Glossary of Weigh-in-Motion (WIM) Terms

Weigh-in-Motion (WIM)
As per ASTM E1318-02, Section 1.1:
"...the process of measuring the dynamic tire forces of a moving vehicle and estimating the corresponding tire loads of the static vehicle. Gross-vehicle weight of a highway vehicle is due only to the local force of gravity acting upon the composite mass of all connected vehicle components, and is distributed among the tires of the vehicle through connectors such as springs, motion dampers, and hinges. Highway WIM systems are capable of estimating the gross weight of a vehicle as well as the portion of this weight, called load in this specification, that is carried by the tires of each wheel assembly, axle, and axle group on the vehicle."

WIM Site
A specific roadway location that meets the LTPP smoothness requirement in which a WIM system has been or will be installed. Such a site includes the installation of all WIM in-road components, the WIM controller and its electronics, the power and phone facilities, all wiring, conduits, pull boxes, and cabinets to make the WIM functional. A WIM site may be further defined, as appropriate, for direction and/or lane.

WIM Site Assessment—*Existing System*
In addition to reviewing an existing WIM site for the conditions listed under WIM Site Assessment—No Existing System, the review should include physical inspection of the system's components, the performance of equipment diagnostics to determine if all of the system's components are working properly, and a thorough review of the data from the system. Historical trend analyses as well as analyses of the individual vehicle records should be done in an effort to point out functional and/or operational problems with the existing WIM system.

WIM Site Assessment—*No Existing System*
Review of a specific segment of roadway for the purpose of determining the best location to install a WIM system. Such a review should include, but is not limited to, the condition and profile of the existing pavement and the extent of any necessary replacement; the roadway's geometrics and grade; adequate drainage for the site and the weigh pad scale pits if applicable; adequate location for the controller cabinet and pullboxes; the availability of power and phone facilities; adjacent facilities that may effect signal interference (such as power lines or railroad lines); and any undesirable traffic operational characteristics (such as passing, weaving, stop and go). The truck traffic composition should be verified (to be the same) at both the candidate WIM site and the LTPP test site.

WIM System
As per ASTM E1318-02:
"3.2.15 WIM System, n-a set of sensors and supporting instruments that measure the presence of a moving vehicle and the related dynamic tire forces at specified locations with respect to time; estimate tire loads; calculate speed, axle spacing, vehicle class according to axle arrangement, and other parameters concerning the vehicle; and process, display, store, and transmit this information. This standard applies only to highway vehicles."

WIM System Calibration
The process by which the known static axle and/or wheel loads and known axle spacings of two or more test vehicles are compared with the corresponding estimates from a WIM system's generated dynamic tire force and axle spacing calculations for such test vehicles. The purpose for this comparison is to determine and implement the WIM system calibration factor settings, which will result in the system's generating the best possible estimate of static axle and/or wheel loads, axle spacing distances, and the range of vehicle speeds for the typical truck configurations in the traffic stream.

WIM System Classification Algorithm
A WIM vendor's specified format that implements a user's logical classification scheme and the process by which the system accesses and utilizes such formatted information to assign a classification number to each vehicle passing over the system.

WIM System Components
The components that make up the WIM system controller unit, include but are not limited to the central processing unit, interface cards/boards, analyzer cards/boards, detector cards/boards, communication interfaces/ports, and the controller unit's power supply. The system components also consist of the individual roadway sensors, including those for vehicle detection (loops), axle detection, and wheel weighing.

WIM System Component Diagnostics
The utilization of features provided by the system's controller to monitor and analyze signal outputs from the system's components to determine whether or not a particular component is malfunctioning.

WIM System Configuration
The controller type, the type of in-road components, and the physical layout of the in-pavement components.

WIM System Hardware Component Adjustments
Any physical adjustments of dipswitches, potentiometers, or other devices that are integral parts of a system controller unit's interface cards/boards, analyzer cards/boards, detector cards/boards, or other components. These adjustments typically include, but are not limited to loop frequencies, sensor sensitivities, and bending plate base line or "zero" points.

WIM System Setting Adjustments
Modifications to the on-site software's system command, parameter, value, and calibration factor settings. Typically such adjustments are made to improve a system's performance and accuracy.

WIM System Validation
The testing of a WIM system to determine whether or not the system is in conformance with operational and LTPP precision requirements. Such testing may include but is not limited to the use of two or more test trucks with known static axle and/or wheel weights, and known axle spacing distances to determine accuracy compliance with weight and speed/axle spacing requirements. The on-site visual comparison of actual vehicles and WIM real time vehicle displays for conformance to classification coding and other operational requirements is performed. Validation also consists of analyzing downloaded data from the system to determine conformance with requirements as to data file generation and operational requirements that cannot be determined solely by on-site visual observation.

WIM Vehicle Classification Scheme
A logical matrix formulated by an agency which utilizes axle counts, axle distance measurement range between each axle (minimum & maximum), front axle weight, and gross vehicle weight to determine vehicle description and classification coding for each vehicle passing over a WIM site.

Communications Software
Software that is installed in the WIM equipment and the user's PCs (desktop and/laptop), which allows for remote access of the on-site software for real time displays, data downloading, system diagnostics, and modifications to the system software settings. The software programs can be off-the-shelf commercial programs furnished by the WIM vendor or user, or proprietary custom software provided by the WIM vendor. The communications software can also be used on-site either by using a laptop PC or a permanent on-site monitor and keyboard. This also includes wireless modes.

WIM Application Software
The WIM vendor provides the application software to the user to install on the user's PCs (desktop and laptop). The software reads the downloaded raw WIM data and generates reports and exported files in accordance with the user's specifications.

WIM System Software Settings
Multitude of variable on-site software commands, parameters, values, and factors that determine, for example, how the system controller inputs and processes signals from each in-road sensor; how processed sensor inputs are converted to WIM data outputs; and how the system creates, stores, and transmits data files. These settings are accessible either on-site (terminal or laptop PC) or by remote terminal access and displayed with provisions for revision, by means of some type of site software menu system. More specifically, these settings include but are not limited to:
- System/site setup configuration
- Time and date
- Criteria for data file formulation and storage, and individual vehicle records
- Criteria for assigning invalid weights and warnings
- Criteria for assigning weight violation codes
- Look-up values utilized by the system's classification algorithm processing
- Loop delay factors
- Weigh sensor thresholds
- Calibration factors for weight, speed/spacing, and overall length data outputs
- Temperature compensation factors
- Static weight settings.

Raw WIM Data
Data that is downloaded or transferred directly from the WIM system controller. The data is typically included within the WIM vendor's proprietary file format and is unaltered, unprocessed, and unedited.

Real Time Monitoring
Viewing of the system controller's display output of each vehicle subject to filtering parameters (typically lane and vehicle classifications), as it completes its pass over the system's in-road sensors. The WIM data elements for each vehicle are displayed in either columnar or graphic display. Such display is instantaneous subject to the amount of traffic, the filter parameters set, and the system's capabilities. Typically, WIM system component diagnostics can also be performed on a real time basis. Real time monitoring can be performed on-site or remotely.