ABSTRACT

Nichols, Andrew P. Ph.D., Purdue University, May, 2004. Quality Control of Weigh-in-Motion Data. Major Professor: Darcy M. Bullock.

Weigh-in-Motion (WIM) sensors have been installed on a widespread basis in the United States to collect vehicle weight data for designing pavements and monitoring their performance since the 1980's. These sensors are now being used for enforcement purposes to improve the efficiency and effectiveness of identifying overweight vehicles. To be successful, these enforcement applications require a high level of accuracy and reliability that can only be attained with a rigorous quality control program.

This dissertation proposes a quality control program that addresses vehicle classification, speed, axle spacing, and weight accuracy by identifying robust metrics that can be continuously monitored using statistical process control procedures that differentiate between sensor noise and events that require intervention. The speed and axle spacing accuracy is assessed by examining the drive tandem axle spacing of a population of Class 9 vehicles. The weight accuracy is assessed by examining the left-right steer axle residual weight of a population of Class 9 vehicles. Data mining of these metrics revealed variations in the data caused by incorrect calibration, sensor failure, temperature, and precipitation.

The accuracy metrics can potentially be implemented in a performance-based specification for WIM systems that is more feasible to enforce than the current specifications based on comparing static vehicle weights with dynamic vehicle weights measured by the WIM sensors. The quality control program can also be used by agencies to prioritize maintenance to make better use of the limited funds available for sensor repair and calibration. This research provides a tool that agencies can use to obtain higher quality WIM data and sustain that quality over time.