft(^{[6]})</td>
<td>4 ft</td>
</tr>
<tr>
<td>Parking Lanes Urban</td>
<td>8 ft</td>
<td>8 ft</td>
<td>8 ft(^{[3]})</td>
<td>8 ft</td>
<td>8 ft</td>
<td>8 ft(^{[3]})</td>
</tr>
<tr>
<td>Minimum Width for Bridges to Remain in Place(^{[6][7]})</td>
<td>22 ft(^{[8]})</td>
<td>24 ft</td>
<td>28 ft</td>
<td>22 ft(^{[8]})</td>
<td>24 ft</td>
<td>28 ft</td>
</tr>
<tr>
<td>Minimum Width for Rehabilitation of Bridges to Remain in Place(^{[7][9]})</td>
<td>28 ft(^{[10]})</td>
<td>32 ft</td>
<td>32 ft</td>
<td>28 ft(^{[10]})</td>
<td>32 ft</td>
<td>32 ft</td>
</tr>
<tr>
<td>Minimum Width for Replacement Bridges</td>
<td>Full Design Level Applies(^{[11]})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Access Control:** For limited access highways, see Chapters 530 and 540 and the Limited Access and Managed Access Master Plan, or WAC 468-52 and the region’s Highway Management Classification Report.

**Notes:**

1. If current ADT is approaching a borderline condition, consider designing for the higher classification.
2. For turning roadways, see Exhibits 1130-12a and 1130-12b.
3. Parking restrictions are desirable when ADT exceeds 7500.
4. When a curb section is used, the minimum shoulder width from the edge of traveled way to the face of curb is 4 ft. In urban areas, see Chapter 1140. On a route identified as a local, state, or regional significant bicycle route, the minimum shoulder width is 4 ft (see Chapter 1520).
5. For design speeds of 50 mph or less on roads of 2000 ADT or less, width may be reduced by 1 ft, with justification.
6. Use these widths for bridge deck treatment or thrie beam retrofit only.
7. Width is the clear distance between curbs or rails, whichever is less.
8. 20 ft when ADT is 250 or less.
9. Use these widths when a for any bridge work beyond the treatment of the deck, such as bridge rail replacement, deck replacement, or widening.
10. 26 ft when ADT is 250 or less.
11. Modified design level lane and shoulder widths may be used, when justified, with a corridor or project analysis.
Radius of Centerline, R (ft) | Minimum Total Roadway Width[^1], W (ft) | Minimum Lane Width, L (ft)
--- | --- | ---
Tangent | 26 | 11
900 | 26 | 11
800 | 27 | 12
700 | 27 | 12
600 | 28 | 12
500 | 28 | 12
400 | 29 | 12
350 | 30 | 12
300 | 31 | 12
250 | 33 | 13
200 | 35 | 13
150 | 39 | 13

Notes:
Also see minimums from Exhibit 1130-11. If the minimum total roadway width is greater than the sum of the shoulders and lane widths, apply the extra width to the inside of the curve.

[^1] Total width may include the shoulders.

Roadway width is based on:
- WB-63 design vehicle (the WB-63 was used as the design vehicle with 48-ft trailer adopted in the 1982 Surface Transportation Assistance Act).
- 2.5-ft clearance per lane.
Minimum Total Roadway Widths for Two-Lane Two-Way Highway Curves:
Modified Design Level, Based on the Delta Angle

Exhibit 1130-12b

Notes:
May be used when the internal angle (delta) is less than 90°.
If result is less than the total roadway width from Exhibit 1130-11, use the greater.

[1] Total width may include the shoulders.

Roadway width is based on:
- WB-63 design vehicle (the WB-63 was used as the design vehicle with 48-ft trailer adopted in the 1982 Surface Transportation Assistance Act).
- 2.5-ft clearance per lane.
### Height of Cut (ft)

<table>
<thead>
<tr>
<th>Height of Cut (ft)</th>
<th>Slope Not Steeper Than[^5]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>4H:1V</td>
</tr>
<tr>
<td>5 – 20</td>
<td>3H:1V</td>
</tr>
<tr>
<td>over 20</td>
<td>2H:1V</td>
</tr>
</tbody>
</table>

**Cut Slope Selection Table**

[^5]: Or as recommended by the soils or geotechnical report. (See Chapter 1600 for clear zone and barrier guidance.)

### Height of Fill/Depth of Ditch (ft)

<table>
<thead>
<tr>
<th>Height of Fill/Depth of Ditch (ft)</th>
<th>Slope Not Steeper Than</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20</td>
<td>4H:1V</td>
</tr>
<tr>
<td>20 – 30</td>
<td>3H:1V</td>
</tr>
<tr>
<td>over 30</td>
<td>2H:1V[^6][^7]</td>
</tr>
</tbody>
</table>

**Fill and Ditch Slope Selection Table**

[^6]: Where feasible, provide flatter slopes for the greater fill heights and ditch depths.
[^7]: Fill slopes up to 1½H:1V may be used where favorable soil conditions exist. (See Chapter 1230 for additional details and Chapter 1600 for clear zone and barrier guidance.)

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**Notes:**

[^1]: For minimum roadway widths, see Exhibits 1130-10 and 1130-11. For turning roadway widths, see Exhibits 1130-12a and 1130-12b.

[^2]: Widen and round embankments steeper than 4H:1V.

[^3]: For shoulder slopes, see Chapter 1230.

[^4]: Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds 40 mph or less.

[^5]: Or as recommended by the soils or geotechnical report. (See Chapter 1600 for clear zone and barrier guidance.)

[^6]: Where feasible, provide flatter slopes for the greater fill heights and ditch depths.

[^7]: Fill slopes up to 1½H:1V may be used where favorable soil conditions exist. (See Chapter 1230 for additional details and Chapter 1600 for clear zone and barrier guidance.)
Notes:


[3] Minimum ditch depth is 2 ft for design speeds over 40 mph and 1.5 ft for design speeds at and under 40 mph.

[4] For minimum ramp width, see 1130.04(2)(b) and Exhibit 1130-6.

[5] For shoulder slopes, see Chapter 1230.

[6] Provide the median width of a two-lane two-way ramp not less than for traffic control devices and their shy distances.

[7] Widen and round embankments steeper than 4H:1V.

[8] Existing 6 ft may remain. When the roadway is to be widened, 8 ft is desirable.

[9] When guardrail is installed along existing shoulders with a width greater than 4 ft, the shoulder width may be reduced by up to 4 inches.

Ramp Roadway Sections: Modified Design Level

*Exhibit 1130-14*