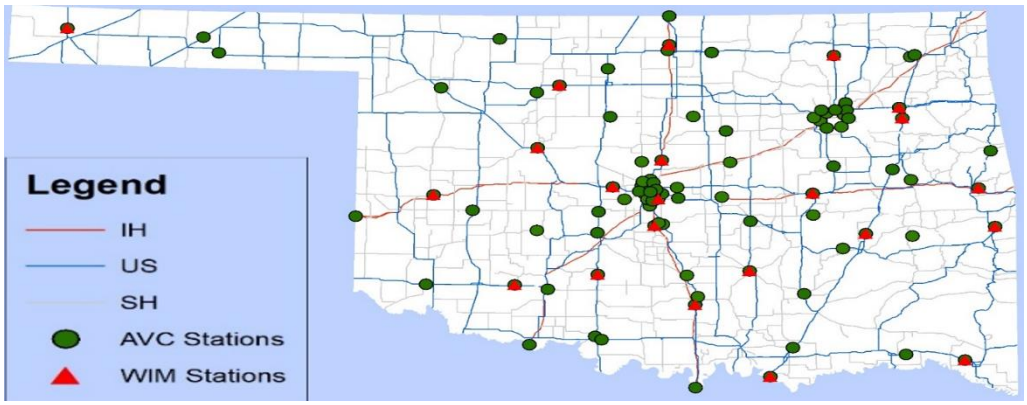
HIGHLIGHTER

DEVELOPMENT OF STATEWIDE WIM DATA QUALITY CONTROL, AXLE LOAD SPECTRA AND TRAFFIC VOLUME ADJUSTMENT FACTORS FOR OKLAHOMA

December 2018

OVERVIEW Traffic loads are one of the key data elements required for the design and analysis of pavement structures. The Mechanistic Empirical Pavement Design Guide (MEPDG), later named as DARWin-ME and Pavement ME Design, proposes a more rational approach than traditional ESALs to characterize traffic in terms of full axle-load spectrum, which requires automated traffic collection techniques. However, automated traffic data often have errors, particularly for data collected from weigh-in-motion (WIM) sites. The Oklahoma Department of Transportation (ODOT) operates WIM stations statewide (shown below) and is actively adopting portable WIM programs. Recognizing that no comprehensive study has been conducted to evaluate the quality of WIM data in Oklahoma, this project aims to develop quality control (QC) metrics and associated software interfaces for checking the quality of statewide WIM data, and to develop site-specific (Level 1), region-specific (Level 2), and statewide (Level 3) traffic inputs that are required for the Mechanistic-Empirical (ME) based pavement design in Oklahoma.



RESULTS With limited number of available WIM sites within a state highway agency, generating the traffic inputs required in MEPDG for any design location remains a challenge. If no prior Level 1 traffic WIM data are available for a pavement design, utilizing Level 3 state-wide default traffic input parameters may lead to estimation of inconsistent pavement performance. Therefore, this project develops Level 2 regional traffic inputs to be used for pavement design by combining existing site-specific data from WIM systems located on sites that exhibit similar traffic characteristics. How to qualify these similarities and develop loading groups (also called traffic clusters) are therefore critical for the successful implementation of Pavement ME Design at any design location. The project deliverables include a user-friendly WIM data software, named Prep-ME, which offers efficient WIM data import capability, data quality review and control functions, data visualization and analysis, and three levels of traffic outputs to meet ME based pavement design needs.

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FINAL REPORT
SPTC15.2-04-F
Southern Plains Transportation Center,
ODOT MATCHING FUNDS,
SP&R 2160

