UNIVERSITI TEKNOLOGI MARA

MACROSCOPIC AND MICROSCOPIC TRAFFIC PARAMETER MODELS FOR OPERATING SPEED ON HORIZONTAL HIGHWAY CURVE

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ABSTRACT

Operating speed is known by the maximum speed of the road users operate their vehicles along a travel path under favorable traffic and weather on the horizontal curve of a two-lane rural highway under free flow conditions, the 85th percentile distribution has been observed to be the most frequently used method to measure the operating speed associated with the geometric features. Meanwhile, the design speed includes logical consideration reflecting the topography, function of all class highway and operating speed. Locally, until the recent release of guideline by the authorities, the Public Work Department in 2015 has not embedded the Operating Speed Model in their document. With the existence of the model, it will enable the designer to anticipate the speed of vehicles travelling along a distance. The speed prediction is considered essential because it can produce an estimated speed in handling the vehicle. This will assist in reducing accident risks at curves, 85th percentile speed prediction model is needed for the Malaysian scenario to ensure the speed design relevancy. The study aims to establish an Operations Speed model based on local environment, targeting at the curve section. This will also take into consideration the geometric factor, traffic factor and road roughness. As for methodology, several tools were applied for data collection across Malaysia namely Laser Gun, Video VBOX, Ball Bank, Roughnometer and Automatic Traffic Classifier. The captured data can be grouped as geometric data, traffic data and comfort data. The Multiple Liner Regression was applied in constructing the Operating Speed Prediction Model. The study was conducted on 9 sites throughout Malaysia. Each site has different site parameter of geometric and traffic composition. Completion of this study has resulted in three significant models being developed namely V_{D85CS}, V_{85CM} and V_{85CE}. To confirm the usefulness of the models in performing the prediction of the operating speed, the developed models were then further validated by performing t-test, RMSE, MAPE and MAE by comparing the developed models with empirical data, and also further compared with existing models from Transportation Association Canada, Federal Highway Association and Institution of Engineers Malaysia. The developed models were test for its sensitivity to identify the effect of changes on each individual variable for the developed models. The comparison shows that the developed models are more superior for local traffic environment. Therefore, the developed models in this study are proposed to be a starting basis of the 85th percentile speed model to be implemented in the Malaysian geometric road design guidelines. The guidelines are to be issued by the Public Work Department of Malaysia.

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CHAPTER ONE
INTRODUCTION

1.1 Background of Study

Highway designers should not only consider the economic value but they need to take into consideration the safety aspects of human factors while maneuvering along horizontal curves on their wheels. This can be achieved by modification on the highway geometric design in order to obtain smooth and safe traffic operation. The implementation of the proper design and selection of optimum geometric specification in design can contribute to safer highway and traffic movements in urban and rural roadway roads. In general, highway planners and designers play important roles in highway geometric designing that could contribute to the safety of road users, and thus, enable achievement of sustainable road infrastructure.

The development of the operating speed model keeps on evolving since 1950s (Taragin, 1954) up to recent years. It can be seen that the operating speed model keep being upgraded and improved to reflect the current needs and localized traffic environment. The number of operating speed is expanding, this is to accommodate the most recent model with the new parameter, localized model to suit a certain geographical location or traffic demand and also due to the change in time that indirectly revolutionize the technology (K. Fitzpatrick, Carlson, Brewer, Wooldridge, & Miaou, 2005) (Sun, He, Wang, & Wang, 2010). Some models are applied directly as part of the guideline and design by Canada. For example, in Malaysia, a few models are available for the operating speed, however, the model by Syed Abbas, Adnan, & Endut (2011) was found to be focusing on the middle curve model for horizontal rural highway. The model was developed based on a study conducted on a single geographic location.

Models for this study were developed based on 9 local sites, throughout Malaysia. The selected site was from rural two lanes horizontal highway. The selection of site across Malaysia is generalized to whole traffic to reflect the Malaysian traffic. The models of this study incorporated geometric, comfort and traffic parameters in order to provide the appropriate model for operating speed model for Malaysian traffic on rural two lanes horizontal curve.

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