Florida Department of Transportation Research
Heavy Vehicle Effects on Florida Freeways and Highways
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Essential for roadway planners is understanding how roadways accommodate traffic and how traffic affects performance and durability of roadways. The variety of road configurations, vehicles, and roadway users makes this complex. The Florida Department of Transportation (FDOT) uses FREEPLAN and HIGHPLAN, programs based on the Transportation Research Board's Highway Capacity Manual (HCM), for freeway and highway level of service (LOS) analyses.

HCM-based traffic flow operations analyses view traffic streams in units of passenger cars; heavy vehicles are converted to an equivalent number of passenger cars through passenger car equivalency (PCE) values. Current HCM freeway and multilane highway PCE values are based on studies from the mid 1990s. Since that time, commercial truck drivetrain capabilities have improved. Loading conditions have also changed due to the increased amount and percentage of freight moved by truck. Also, the HCM PCE values rely outdated simulation modeling and one "typical" truck type.

In this project, University of Florida researchers developed more accurate PCE values for the current truck fleet on Florida freeways and multilane highways were developed, based on results from a state-of-the-art microscopic simulation program, CORSIM-NG, which employs a comprehensive vehicle dynamics approach that utilizes physical vehicle and drivetrain characteristics to estimate truck acceleration performance with greater accuracy than other simulation program.

Current truck fleet information specific to Florida freeways and multilane highways, including average annual daily traffic, truck classification, total truck volume, and typical weight loadings, was developed from data from FDOT's 24 weigh-in-motion stations. From this, researchers identified three truck types for which separate PCE values should be developed: single unit, combination, and double trailer.

Heavy vehicles are a common sight on Florida's highways, and more precise tools are required to plan for their needs and impacts.

An experimental design that resulted in over 300,000 simulation runs generated PCE values used in regression analysis to develop PCE estimation equations for the three truck types. Unlike the HCM PCE values, which depend only on length of grade, steepness of grade, and truck percentage, the PCE estimation equations developed in this project included additional factors: number of lanes, free-flow speed, and flow rate. The PCE values increased with increasing magnitude of grade, length of grade, free-flow-speed, flow rate, and proportion of trucks and decreasing number of lanes.

It is difficult to directly compare PCE values from this study with those HCM 2010 values because the HCM values are much more generalized. However, for similar input conditions, PCE values from this study are generally slightly lower, largely due to higher power-to-weight ratios of the trucks used in this study and more detailed vehicle dynamics modeling. Generally, for the range of input values given in the HCM PCE tables, the range of PCE values estimated from the equations in this study are as follows: 1.18-3.42 for single unit trucks, 1.21-3.57 for combination trucks, and 1.32-4.08 for double trailer trucks.