Florida Department of Transportation Research

Enhanced Hydroplaning Prediction Tool

August 2020

Project Number
BE570

Project Managers
Charles Holzschuher
FDOT Materials Office

Principal Investigator
Hyung Lee
Applied Research Associates, Inc.

Current Situation

Hydroplaning occurs when a film of water causes tires to lose contact with the pavement, and usually results from driving too fast for the conditions. To better understand the factors that affect hydroplaning, in 2012, the Florida Department of Transportation (FDOT) developed a tool for predicting the traveling speed at which a vehicle begins to hydroplane. This requires a complicated calculation that involves pavement characteristics, roadway geometry and design, rainfall event details, temperature, and driver and vehicle factors. FDOT decided to revisit this issue to improve and extend the hydroplaning prediction software and to make it easier to use, based on several years of user experience.

One of the hazards of driving is rain is the possibility of hydroplaning, which can cause a driver to lose control of a vehicle.

Research Objectives

Researchers at Applied Research Associates, Inc., updated FDOT's Hydroplaning Prediction (HP) software as well as adding new features and capabilities.

Project Activities

The researchers reviewed the literature to update the models at the core of the HP software: the empirical water film thickness (WFT) and hydroplaning speed (HPS) models. The HP software was reviewed extensively to identify any bugs or shortcomings. A comparison of the current software and the desired software indicated that many features that may be useful to the users are lacking.

Roadway characteristics such as texture and permeability that are collected by FDOT and used in the software were reviewed in an attempt to develop the necessary relationship between mean texture depth (MTD) and mean profile depth (MPD) and to characterize the permeability of in-service pavement surfaces.

Building on the lessons learned from the previous HP software, FDOT's new HP software was implemented in a macro-enabled Excel spreadsheet environment. The new program allows for three different WFT models and four different HPS models (i.e., total of twelve combination of WFT and HPS models).

Given the complex nature of hydroplaning prediction, the new HP software adds capability to study the effect of certain variables on WFT and HPS (i.e., sensitivity analysis) or for studying the uncertainties associated with the input variables (i.e., probabilistic analysis). The new tool was validated against the examples provided in previously published literature. The validation results showed that the WFT and HPS equations are correctly implemented in the new software.

Project Benefits

Updated hydroplaning prediction software will improve the ability to design safer roadways for Florida regularly rainy environment.

For more information, please see www.fdot.gov/research/.