Abstract

Understanding traffic flow dynamics is crucial for optimizing traffic management and reducing congestion. Traffic congestion is a widespread issue in urban areas globally, significantly impacting daily commute times. This paper presents an analysis and simulation of a traffic flow model with a velocity-density function. The velocity- density function obtained from linear regression method. The traffic flow model is characterized by a macroscopic approach that considers vehicle interactions. This model is commonly referred to as the Lighthill, Whitham, and Richards (LWR) model. The data was collected through real observations on Bojongsoang Highway in Bandung, West Java, Indonesia. Data processing involves calculating time intervals (ΔT), density, and velocity. The processed data was then used to develop and validate the velocity-density function. The approximation of the velocity-density function using the linear regression method is given by $v(\rho) = -10.028\rho + 5.034$. Using Upwind Scheme, at the final simulation time of $t = 5$ minutes, peak congestion is observed at $x = 28$ meters with a density of $\rho = 0.39$. The lead vehicle, following $v(\rho)$, reaches $x = 40$ meters. It can be concluded that linear regression effectively determines the velocity-density function in simulations using upwind scheme.

Keywords: linear regression, traffic flow, velocity-density, simulation.