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Intercomp®
advanced weighing technology . . . by any measure

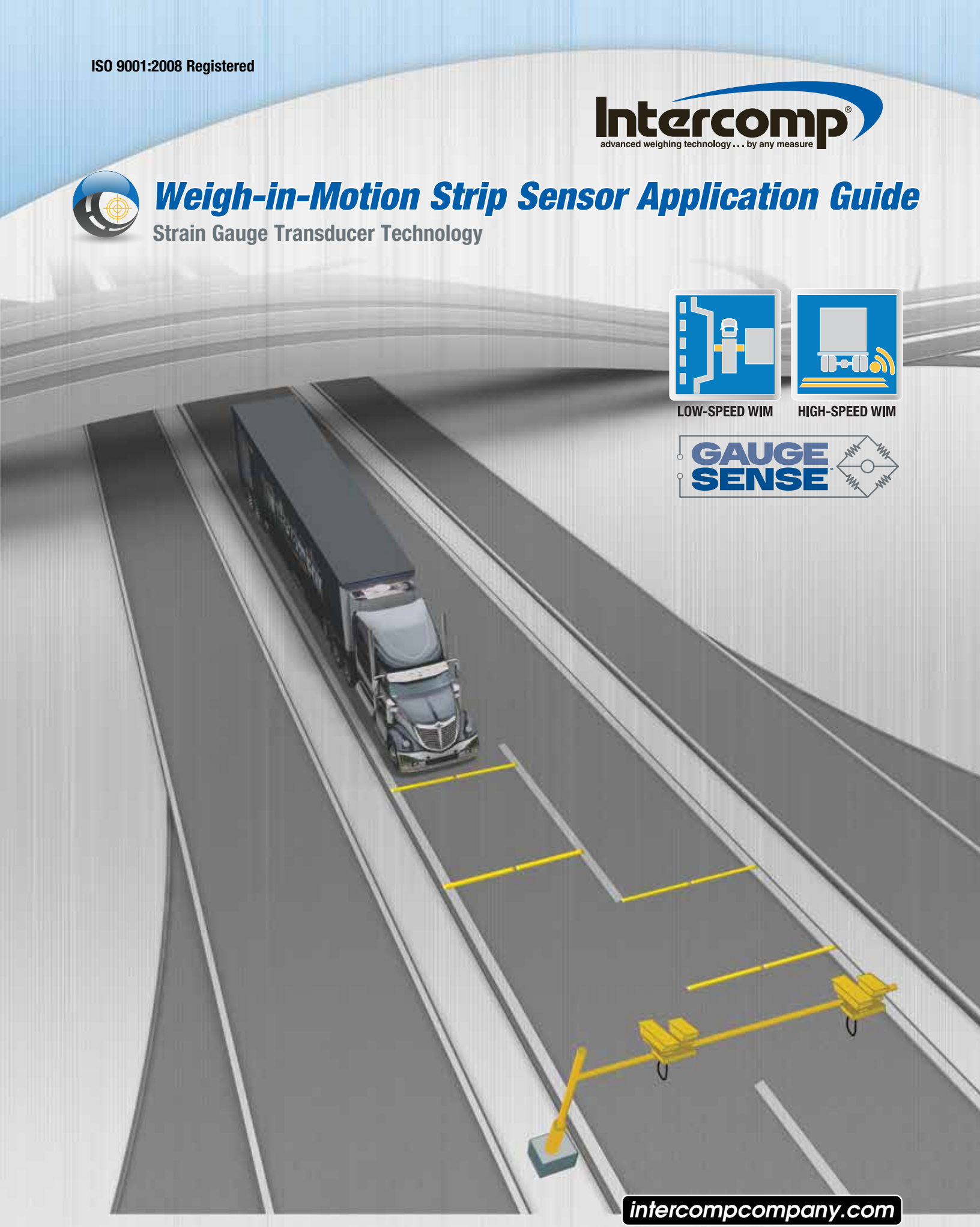
Weigh-in-Motion Strip Sensor Application Guide

Strain Gauge Transducer Technology

LOW-SPEED WIM

HIGH-SPEED WIM

GAUGE SENSE™



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In-Ground Strip Sensors for WIM

Weigh-in-Motion

Strip Sensors

Meets or Exceeds ASTM E1318-09
Type I, II, III and COST 323 A(5), B+(7)
or B(10) Performance Requirements

Intercomp strain gauge strip sensors provide accurate dynamic weighing across many applications in installations all over the world. The performance, reliability and longevity of Intercomp's WIM strip sensors provide the best return on investment of any form of precision WIM technology. Strip sensors involve minimally invasive installation in concrete or asphalt, and installations can be used in low speed (LS-WIM) and high speed (HS-WIM) applications.

