

Abstract

Treiterer's Legacy – Traffic Flow Measurements and Characteristics

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This paper will present the highlights of contributions of the late Professor Joseph Treiterer to traffic flow theory, characteristics, data collection methods, platoon dispersion, and automated vehicle control areas. Treiterer was pioneer researcher and about 40 years ago tested the application of infrared radar for longitudinal control of vehicles on highways. After 35 years, his collection method for the trajectory data that captured the disturbance in traffic flow is still unmatched. Treiterer studied the traffic dynamics using aerial photogrammetry and developed methods for data reduction and analysis of aerial photos. He continuously recorded the traffic movement on I-71 by following platoons of vehicles from a helicopter with an aerial camera. His data collections method was unique and enabled him to follow the propagation and dissipation of traffic disturbances through platoons of vehicles. He was able to capture the hysteresis phenomenon in traffic flow. Treiterer showed that there are loops in q-k curves (A loop and B loop) and showed that a rapid “jump” in flow rate (or speed) occurs when state of traffic was about to change from congested state to uncongested state. Treiterer also found that neither safe traffic flow criterion nor marginally safe traffic flow criterion was satisfied for about 11 percent of the total observation time, which indicated the inherent danger in platoon movement on freeways. This highlighted the need for a longitudinal control system capable of monitoring the safe spacing of vehicles traveling in a platoon. Treiterer studied the application of infrared technology for longitudinal control of vehicles. He found that speed difference between the lead and trailing vehicles and the acceleration pattern of the lead vehicle could be the most useful information to improve traffic safety and increase traffic capacity through such a remote-sensing system. Then, traffic studies on I-70 were carried out by aerial surveys to obtain further data on the hysteresis phenomenon. He found that the shape of the q-k curves and thus the hysteresis phenomenon was not the same for single disturbance compared to multiple stop-and-go conditions. Treiterer studied the effects of signal spacing on platoon dispersion and characteristics as they passed through nine signalized intersection on an urban arterial. This comprehensive data included platoon size, lane distribution, lane change maneuvers, and traffic breakdowns on 28 platoons. He developed models to predict queue lengths and vehicle delays as a function of signal offset and spacing conditions. Treiterer found that platoon size effected platoon behavior. Platoon velocity seemed to decrease as platoon size increased. He also found that initial acceleration characteristics of the smaller-sized platoons (4-6 vehicles) were higher that of the larger-sized platoons (10-13 vehicles). He developed a mathematical model to simulate the behavior of a platoon of vehicles passing through a group of intersections Treiterer also developed a technique for collecting simultaneous traffic data on all approaches of an intersection utilizing time lapse photography.