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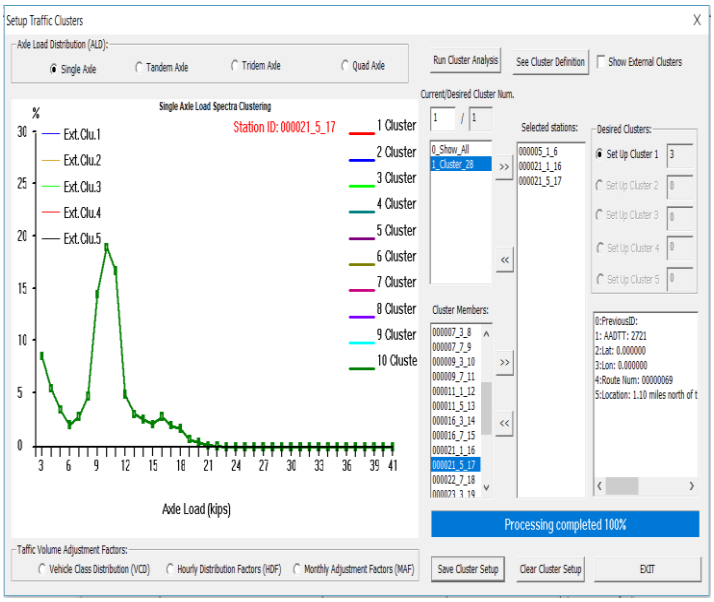
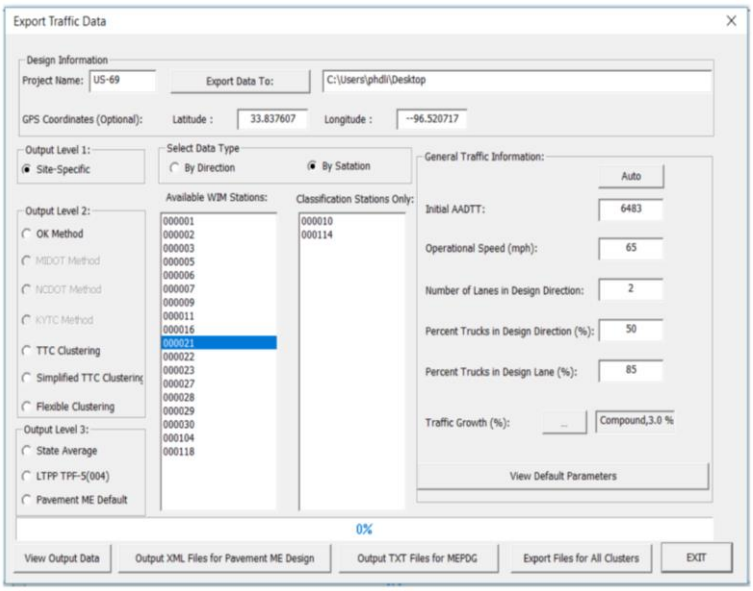
For Level 1 input, Prep-ME allows users to export site-specific traffic data "By Direction" or "By Station". The data shown by station contains the average data for both directions whereas the data shown by direction is only for the specified direction.

Clustering method is developed for Level 2 traffic input in Oklahoma and implemented in the Prep-ME software. The rural or urban classification, function class of highway, average daily truck traffic volume (AADT) and ratio of single unit and multiple unit trucks (SU/MU) are adopted as the clustering parameters for generating Pavement ME Design traffic inputs. Three levels, low, medium, and high, are defined for the "SU/MU" and ADTT parameters. The traffic stations that meet the criteria of the four retrieving parameters will be used to generate Level 2 traffic inputs for Pavement ME Design. In addition, the Prep-ME software includes the TTC approach and simplified TTC approach, which have much simpler user interfaces and less data requirements. The TTC approach requires manual traffic counts for vehicle classes 4, 5, 9, and 13 to determine the cluster of a pavement under design; while the simplified TTC approach only need engineers' judgment on the majority classes of trucks on a roadway. The two methods can be used for lower volume roads or design sites without relevant traffic data inputs. In many cases, traffic engineers are familiar with the traffic patterns on the highway segments where WIM stations are located and may decide to select the data from WIM stations with similar traffic patterns for pavement design using the "Flexible Clustering" method available in the Prep-ME software (as shown in the left figure). Users only need to manually select relevant WIM stations for traffic data export for the traffic parameters. The example in the figure uses three WIM stations on US-69 to generate Single Axle Load Distribution factors.





For level 3 output (shown in the right figure), three methods are provided in Prep-ME: State Average, LTPP-5(004) and Pavement ME Default. For each output level, Prep-ME can automatically process Pavement ME Design required traffic data. By clicking "View Output Data" button, users can view four types of traffic data: Vehicle Class Distribution (VCD), Hourly Distribution Factors (HDF), Monthly Adjustment Factors (MAF), Axle Load Distribution Factors (ALDF) including those for single, tandem, tridem, and quad axles. Prep-ME also allows users to generate mixed levels of traffic inputs. The traffic files can be output in XML format for Pavement ME Design and text format for the MEPDG software. The generated output files can be directly imported to the ME design software, and greatly reduce pavement engineers' work load preparing traffic loading spectra data.

POTENTIAL BENEFITS The development of traffic and material inputs for pavement design software generated by this project will assist ODOT in the design and accurate prediction of pavement performance. Additionally, results will help state pavement design engineers to analyze and prepare traffic loading data collected through WIM. Outcomes will also be beneficial to state traffic data collection engineers in conducting an effective quality control check on collected traffic data. Implementation of results will enhance overall productivity of these operations.