VALIDITY OF AASHTO SIGHT DISTANCES IN GEOMETRIC DESIGN OF EXPRESSWAYS IN SRI LANKA

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DECLARATION

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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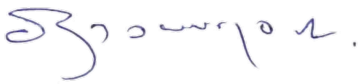
The above candidate has carried out research for the Masters thesis/dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Prof. W. K. Mampearachchi

Signature of the Supervisor:  Date: 02.07.2025

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R. A. D. Perera

ABSTRACT

Sight distance is a critical design parameter in the geometric design of highways, directly influencing their operational efficiency and safety, particularly under nighttime conditions. Stopping sight distance is a fundamental requirement for all types of highways, playing a key role in horizontal curves, crest vertical curves, and sag vertical curves, which are essential components of highway geometry.

This research evaluates the validity of AASHTO sight distance criteria in the geometric design of expressways in Sri Lanka. The study involved analyzing accident data from the Southern Expressway to identify critical locations and reviewing their design compliance with AASHTO guidelines. Additionally, sight distance variations were compared with geometric design standards of other guidelines, such as Japan, Australia, Austria, Britain, United States, Canada, France, Germany, Greece, South Africa, Sweden, and Switzerland, to highlight key differences.

The analysis was conducted using accident data from a 126 km section of the expressway. A preliminary assessment was performed at 10 km intervals using accident frequency data, followed by an advanced analysis at 1 km intervals using the 85^{th} and 90^{th} percentile accident values. The most critical sections were further examined at 100 m intervals, where accident distribution percentiles were considered to pinpoint high-risk locations.

To enhance the analysis, questionnaire responses from general public, mainly drivers and road users were collected through online surveys, telephone conversations, and in-person interviews at toll booths and bus stations. These responses provided insights into real-world driving experiences, visibility challenges, and safety concerns related to sight distance.

Accident-prone locations were evaluated for compliance with AASHTO sight distance and object height criteria. Crest and sag vertical curves were assessed for specific driver eye and object heights, including nighttime headlight sight distance. Passenger comfort was analyzed based on a 0.3 m/s^2 centripetal acceleration limit, while drainage control was reviewed for Type III vertical curves. The general appearance of vertical curves was examined using the rule-of-thumb method, and horizontal curves were assessed for lateral clearance at a 120 km/h design speed.

The study found that the Southern Expressway's design meets AASHTO sight distance and object height criteria at critical locations. However, differences in stopping sight distance and vertical curve length compared to international standards were observed (0+600, 5+900, 87+300, 93+000), primarily due to variations in friction coefficients, deceleration rates, and object height assumptions. The current standard for expressways in Sri Lanka specifies an object height of 0.6 m (2 feet) for visibility assessments. Considering the height of animals crossing the road, record of animal collisions, questionnaire responses suggest that maintaining an object height of 0.15 m (6 inches) improves safety and helps reduce the risk of animal collisions.

Keywords: Stopping sight distance; Geometric design parameter; Horizontal curve; Vertical curve; Headlight sight distance; Questionnaire responses.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials
EOM&M	Expressway Operation Maintenance & Management
RDA	Road Development Authority
EO-1	Southern Expressway
EO-1-1	Kottawa to Godagama Road Section
EO-1-2	Godagama to Mattala Road Section
SSD	Stopping Sight Distance
C/L	Center Line

LIST OF ANNEXES