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Thesis

Development of Cost-Effectiveness of New and Improved Design Guidelines for 3D Reverse Horizontal Curves with Intermediate Tangents

Abstract

Current design guides of the Transportation Association of Canada (TAC) and the American Association of State Highway and Transportation Officials (AASHTA) establish the minimum radius requirements for reverse horizontal curves by designing each arc of the reverse curve as a separate simple horizontal curve, on level terrain. This traditional design disregards the effects of both reverse horizontal curvature and vertical alignment. The purpose of this research is twofold: (1) to establish minimum radius and spiral length requirements for three-dimensional (3D) reverse horizontal curves with intermediate tangents based on vehicle stability and (2) to evaluate the cost-effectiveness of the new proposed guidelines for minimum radius. Using vehicle simulation software (VDMRoAD), vehicle dynamics were recorded for the base-case of 2D simple horizontal curves to enable a comparison with reverse horizontal curves with intermediate tangents, superimposed with various vertical alignments.

The results show that an increase in the minimum radius requirements of TAC and AASHTO design guides, ranging from 3% to 29%, is required to compensate for the effects of reverse curvature and vertical alignment. The guidelines for reverse horizontal curves with intermediate tangents developed in this research, besides achieving vehicle stability requirements, were found to be more cost-effective than the traditional North American guidelines.

Degree

M.A.Sc.

Completion

2004

Supervisors

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