

Using Weigh in Motion to Improve Operational Productivity

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What is Weigh-in-Motion

Weigh-in-Motion, also known as WIM, is the process of weighing vehicles as they travel at speeds ranging from under 5mph to as high as 65mph. Using weighing sensors embedded in the road, along with electronics and software for interpreting the sensors' signals, an approximation of the vehicles axle and gross weights is made. Axle spacing and vehicle class information can also be determined. Depending on site conditions and the type of WIM technology used, gross vehicle weight accuracies of +/- 2% can be achieved.

The most accurate and durable type of WIM system is an in-ground, load cell based system. As the vehicle crosses the scale software calculates individual wheel, axle, and gross weights and are captured at a powerful industrial computer. Data is then available for display on a CRT or scoreboard, stored on the hard drive, sent to a printer, or transmitted to a remote device.

The weight information can also be transmitted to a "host" device PC or mainframe computer in an ASCII format. The system can control traffic lights, gates, or other peripheral equipment. Interface with cameras or AVI (automatic vehicle identification equipment) is also possible (see Figure 1 and 2).

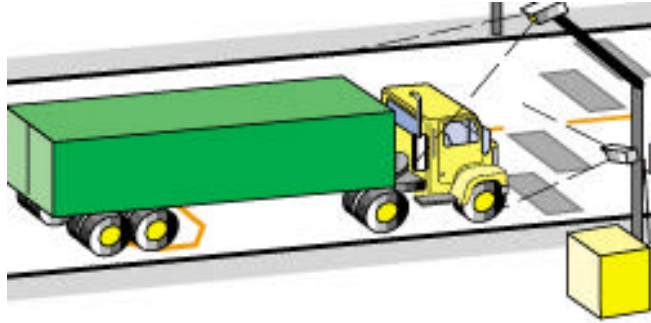
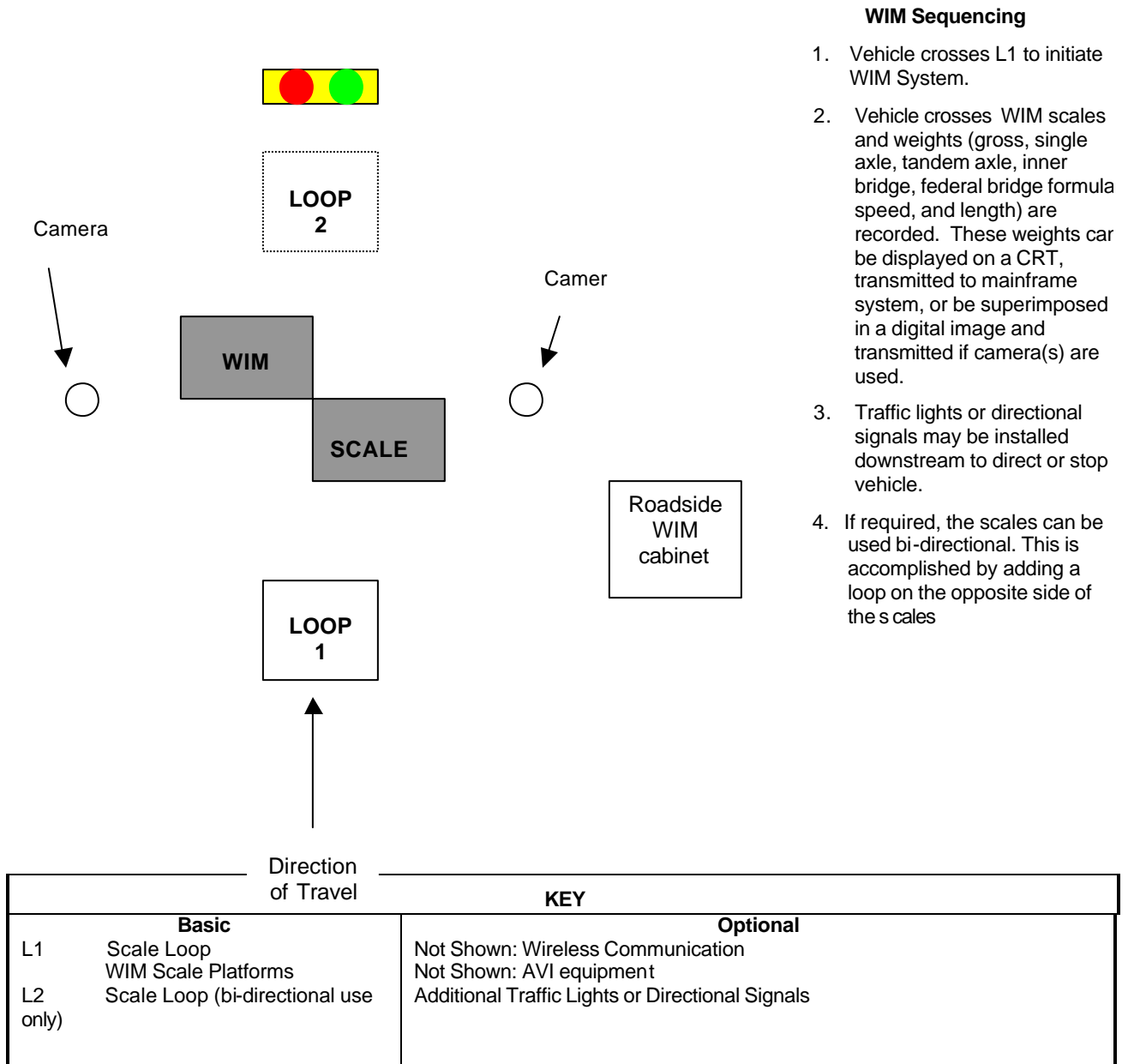


