TECHSUMMARY February 2015

State Project No. 30000424 / LTRC Project No. 12-1PF

Traffic and Data Preparation for AASHTO DARWin-ME Analysis and Design

INTRODUCTION

Although the Mechanistic Empirical Pavement Design Guide (MEPDG), now called Pavement ME Design, is a significant advancement in pavement design, it requires much more input from designers. Many data sets, such as weigh-in-motion (WIM) traffic data, need to be pre-processed before use in the MEPDG procedure. In addition, MEPDG models were developed using nationwide data sets, and require local calibration. Therefore, it is critical to have a supporting database platform that is able to pre-process certain input data sets for both quality and format, and support the local calibration and implementation of Pavement ME Design.

OBJECTIVE & SCOPE

The research team of the transportation pooled fund study TPF-5(242) is tasked with enhancing the existing Prep-ME software, aiding participating states utilize the tool in data preparation, and improving the management and workflow of Pavement ME Design input data. The objective of Prep-ME is to be used as a critical tool for calibrating and implementing the Pavement ME Design. For production use, the Prep-ME software needs to excel in speed, usability, functionality, and stability.

The scope of this study includes: (1) recognizing the differences in loading patterns or traffic groups and estimating full axle load spectrum data occurring under different conditions based on large amount of WIM data; (2) developing algorithms to examine raw WIM data for quality and conduct data operations to salvage usable information in WIM data; (3) customizing Prep-ME for participating states; and (4) preparing and conducting training for personnel from participating states.

METHODOLOGY

Based on the features and stability of the existing Prep-ME originally developed for the Arkansas Highway and Transportation Department (AHTD) in 2009, a unified and consistent architecture is re-designed, documented, and implemented in this project. The redesign allows for the most seamless integration of the design recommendations by the Prep-ME participating states while giving end-users a stable, fast, and modern software system. The improvements of the user interfaces, software efficiency, software functionality, and software stability are implemented based on close consultation with participating states' requirements.

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Three face-to-face meetings were held during this project. The attendees included the representatives of participating states as well as experts from other states, industry partners, and universities. The purpose of the meetings was to develop the objective and scope of the study, demonstrate software capabilities and gain feedback from participating states, explore the opportunity of cooperation to help state highway agencies by reviewing the best approach available to the issues to be addressed in this study, brainstorm the scope and tasks that the study should include in addition to the current functions in the Prep-ME software, and prioritize tasks based on the available funding.

CONCLUSIONS

This pooled-fund study developed a full-production software Prep-ME with comprehensive database features capable of pre-processing, importing, checking the quality of raw WIM traffic data, and generating three levels of traffic data inputs with in-built clustering analysis methods for Pavement ME Design. This tool can be used not only by pavement design engineers to prepare input for Pavement ME Design, but also traffic engineers to collect better traffic data and manage those data for other applications. The software has the following basic functions with more specific features requested by individual states.

1. Import an agency's WIM traffic data complying with FHWA Traffic Monitoring Guide (TMG) file formats, and store the data in SQL server Local database with exceptional computation efficiency.
2. Conduct Travel Monitoring Analysis System (TMAS 2.0) data check and generate TMAS check error log for each imported raw file.
3. Perform automatic quality control checks by direction and lane of a WIM station for both classification and weight data following algorithms defined in TMG.
4. Provide user friendly interfaces to review monthly, weekly, and daily traffic data, and investigate the WIM data that is incomplete or fails the automatic QC check through various manual, sampling, and analyzing operations
5. Generate three levels of traffic inputs and defaults: Level 1 site specific, Level 2 clustering average, Level 3 state average, and LTPP TPF-5(004) defaults, in the file formats that can be directly imported into MEPDG and Pavement ME Design software.
6. Implement clustering methods developed by North Carolina, Michigan DOTs, Kentucky Transportation Cabinet (KYTC), the Truck Traffic Classification (TTC) method, and the simplified TTC approach.

A number of other features in Prep-ME may be useful to any highway agency, including (1) importing raw climatic data and exporting XML climate files for Pavement ME Design; (2) populating and exporting material inputs including E* for HMA, CTE for PCC, and soil properties based on soil map for Pavement ME Design; and (3) importing FWD raw files and preparing FWD XML file for Pavement ME Design inputs.

RECOMMENDATIONS

Several participating states have used Prep-ME-ME within their agencies to:

- Help state traffic engineers conduct an effective QA/QC check on traffic data collected
- Help state pavement design engineers to analyze the traffic WIM loading data and select the spectra for pavement design at three different traffic input levels for Pavement ME Design local calibration and implementation

Implementation and testing of the Prep-ME software is an integral and important phase for the software development life-cycle. More testing by participating states is expected along with the proposed training and support in the future years by the research team.