Florida Department of Transportation Research

Evaluation of Free Flow Speeds on Interrupted Flow Facilities

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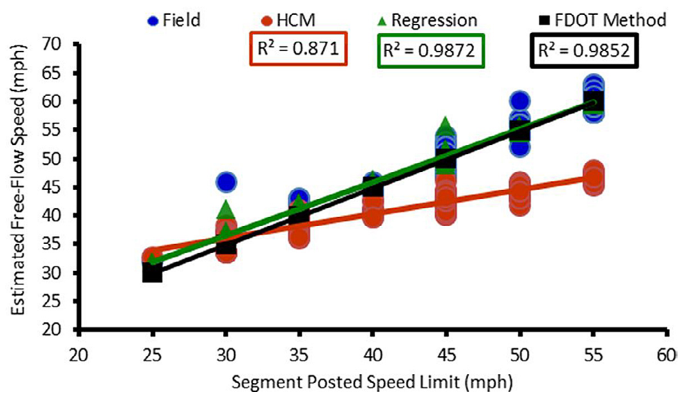
Free-flow speed is a parameter that plays an important role in planning, operational analysis, and performance evaluation of transportation systems. Ideally, free-flow speed would be determined by field observation, but this is often hampered by constraints of time and resources needed to obtain sufficient sample size of free-flowing vehicles. To overcome these challenges, the Florida Department of Transportation (FDOT), like many other agencies, uses modeling methods to predict free-flow speed.

The FDOT Quality/Level of Service Handbook uses a simple model to obtain a reasonable estimate of free-flow speed: add 5 mph to the posted speed limit. As the FDOT Systems Planning Office transitions to using the 2010 Highway Capacity Manual (HCM 2010), concerns have been raised about the accuracy of the HCM 2010 speed prediction method, which uses nine independent variables to predict free-flow speed: speed limit; proportion of segment length with restrictive median; proportion of segment with curb on right side; number of access point approaches on right side in subject's direction of travel; number of access point approaches on right side in opposing direction of travel; segment length; width of signalized intersection; number of through-lanes; and distance between intersections.

FAMU-FSU College of Engineering researchers compared the performance of the HCM 2010 and the FDOT prediction methods using speed data from 104 roadway segments located on interrupted flow arterials. Speed data from 84 of these segments came from permanent traffic monitoring sites; data from the other 20 segments were collected using pneumatic tube counters. The speed limit on these roadway segments ranged from 25 to 55 MPH.

The relationship between posted speed limit and field-estimated free-flow speed is shown in the scatterplot. Also shown on the scatterplot are free-flow speed data points predicted by the HCM 2010, FDOT, and a best-fit model developed by the researchers.



The authors' regression model (green line) correlated to field data than either the FDOT or HCM methods.

Results showed that the HCM 2010 model underpredicted when field free-flow speed is 40 mph or higher. Because of fewer segments with posted speed limit less than or equal to 35 MPH, the efficacy of the HCM 2010 prediction model cannot be ascertained in this speed range. The FDOT method seemed to perform well, judging by the high coefficient of determination, R^2, of 98.52%. Statistical analysis of the researchers' best-fit model for these data showed that only a few independent variables were significant in predicting free flow speed: speed limit; proportion of segment length with restrictive median; and proportion of segment with curb on right side. However, it should be noted that the best-fit model has not been validated using a different set of data due to resource limitations.

The use of modeling techniques to determine free flow speed creates the need to continuously search for simple, accurate, and most cost-effective models for use in planning and operational analysis.

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