MOE-Analysis for Oversaturated Flow with Interrupted Facility and Heterogeneous Traffic for Urban Roads

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ABSTRACT

Speed–flow functions have been developed by several transportation experts to predict accurately the speed of urban road networks. HCM Speed-Flow Curve, BPR Curve, MTC Speed-Flow Curve, Akçelik Speed-Flow Curve are some extraordinary efforts to define the shape of speed-flow curves. However, the complexity of driver's behaviour, interactions among different type of vehicles, lateral clearance, co-relation of driver's psychology with vehicular characteristics and interdependence of various variables of traffic has led to continuous development and refinement of speed-flow curves. The problem gets more difficult in the case of urban roads with heterogeneous traffic, oversaturated flow and signalized network (which includes some un-signalized intersections as well). This paper presents analysis for various measures of effectiveness (MOE) for urban roads with interrupted flow comprising heterogeneous traffic. Model has been developed for heterogeneous traffic under constraints of roadway geometry, vehicle characteristics, driving behaviour and traffic controls. The model developed in this paper predicts speed, delay, average queue and maximum queue estimates for urban roads and quantifies congestion for oversaturated conditions. The investigation details the oversaturated portion of flow in particular.

Key words: Density (k), Speed (v), and Flow (q), Oversaturated Flow, Interrupted Flow, Traffic Congestion, Intersection, Heterogeneous Traffic, Microscopic Simulation, Average Delay Time per Vehicle, Average Speed, Queue Length, Level of Service (LOS).

INTRODUCTION

Traffic streams are described by three variables: density (k), speed (v), and flow (q), measured respectively in vehicles per lane per km., km. per hour, and vehicles per lane per hour. At the macroscopic level these variables are defined under stationary conditions at each point in space and time, and are related by the identity $q = k \times v$. Driver behaviour creates a second functional relationship between the three variables. Though studied for several decades; understanding about the shape of this curve continues to evolve. The precise shape on a given road segment depends on various factors. These include the number and width of traffic lanes, grade, road curvature, speed limit, location vis-à-vis entrance and exit ramps, weather, mix of vehicle types, proportion of drivers who are familiar with the road, and idiosyncrasies of the local driving population [1, 2, 3, 4].

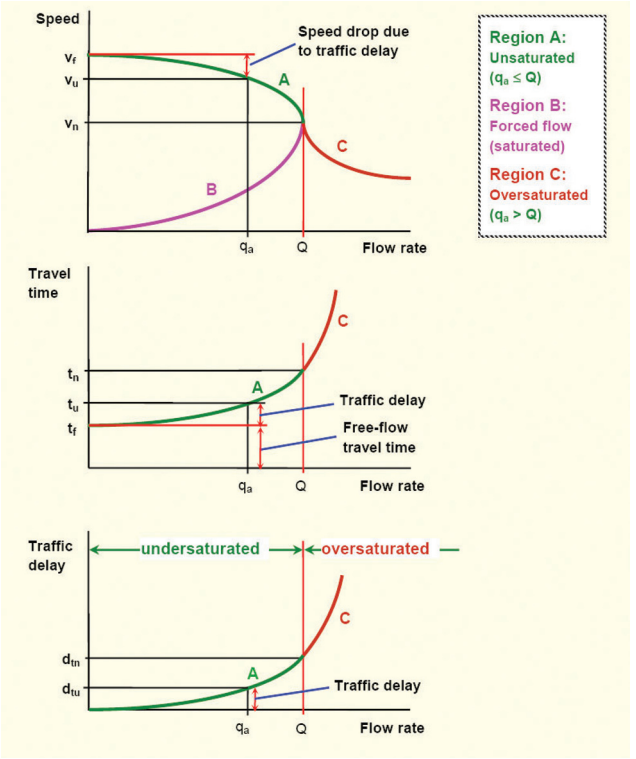

Figure 1. Speed, travel time and delay as a function of flow rate for uninterrupted traffic streams [2]

In Fig. 1 region A represents under- saturated conditions with arrival flows (q_a) below capacity ($q_a \le Q$) which is associated with uninterrupted travel speeds. Uninterrupted travel speed at a given flow rate (v_u) is between v_f and v_n ($v_f \ge v_u \ge v_n$) where v_f is the