MODELLING AND SIMULATION OF VEHICLE SPEED GUIDANCE IN CONNECTED VEHICLE ENVIRONMENT

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Abstract
Most previous works on urban traffic efficiency focused on the optimization of signal timings, assuming vehicle speed was fixed or followed a giving distribution. In this paper, based on the two way communication between vehicles and signal controller in Connected Vehicle (CV) environment, we developed two vehicle speed guidance methods to decrease delay and number of stops at intersections. By using Visual Basic and VISSIM COM interface, the simulation model consists of three modules: the signal timing, the vehicle speed guidance, and the dynamic optimization. A field intersection of Cao’an Road and Lyuuan Road in Shanghai is employed for simulation tests. Compared with the simulation results optimized by classical signal control method, the proposed methods can significantly decrease delays and number of stops, and improve the efficiency of traffic control.

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Key Words:  Traffic Simulation, Speed Guidance, Connected Vehicle, Signalized Intersections

1. INTRODUCTION

As a result of rapid urbanization and motorization in China in the past 2 decades [1, 2] traffic congestion has become a severe issue and even a major cause of urban traffic and environment problems [3, 4]. An increasing number of researchers have recognized that decreasing delay and number of stops at signalized intersections is a potentially effective strategy for relieving traffic congestion. In practice, there is also an increasing emphasis on efficient traffic signal operations and strategies in many big cities within developing countries, such as Beijing, Shanghai, and Jinan in China. Compared with the considerable amount of time and resources to build urban expressway, inexpensive solutions that do not involve new infrastructure investment are more desirable [5-7].

Traffic signal optimization is one of these promising low-cost options. Since Webster proposed the original signal timing method, which resulted in a significant reduction of vehicle delays [8], many studies have proposed signal timing strategies and documented the benefits of signal timing program implementations. Most of the literature falls into the following two classes: mathematical programming approach and simulation-based approach [9]. Mathematical programming approach employed a set of mixed integer linear programming (MILP) formulations to minimize the total intersection delays or to maximize the green bandwidth [10-12], while simulation-based approach are developed to represent the complicated interactions between traffic flow interactions and signal timing parameters [13-15].

Most previous studies, including isolated intersection signal timing methods [16, 17] and coordinated signal timing methods [18, 19], focus on optimizing signal timings without considering speed. Even with a small traffic demand, real-time travel speed is a function of


