

## 0-6940: Develop System to Render Mechanistic-Empirical Traffic Data for Pavement Design

### Background

Axle load spectra data, typically generated from permanent weigh-in-motion (WIM) stations, constitute the primary mechanistic-empirical (ME) traffic data input for accurate and optimal pavement designs. Due to limited permanent WIM stations (mostly located on interstate highways), most ME pavement designs rely on default axle load spectra or antiquated traffic estimates even for the 18-kip equivalent single axle loads used in Flexible Pavement Design System (FPS) software. The net result is un-optimized, costly designs, and/or poor performing pavement structures with increased maintenance costs or high construction costs due to over-designing, with high overall life-cycle costs. Successful implementation of the newly developed Texas Mechanistic-Empirical Flexible Pavement Design System (TxME) is also largely dependent on the availability of ME-compatible traffic data. Thus, there is a critical need to explore alternate means of generation and provision of ready-to-use ME traffic data for pavement designs and analysis, including the FPS, TxCRCP-ME, TxME, and AASHTOWare software.

### What the Researchers Did

Researchers conducted the following key tasks:

- Reviewed the current state-of-the-art methodologies used for estimating ME traffic data inputs.
- Collected, assembled, and analyzed various permanent WIM station data.
- Explored and installed portable WIM units on various highway sites for traffic data collection as a supplement to the permanent WIM station data (Figure 1).
- Developed macros for the analysis of permanent and portable WIM data to generate ME traffic inputs, for both flexible and rigid pavements

including FPS, TxCRCP-ME, TxME, and AASHTOWare software.

- Developed clustering algorithms and macros for predicting and estimating site-specific ME traffic data for FPS, TxCRCP-ME, TxME, and AASHTOWare pavement designs and analysis.
- Developed an Microsoft Access ME-compatible traffic data storage system (T-DSS).



**Figure 1. Portable WIM Setup.**

Research Performed by:  
Texas A&M Transportation Institute

Research Supervisor:  
Lubinda F. Walubita, TTI

Researchers:  
Aldo Aldo, TTI  
Clement Djebou, TTI  
Sang Ick Lee, TTI  
Adrianus Prakoso, TTI

Project Completed:  
8-31-2018

## What They Found

The key findings are summarized as follows:

- Portable WIM units are a cost-effective, practical, and reliable supplement for site-specific traffic data collection (volume counts, speed, classification, and vehicle/axle weight measurements). With proper installation and calibration, data accuracy of up to 92.5 percent is attainable.
- Traffic-tube counters are a cheaper and quick supplement for traffic volume counts, vehicle speed, and classification data only—but no vehicle weight data.
- The developed WIM data analysis macros are satisfactorily able to compute and generate M-E traffic inputs for both flexible and concrete pavement designs.
- The developed clustering algorithms constitute an ideal and rapid methodology for predicting and estimating M-E traffic data inputs (in the absence of actual field measurements).
- The T-DSS is a viable, user-friendly, and readily accessible Microsoft Access storage platform for the storage and management of ME traffic data.

## What This Means

The readily provision and use of ME traffic data inputs will result into optimal pavement designs that are cost-effective with low life-cycle costs, including the following:

- **Reduced costs of traffic data collection.** Portable WIM units are over 10 times cheaper than permanent WIM stations in unit purchase, installation, operational, and maintenance costs

including manpower needs. Use of portable WIM units for site-specific ME-compatible traffic data collection will lead to rapid, cost-effective field traffic data measurements.

- **Increased pavement service life.** With the use of more accurate and representative axle load spectra data, Texas Department of Transportation (TxDOT) engineers can design more durable pavements, increasing the service life of pavements and ultimately saving TxDOT money in maintenance/rehabilitation activities.
- **Optimal pavement materials selection.** Use of accurately determined ME traffic design data will lead to optimized pavement material selection to support the specific traffic loading. For instance, there is no need to use prime costly materials if the actual measured ME traffic design data for a given highway shows low truck-traffic and vice versa, thus optimizing the material costs.
- **Engineering design improvement.** Use of accurately determined ME traffic data inputs will yield more optimized pavement designs in terms of layer thicknesses. Reduced layer thickness means reduced material usage and costs (i.e., up to 25 percent cost savings). Additionally, the ready availability of ME traffic data will beneficially aid in the direct implementation of TxME and AASHTOWare.
- **The T-DSS and clustering algorithm/macros.** While the T-DSS will valuably serve as an ongoing reference data source by TxDOT engineers for ready-to-use ME traffic data, the clustering macro will cost-effectively serve as a rapid methodology for estimating M-E traffic data in the absence of field traffic measurements.

### For More Information

Project Manager:  
Wade Odell, TxDOT, (512) 416-4737

Research Supervisor:  
Lubinda F. Walubita, TTI, (979) 862-3356

Technical reports when published are available at  
<http://library.ctr.utexas.edu>.

Research and Technology Implementation Office  
Texas Department of Transportation  
125 E. 11th Street  
Austin, TX 78701-2483

[www.txdot.gov](http://www.txdot.gov)

Keyword: Research