Adding Lanes

When additional lanes are developed, such as for passing lanes, climbing lanes, additional lanes at intersections, or in other circumstances, they should be developed with a 15:1 taper ratio, as shown in Figure 1. This section discusses adding, dropping, and redirecting through lanes. Taper ratios for right- and left-turn lanes are discussed in Section 6A-1.

Dropping Lanes

When dropping a through lane, the minimum length of taper can be determined by the following formulas:\(^1\)

\[
L = \frac{W S^2}{60} \quad \text{for speeds of 40 mph or less} \\
L = \frac{WS^2}{155} \quad \text{for speeds of 70 km/h or less}
\]

\[
L = S \times W \quad \text{for speeds of 40 mph or more} \\
L = 0.62 \times S \times W \quad \text{for speeds of 70 km/h or more}
\]

where:

- \(L\) = minimum length of taper
- \(S\) = posted speed limit or 85\(^{th}\) percentile speed
- \(W\) = width of lane to be dropped or redirection offset

Preferably, taper ratios should be evenly divisible by 5 (15:1, 20:1, etc.) Calculations that result in odd ratios should be rounded up to the next increment of 5. Table 1 utilizes the formulas to determine the appropriate taper ratios for dropping a 12-foot (3.6-meter) wide lane. The ratio remains constant for a given design speed, while the length varies with the lane width.

Chapter 6—Geometric Design

Table 1: Length and Taper Ratio for Dropping 12-foot (3.6-meter) Lane

<table>
<thead>
<tr>
<th>English units</th>
<th>Design Speed (mph)</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taper Ratio</td>
<td>15:1</td>
<td>25:1</td>
<td>30:1</td>
<td>45:1</td>
<td>50:1</td>
<td>55:1</td>
<td>60:1</td>
<td>65:1</td>
<td>70:1</td>
<td></td>
</tr>
<tr>
<td>Length (L) in feet</td>
<td>180</td>
<td>300</td>
<td>360</td>
<td>540</td>
<td>600</td>
<td>660</td>
<td>720</td>
<td>780</td>
<td>840</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>metric units</th>
<th>Design Speed (km/h)</th>
<th>45</th>
<th>55</th>
<th>65</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taper Ratio</td>
<td>15:1</td>
<td>20:1</td>
<td>30:1</td>
<td>45:1</td>
<td>50:1</td>
<td>60:1</td>
<td>65:1</td>
<td>70:1</td>
<td>75:1</td>
<td></td>
</tr>
<tr>
<td>Length (L) in meters</td>
<td>54</td>
<td>72</td>
<td>108</td>
<td>162</td>
<td>180</td>
<td>216</td>
<td>234</td>
<td>252</td>
<td>270</td>
<td></td>
</tr>
</tbody>
</table>

Redirecting Lanes

The procedure for determining minimum taper ratios for redirecting through lanes is the same as shown in Table 1 for lane drops; however, for design speeds over 45 mph (70 km/h), the use of reverse curves rather than tapers is recommended. Figure 2 below illustrates a taper for redirecting through lanes and Figure 3 illustrates redirecting through lanes using reverse curves. Section 2D-1 of this manual provides more information regarding reverse curves.

![Figure 2: Redirecting through lanes using tapers.](image-url)

![Figure 3: Redirecting through lanes using reverse curves.](image-url)