WIM strip sensors can be installed in rows depending on the application and required accuracy. Providing the sensors alone, or with electronics and software, Intercomp sensors are ideal for integration into complete WIM systems. When combined with cameras, detectors, and data transmission devices, they are capable of serving as standalone virtual remote weigh stations or work in tandem with commercial weigh stations while operating as pre-selection for enforcement.

Solutions

ACCURACY

Intercomp strip sensor WIM systems are designed to deliver best-in-class accuracy across a wide range of speeds and temperatures.

Data Collection

WIM screening allows transportation engineers to study traffic characteristics for the planning and maintenance of roadways.

Screening for Enforcement

Vehicle data such as classification and flagged violations can be remotely accessed for enforcement efforts downstream of WIM site.

Worldwide Sites and Distribution

INTERCOMP WIM STRIP SENSORS

Intercomp designs and manufactures weighing and measurement solutions to help our customers in WIM product deployment maximizing system performance and compliance.

Manufactured at our headquarters in the United States, Intercomp products build upon 40 years of global industry expertise and applications experience to provide our customers superior quality, reliability and certainty in the products and services we deliver.

Pre-Selection

Traffic can be directed to specific lanes, off the mainline for further inspection, or to continue on without further interruption.

Bridge Protection

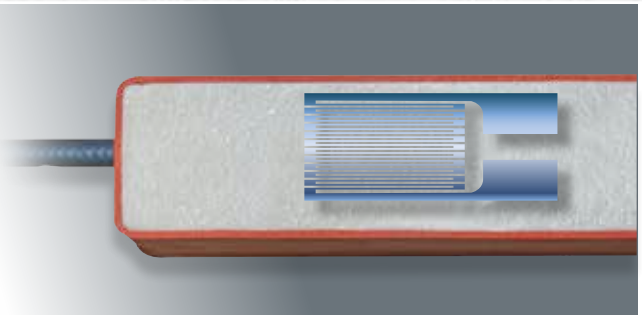
Data collection to identify and divert overloaded vehicles for protecting bridges and infrastructure.

Tolling/Ports of Entry

Weight based information is used to confirm vehicle loading or calculate fees. In tolling, heavier vehicles are charged more than lighter vehicles due to impact on roadways.

Strain Gauge Technology for Weigh-In-Motion

GAUGE SENSE™



Intercomp's GaugeSense™ Technology actively senses, corrects, and controls to provide the most accurate measurement possible. The inherent benefits of this technology are integrated into the WIM strip sensor with many advantages for in-road use.

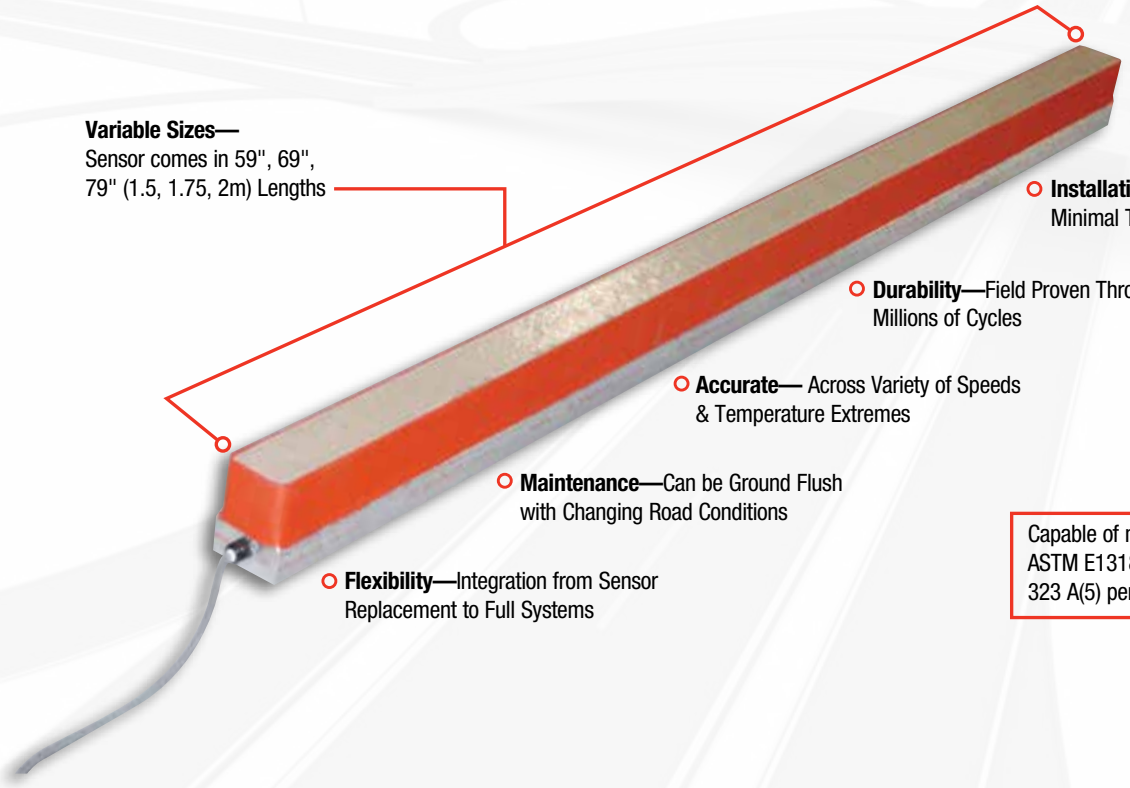
Designed from NTEP/OIML approved scale technology, the sensor measures the magnitude of mechanical quantities such as force, torque, load, and pressure to provide the benefits customers are accustomed to with precision scale technology. This enables customers to comply with accepted metrology, standardization, testing, certification and accreditation used by legal metrology authorities and industries worldwide.

