

Abstract (English)

This paper analyses the relationship between vehicle velocity and traffic density on Bojongsoang Road, Bandung, focusing on the effects of obstacles such as parked vehicles and large trucks. The study derives velocity-density functions for scenarios with and without obstacles using the macroscopic Lighthill-Whitham-Richards (LWR) model and second-order polynomial regression. The observational data were collected over a 40-meter segment of Bojongsoang Road through stationary camera recordings, capturing the variations in vehicle density and speed under different conditions. The derived velocity functions are $v(\rho) \approx -21.391\rho^2 + 21.330\rho + 6.049$ for traffic without obstacles and $v(\rho) \approx -17.251\rho^2 + 13.143\rho + 5.704$ for traffic with obstacles. The results indicate that obstacles significantly reduce vehicle velocity and increase congestion. Numerical simulations using the Lax-Wendroff scheme demonstrate stable density distributions without obstacles. In contrast, the presence of obstacles causes notable fluctuations, particularly in the middle section of the road. These findings emphasize the importance of effective obstacle management in improving traffic flow stability, road safety, and overall user comfort. This study highlights the potential benefits of targeted traffic management strategies in optimizing traffic conditions.

Keywords: Traffic flow, velocity-density function, polynomial regression, Lax-Wendroff scheme, road obstacles.
