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SIMULATION MODEL OF TRAFFIC OPERATIONS ON SINGLE CARRIAGEWAY ROADS: MODEL CALIBRATIONAND VALIDATION

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ABSTRACT

The current Malaysian procedure for a detailed evaluation of the capacity and effects of various road and traffic characteristics for single carriageway roads, which is adopted directly from the American Highway Capacity Manual, is inadequate and inaccurate since several aspects used in the method such as the consideration of the recreational vehicles and trucks are not directly applicable to the Malaysian traffic characteristics. The validity of the analysis is debatable since the way in which the effect of motorcycles on overall performance of the roadways is considered is not clear. The existing simulation models of traffic operations on single carriageway roads also suffer from a similar weakness. Therefore, there is a need to develop a comprehensive traffic simulation model to carry out this task. Such a model must be capable of simulating traffic behavior for a range of road layout and geometry, at junctions and compositions of traffic which include motorcycles. This paper describes the development of a simulation model of traffic operations on single carriageway roads to assess and evaluate the speed/flow relationships and hence the road capacity from the simulation model for a given road geometry and traffic demand.

Keywords: simulation model, traffic behavior, capacity, traffic operations.

INTRODUCTION

The rapid growth of road traffic has become a major concern to traffic engineers and transportation planners worldwide. This rapid growth has affected not only the road traffic behaviour but also the travel pattern of the community to commute from their origin to any of their preferred destination. The trend in Malaysia shows that the number of vehicles on the road has increased every year [1].The increment of the number of vehicles on the road will have a significant effect on the capacity of the road and the level of service, and it will also increase the road congestion especially during peak hour.

With the advances in computers and simulation techniques, it is now possible to model any roadway network and simulate traffic flow on the roads in a very realistic fashion. Traffic simulation modeling is becoming more attractive and effective tools in studying traffic issues. This enables traffic engineers and transportation planners to investigate the effect of changes in the network geometry, capacity analysis and traffic control strategies on traffic performance. The purpose of this study is to develop a simulation model of traffic flow on single carriageway roadways for a given road geometry and traffic demand.

METHODOLOGY

Capacity defined as a measure of the effectiveness of the road in accommodating traffic. TRB (2000) [2] stated that the definition of capacity is based on the maximum sustainable rate per hour where individuals or vehicles could be expected to go through a point or at an identical section of lane or road in a specific duration of time under usual road, traffic and the controlled situation. Observing flow phenomena at or near capacity is a challenge to attain practically. After HCM was first published in 1965, therehas been extensive discussion of methods for capacity evaluation [3]. Peterson (1977) recommended that diverse methods discovered different resolutions to identical issues.

Factor affecting speed/flow relationship and capacity

The operational characteristics of single carriageway roads are determined by the following factors:

- Lane width and lateral clearance
- Vertical and horizontal alignments
- Traffic composition
- Directional split
- Environmental effects
- Traffic interruptions

Simulation model of traffic flow

The main behavioural sub-models used in microsimulation in traffic flow are described below.

a) Car following model

Car following model is of particular importance to traffic safety. Not only because close following with excessive speed is known to increase the risk for rear-end collisions, but also because car following behavior determines the distribution of gaps that exist at any particular point of measurement in a traffic stream. Researchers such as Gazis *et al* (1961) [4], May *et al* (1967) [5], Kohler (1979) [6], Gipps (1981) [7], Miyahara (1994) [8], Cho (2008) [9], had studied and modeled drivers' car following behavior. Their studies and models varied in objectives and ranged from an empirical