The Intercomp strain gauge strip sensor:

- Not position sensitive to tire placement with consistent linear output along entire length of sensor.
- Designed to measure only vertical force by removing side loads associated with pavement crowding or side or angle loading.
- Internal temperature compensation adjusts for changes in temperature at sensor. This improves consistency of output from day to day and season to season and reduces calibration frequency as compared to piezo-electric and quartz sensors.
- The capacitance of a long cable does not affect the measurement characteristics of the strain gauge sensor, so there is no need for a charge amplifier.
- Long life span – designed for mainline operation of 5 or more years.

Weigh-in-Motion Strip Sensors *Patent pending*

Strain gauge technology is used in static weighing for direct weight enforcement and is accepted as the most accurate and reliable means to weigh a vehicle. Intercomp's strip sensors integrate the same strain gauge technology incorporated into a compact strip for accurate WIM applications. Offering the lowest cost of ownership of any precision WIM sensor, the price, durability, and longevity of Intercomp sensors deliver performance to rely on.



Variable Sizes—
Sensor comes in 59", 69", 79" (1.5, 1.75, 2m) Lengths

Installation—In a Single Day with Minimal Traffic Interruptions

Durability—Field Proven Through Millions of Cycles

Accurate— Across Variety of Speeds & Temperature Extremes

Maintenance—Can be Ground Flush with Changing Road Conditions

Flexibility—Integration from Sensor Replacement to Full Systems

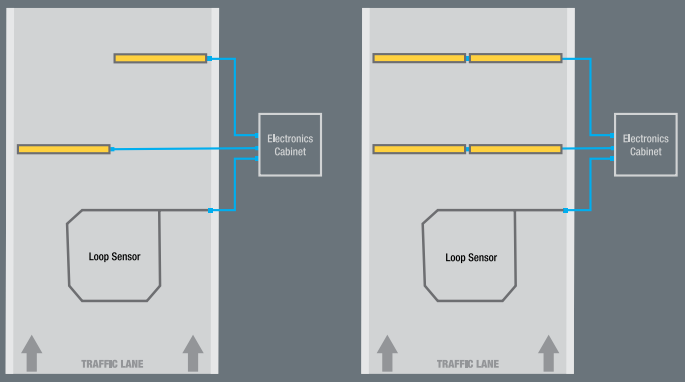
Capable of meeting or exceeding ASTM E1318-09 Type III and COST 323 A(5) performance requirements

The sensors are installed within 3" wide (75mm) channels cut into the existing asphalt or concrete road surface. Installation can be completed in a single day.

DATA COLLECTION

Transportation officials rely on Weigh-In-Motion (WIM) sensors for collecting vehicle data at high speeds for highway data and traffic monitoring. Traffic volume, speed, vehicle classifications, and vehicle weights are all part of monitoring current usage and highway planning for the future.

Typical Sensor Configurations



2-Sensor Staggered Installation

4-Sensor In-line Installation

DATA COLLECTION | CASE STUDY

NETHERLANDS: DATA COLLECTION

Just outside of Rotterdam in the Netherlands, Intercomp strip sensors are installed in multiple lanes to gather traffic and vehicle data in the mainline. As Rotterdam is one of the busiest shipping ports in the world, gathering traffic and vehicle data supplies the Ministry of Infrastructure and the Environment valuable information for roadway planning and utilization.

Sensors were installed in four lanes, with two sensors per lane for this mainline application. The WIM site experiences high speed vehicle traffic, with significant heavy vehicles due to the commercial traffic for the port. Additionally, one lane of traffic required bi-directional capability, so monitoring traffic in both directions was enabled for that lane.

Delivering GVW accuracy of better than COST 323 B+(7) requirements with the bi-directional and single lanes, the Intercomp strip sensors satisfied the requirements to provide excellent traffic and weight data for this high traffic volume WIM site.

As the Intercomp sensors were integrated with the local operator's electronics and software, this adds to the variety of electronics platforms that are currently capable of working with Intercomp WIM sensors.

