4.1.5 Transition Curves, Superelevation and Pavement Widening

**Background**

Simple circular horizontal curves are normally used for road design. In order to facilitate the gradual transition of steering from straight sections of road to the curves, transition curves are often provided. The characteristic of a transition curve is that it has a constantly reducing radius, as in a spiral.

Superelevation is often applied over the length of a circular curve to reduce the sideways frictional requirements between the tyres and road surface and to increase comfort. In such situations, the transition curve length may be used to introduce the superelevation (Fig. 4.11).

The widening of traffic lanes is often necessary on lower radius curves to allow for the offset of the rear axles of heavy vehicles following a smaller radius curve than the steering axle.

**Problems**

Too high a superelevation will result in the possibility of stationary, slow moving vehicles sliding sideways or, in extreme cases, overturning. Too low a superelevation may result in standing water on the carriageway.

The application of superelevation with a very low rate of rotation of the carriageway over a long transition section may result in ‘flat spots’ with inadequate drainage.

Without adequate superelevation or removal of adverse camber, the friction required between the tyre and road surface will be much greater, and the risk of an accident higher. Such a situation will encourage drivers to use the centre of the road, or the inside lane, irrespective of direction. This situation is frequently evident on gravel roads, where a lack of adequate maintenance can lead to a loss of profile.

Long transition curves can be deceptive and drivers may enter such curves at speeds that they are unable to sustain safely as the radius reduces.

**Summary**

*Transition curves provide a useful role in enabling drivers to move safely from straight-ahead to circular motion round a curve. The transition length is also useful in introducing superelevation, the removal of adverse camber and lane widening. Care should be taken to ensure that the resulting edge profile shows a consistent aspect to the driver, and there are no inadequately drained ...........*
Possible Solutions/Benefits

<table>
<thead>
<tr>
<th>Curve Radius (m)</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in width (m)</td>
<td>1.50</td>
<td>1.00</td>
<td>0.75</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 4.07
Recommended widening on curves on two lane roads (ref 4)

<table>
<thead>
<tr>
<th>Curve Radius (m)</th>
<th>&lt;50</th>
<th>50-149</th>
<th>150-299</th>
<th>300-400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in width (m)</td>
<td>1.50</td>
<td>1.00</td>
<td>0.75</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 4.06
Recommended widening on curves on single lane roads (ref 4)

- A madum superelevation of eight or ten per cent will generally eliminate overturning and sliding problems (ref. 4).
- The introduction of superelevation and curve widening, where the radius is less than a specified minimum for each design speed, will minimise the intrusion of vehicles on to the adjacent lanes, tend to encourage uniformity of speed, and increase vehicle safety at the curves. This consistency is achieved by using minimum acceptable side friction factors between the tyres of a vehicle at the design speed and the road surface. Acceptable friction factors vary from 0.15 to 0.33, the higher values being used with lower speed, tighter radius curves.
- Transition curves may be inserted between tangents and circular curves to reduce the abrupt introduction of the lateral acceleration, and they may also be used to link straights or two circular curves. The full nature of approaching curves must be evident to a driver. Long transitions which mask a sharp final radius should be avoided. However, transition curves may not be worthwhile on low volume roads where speeds are low; and recent research has indicated that circular curves alone may be safer than those with transition curves. Drivers will always trace their own transitional path wherever there is sufficient carriageway width, and if the road itself is circular they are less likely to be caught out by the bend tightening.
- The length of a transition curve should be the sum of the length required to remove adverse camber and the length needed to increase this crossfall to the full superelevation requirement.
- On roads of lower design classes which have substantial curvature requiring local widening, it may be advisable to increase width over a complete section to offer a more consistent aspect to drivers.
- Drainage conditions should be checked to ensure that combinations of fall along and across the road are adequate to remove water from potential 'flat areas'.

Fig 4.12
Superelevation on road in Papua New Guinea (TRL)

Other relevant sections: 4.1.3, 4.1.4, 4.1.7
Key external references: 1, 4

...... areas. Transition curves must not mask the true nature of curves to oncoming drivers. The applications of the above principles are detailed in Road Note 6 (ref. 4) and will prevent intrusion of vehicles onto adjacent lanes and will increase road safety at curves. A maximum superelevation of eight to ten per cent will eliminate most overturning and sliding problems.