INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Modeling Operating Speed for Geometric Design Consistency and Safety Assessment of a Two-lane Rural Highway located in Mountainous Terrain

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SHORT ABSTRACT

The objective of this study was to develop the operating speed models for evaluating the geometric design consistency of a two-lane rural highway passing through mountainous terrain. Speed data were collected from eighty-six horizontal curves of the Shillong bypass, located in Meghalaya, India. This study hypothesised that a single model would be incapable of predicting the operating speed observed at the horizontal curves superimposed with the vertical alignment and a further understanding of the driver's perception was needed.

This study assumed that the speed and path radius adopted by the drivers while traversing the curves reflected the perception. Analysis of the speed variability and the difference between path radius and curve radius showed that the curve direction and superimposed horizontal and vertical alignments significantly influence the driver's perception. Curve direction and the type of superimposed vertical alignment were considered as the criteria for clustering the curves. Based on these two criteria, the curves were clustered into eight groups. The other important aspect that needs a due consideration in the operating speed model (OSM) for mountainous terrain is the role of sharp curves and long tangents. The existing practice for the development of OSMs cannot capture such distinctive elements as the data are significantly biased to the geometric elements constituting a major part of the alignment. Hence, the present study develops the operating speed models considering the selection bias and heteroscedasticity in the sampled data through the Robust Weighted Least Square (RWLS) approach. Gradient at approach tangent (G_1), curvature change rate (CCR and CCR_S), length of the vertical curve (L_V), length of approach and exit tangents (L_{at} *and* L_{et}), and the interaction of radius with lane width ($R \times LW$) were found to be significant in the OSM.

Safety criterion II shows the highest level of agreement between the endangerment and the consistency, across the vehicle categories. Therefore, this study emphasizes that the successive element design consistency is a better approach for evaluating the consistency. The endangerment of the trucks was showing a better agreement with the overall safety criteria (84-89%) than that of the passenger cars (57-61%). Since trucks have a higher proportion in the crash data, it is more accurate to use the truck endangerment for evaluating the design consistency. The findings from this study could be further improved by considering the curves superimposed with more than one vertical curve.