Arkansas State Highway and Transportation Department  
Transportation Research Committee  

RESEARCH PROBLEM STATEMENT

DATE: 08/29/2016  
PROJECT AREA: Planning

TITLE: Evaluation of WIM Auto-Calibration Practices and Parameters

PROBLEM STATEMENT:
Weigh-in-Motion (WIM) systems capture weight and axle configurations of vehicles using the state highway network. This data serves as valuable and essential input for evaluating the performance of our transportation infrastructure. In particular, WIM data is needed to support Federal truck size and weight regulations, and to design, maintain, and preserve pavements. To produce accurate weights, sensors must be calibrated at installation and at regular intervals following the procedures outlined in ASTM E1318. Poor scale calibration can lead to significant errors in determining the load on the pavement: a 10% over-estimation in axle weight results in 45% overestimation of equivalent single axle loads (ESALs). On-site calibration requires repeated passes over the sensors of test vehicles with known weights. This is a time consuming and expensive process. Therefore, several states have adopted auto-calibration procedures developed by WIM vendors.
Auto-calibration is an algorithmic procedure by which weights measured by the WIM sensor are adjusted based on tunable parameters set by the WIM vendor. The parameters should reflect site conditions such as truck conditions (e.g. average weight of steering axles) and environmental conditions (e.g. temperature and aging). For auto-calibration techniques to be effective, a state must monitor and understand site conditions used to set parameters. The proposed research will evaluate the auto-calibration techniques used for the AHTD’s 40+ piezoelectric sensors. This will ensure that truck size and weight measurements gathered from WIM accurately reflect the loads and configurations of trucks traversing Arkansas highways.

OBJECTIVES:
The research will be carried out under three objectives:  
(1) Coordinate with WIM sensor vendors: (1.1) Determine system calibration parameters and auto-calibration algorithms, (1.2) Set-up system to collected pre- and post-calibrated weights and other measurements.  
(2) Field test calibration: (2.1) Use video recordings to match trucks traveling across static scale (highway police enforcement sites), bending plate, and piezoelectric sensors, (2.2) Perform a calibration analysis by comparing the static and dynamic weights from the three sensor types.  
(3) Automatic Vehicle Identification (AVI)-Based Calibration: (3.1) Acquire AVI data from truck pre-clearance programs (PrePass and/or Drivewayze) to match trucks across multiple WIM sensors, (3.2) Design appropriate filter to capture trucks weighed at piezoelectric and static scales, (3.3) Perform a calibration analysis by comparing the static and dynamic weights from the three sensor types.

FORM OF RESEARCH IMPLEMENTATION:
The main objective of this research is to evaluate the WIM auto-calibration practices used in AR and to recommend effective auto-calibration practices for AHTD. Anticipated implementation of the research findings will be an addendum to the ASTM calibration standard which outlines effective auto-calibration practices specific to WIM sites in AR. Effective auto-calibration will lead to reduced costs associated with calibration. As an added benefit, more reliable WIM data will lead to more accurate pavement and bridge design and maintenance- two of the largest costs for AHTD.

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Estimated Project Duration: 18 month  
Standing Subcommittee Ranking: 1/6  
Advisory Council Ranking: 2  
Statement Combined with Statement Number(s):