Yasser Hassan

Thesis

Geometric Design Considerations of Combined Horizontal and Vertical Highway Alignments

Abstract

The process of highway design is a complex one where many phases are incorporated to achieve safe, efficient, economical, and aesthetically pleasant highways. Among these phases, geometric design is the most related to traffic safety. Highway efficiency, economics, and aesthetics depend on the decisions taken in the geometric design phase. Thus, design standards have been set to guarantee the achievement of the design objectives. However, these standards are based on a 2-D modeling of highways where the horizontal alignment, vertical alignment and cross-section are designed separately. In this research, a framework is presented for 3-D combined highway alignments to jointly design all highway elements based on sight distance, vehicle stability, driver comfort, drainage and aesthetics. Specifically, this research focuses on the daytime sight distance and its related aspects. First, a revised model for the required passing sight distance and minimum length of passing zones is developed, and the resulting passing sight distances show good agreement with field measurements. Second, a new concept for positioning the beginning and end of passing zones is presented and modeled analytically. Third, the available sight distance on complex 2-D horizontal and vertical alignments and 3-D alignments is modeled. Computer software are developed based on these analytical models, and each software is verified graphically or by field measurements. Applications of the developed models and software are presented in marking design. The application of the developed models for the required passing sight distance shows the need for revisions in the marking standards to ensure safety and efficiency of the traffic operation. The models for available sight distance provide a useful tool to replace the current graphical and field practices to establish the no-passing zones on two-lane highways. Such a tool would avoid the potential human errors, reduce the cost and minimize the time required for marking. A comparison with the current design standards may compromise highway economics or traffic safety. As a result, the need for revisions in the design standards based on 3-D alignments is established.

Degree

Ph.D.

Completion

1996

Supervisors

Abd El Halim, Easa