Reverse Curves - When horizontal curves reverse direction the connecting tangents shall be long enough to accommodate the standard superelevation runoffs given on Figure 200.04. In no case shall the cross slope rate of change exceed 4% per 20 m.

Broken Back Curves - A broken back curve consists of two curves in the same direction joined by a short tangent section. Broken back curves are unsightly, undesirable and should be avoided.

Alignment at Bridges - If possible, a bridge should be located entirely on a tangent or curve because superelevation transitions on bridges almost always result in unsightly bridge and bridge railing appearance. However, alignment and safety considerations shall govern.

Intersections and Interchanges - If possible, intersections should be on tangent sections or flat horizontal curves with very little superelevation.

Interchanges, such as a typical diamond interchange, include two closely spaced at-grade intersections that function inter-dependently. A tangent alignment should be maintained between intersections for signal visibility and lane assignment determinations required by the motorist.

204 VERTICAL ALIGNMENT

204.01 GENERAL

Vertical alignment consists of a series of grades connected by parabolic vertical curves. It is used to establish elevations for all roadway features. It is controlled mainly by topography, roadway class, horizontal alignment, safety, sight distance, costs, cultural development, drainage, and aesthetics. Steep grades affect truck speeds and overall capacity.

All portions of the vertical alignment shall meet minimum sight distance requirements.

204.02 VERTICAL ALIGNMENT POSITION WITH RESPECT TO CROSS SECTION

The grade line should generally coincide with the axis of rotation for superelevation. Its relation to the cross section should be as follows:

Undivided Roadways - The grade line should coincide with the roadway centerline.

Expressway Connections and Ramps - The grade line may be positioned at either edge of travelled way or centerline if multilane.

Divided Roadways - The grade line may be positioned at either the median centerline or at the ultimate median edge of travelled way. The former case is appropriate for paved medians 9 m wide or less. The latter case is appropriate when:

a) The median edges of travelled way of the two roadways are at equal elevation.
b) The roadways are at different elevations.
c) The median width is ununiform.

204.03 STANDARDS FOR GRADES

Maximum Grades - Table 200.06 lists the maximum grades for design for rural roadways based on design speed and urban roadways based on roadway type.

Minimum Grades - The desirable minimum grades should be not less than 0.3 percent for curbed pavement sections and 0.2 percent in very flat terrain. Minimum grades can be maintained in very flat terrain by use of a rolling profile.

In developed urban areas with extremely flat terrain, flatter minimum grades may be warranted in consideration of adjacent building elevations and offsite drainage problems associated with rolling profiles. The use of minimum grades flatter than those specified above will require case by case approval by the Road Section.