Figure 1 – WIM Scale with Optional Camera and AVI



Truck Crossing WIM Scale



- WIM Sequencing**
1. Vehicle crosses L1 to initiate WIM System.
 2. Vehicle crosses WIM scales and weights (gross, single axle, tandem axle, inner bridge, federal bridge formula speed, and length) are recorded. These weights can be displayed on a CRT, transmitted to mainframe system, or be superimposed in a digital image and transmitted if camera(s) are used.
 3. Traffic lights or directional signals may be installed downstream to direct or stop vehicle.
 4. If required, the scales can be used bi-directional. This is accomplished by adding a loop on the opposite side of the scales

Figure 2 Typical WIM System Layout

Advantages of Weigh-in-Motion

In operations where speed is critical and vehicle weighing is an integral part of operations, weigh-in-motion (WIM) technology can provide significant cost savings. Axle scales require a truck to stop on each axle and let the scale settle, slowing operations, causing extra wear and tear on the truck, and burning extra fuel.

Though faster than an axle scale but not as fast as a WIM system, a full platform scale takes up valuable real estate and adds considerable cost. WIM technology allows trucks to be weighed as

the move continuously across the scale, at speeds up to 25 mph or even faster. When hundreds of trucks per day require weighing, a WIM system provides reliable weighing performance with no or very minimal disruption to operations. Depending on the number of trucks being weighed per year, payback of a WIM system capital investment can be achieved in less than 12 months.

Additionally, WIM scales automatically check for compliance with the Federal Bridge Formula, which is not possible using either an axle or full platform scale. As with axle scales, WIM scales cannot currently be used to determine legal for trade weights (see Figure 3).

Axle Scale	Lowest Cost Minimal space required	Slowest Technology Not Legal for Trade
Full length platform scale	Legal for Trade Accuracy Faster than Axle Scale	Highest Installed Cost Requires considerable space
WIM Scale	Fastest Operation Minimal space required Checks bridge formula compliance	Not Legal for Trade Requires smooth, level, concrete approach & exit

Figure 3 – Scale Comparison

Proven Performance

Weigh-in-Motion technology has been used for many years in commercial vehicle operations and now is installed in hundreds of locations across the U.S. WIM scales are typically installed on the ramp leading into a weigh station, with the WIM system directing suspected overweight vehicles to a static scale for further inspection.

Given its successful performance in high volume, and often complex, weight enforcement environment, load cell based scales are now the preferred WIM technology. Weigh-in-Motion systems are measured against the standards outlined in ASTM 1318-02. Mettler Toledo exceeds the accuracy requirements for Type III and IV systems as defined by ASTM 1318-02.

Additionally, WIM is used for traffic data collection with over 1000 such sensors installed in U.S. highways and secondary roads.

System Design and Key Components

A WIM system can be configured to meet specific user requirements. The WIM controller and user interface can be located in a building near the scale, or fiber optic connection can be used for scale to user interface distances greater than 2500'.

A typical system includes the following components.

- WIM scale with two compact staggered scale platforms, each containing four IP66 rated load cells with a stainless steel housing. The scale footprint is 12' wide x 5' long. Suitability for weighing 50,000 lb single axles, with a 150% overload rating.
- WIM controller
- Optional traffic light

- Optional traffic gate
- Optional AVI reader

To ensure the highest degree of accuracy, WIM scales must be installed into a shallow concrete foundation and at least 25' of the approach from each direction must be smooth level concrete in accordance to the requirements in ASTM 1318-02.

Applications

WIM for Trucking Terminals

Compliance with legal load limits presents unique challenges. Overloads can lead to both fines and lengthy delays as many states require overweight trucks to be off-loaded prior returning to the road. Not only do axle and gross loads need to be checked, but compliance to the Federal Bridge Formula needs to be calculated. Close to 1/3 of all violations are Federal Bridge Formula related. Some states even have individual wheel load limits, which cannot be checked with axle or platform scales.

Mettler Toledo WIM systems quickly and automatically check for potential gross weight, axle weight, and Bridge Formula violations. The type and location of the violation is pinpointed allowing for precise load rearrangement so the truck can leave the terminal quickly. Weigh tickets can be printed, traffic signals or gates can be controlled, and weight data is stored for future reference. Multiple reporting options allow for operational analysis to measure trailer and terminal productivity. All in a fraction of the time of operations using static scales.



WIM for Seaports

Requirements exist for weighing of containers prior to cranes lifting them onto container ships. Traditionally static scales have performed this operation. For seaport operators needing to improve operational efficiency a weigh-in-motion system provides the ability to weigh thousands of containers daily without trucks stopping as they cross the scale. Weight data is displayed and stored, and traffic signals are used to indicate overloads.



WIM for Toll Roads & Bridges

Toll authorities, which are typically responsible for maintaining their infrastructure, realize that weight, not the number of axles, determines wear and tear on their system. Therefore, many are using weight based tolling relying on weigh-in-motion to determine the proper toll classification while keeping traffic moving. Mettler Toledo's superior accuracy allows for tighter weight tolerances, thereby maximizing toll revenue. Rugged construction ensures operational reliability.



WIM for Border Crossings

Ensuring that vehicles which enter the U.S. are of legal weight is critical in order to protect highway infrastructure and safe operation. Weigh-in-motion allows for screening of overweight vehicles efficiently at high volume border crossings.



WIM for Landfills

For applications where landfill operators also own the vehicle fleet and legal for trade is not required, WIM scales offer productivity improvement and can capture EPA required weight reporting data.

Further Information

For further information on Mettler-Toledo Inc. Weigh-in-Motion solutions contact Mettler-Toledo at (800) 786-0038 or email mtwtwim@mt.com.