Strip sensors for data collection incorporate strain gauge sensor technology:

- WIM Site Installation employs Two to Four Sensors, Loop & Electronics
- Provides Accurate Data for Roadway Monitoring & Planning
- Detection of Overloaded Vehicles & Incidence
- Integrate Sensors in Existing Pavement or during Site Replacement

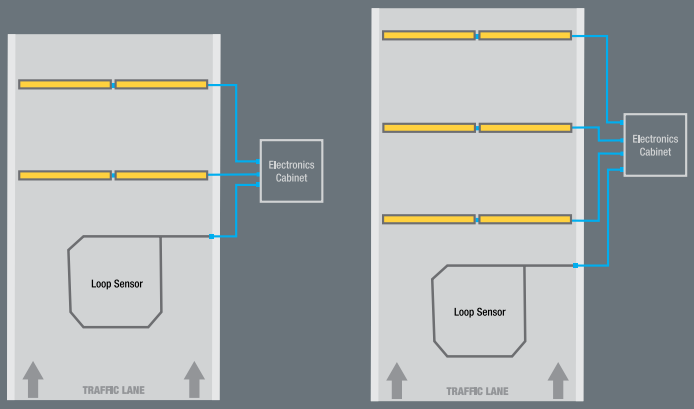
Performance of WIM site has a Gross Vehicle Weight (GVW) accuracy for data collection which meets or exceeds ASTM 1318 Type I and COST 323 B(10) WIM requirements.

ENFORCEMENT & PRE-SELECTION

IN-GROUND

Weight Enforcement is vital to minimize the damage caused by overloaded vehicles to roads and highways, and to increase safety for the operators. Detection of these vehicles at high speeds (HS-WIM) is an efficient and effective method for screening for enforcement or pre-selection of vehicles for static weigh stations.

Typical Sensor Configurations



4-Sensor In-line Installation

6-Sensor In-line Installation

ENFORCEMENT & PRE-SELECTION | CASE STUDY

OREGON DOT: PRE-SELECTION

The state of Oregon in the US has used pit-type Weigh-In-Motion scales for pre-selection in the mainline for many years. Though pleased with the accuracy the scales delivered, the cost of installation and the ongoing maintenance required led the state to evaluate different HS-WIM options. Familiar with the benefits of strain gauge technology, Oregon DOT (ODOT) chose to test Intercomp strip sensors as a WIM sensor replacement integrated into their current electronics and software.

Pilot sites with four sensors in two rows were installed to conduct evaluations of possible WIM replacement scales and sensors. Vehicles crossed the mainline WIM sites at speeds ranging from 40-80mph (65-130kph), and these vehicle records were compared to weights gathered with static scales at weighstations downstream from the WIM sites.

These sites were operated by the ODOT, and when comparing the data from WIM to static scales, performance of 3-4% GVW error were found in diverse weather conditions over time.

This confirmed ODOTs previous positive experience with strain gauge WIM technology, but Intercomp supplies this performance in a smaller, easier to install strip sensor. In the future, when replacing current or creating new WIM sites, the State of Oregon has committed to use Intercomp strip sensors for their High-Speed WIM mainline technology.

Strip sensors for pre-selection or enforcement incorporate strain gauge sensor technology:

- WIM Site Installation Employs Four to Six Sensors, Loop & Electronics
- Consistent Accuracy for Selection of Vehicles from Screening
- Improve Vehicle & Operator Safety
- Simple Integration of Sensors into Existing Enforcement Systems

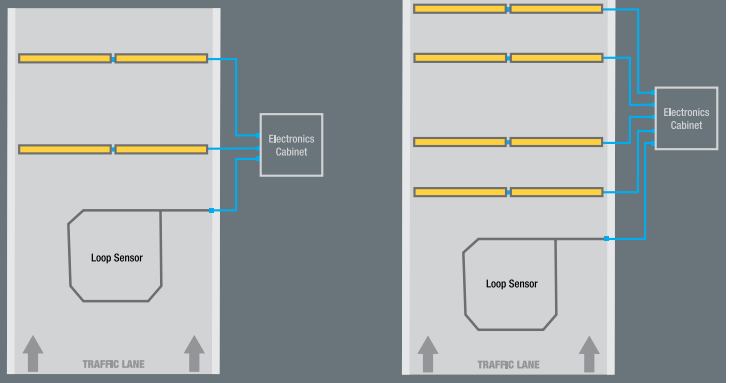
Regions can have different requirements for accuracy of systems employed in screening for enforcement WIM systems. COST 323 A(5) and COST 323 B+(7) are commonly referenced for these screening for enforcement sites. Six sensors (three pairs) have been used in some countries for these applications.

Performance of WIM sites have a Gross Vehicle Weight (GVW) accuracy for screening for enforcement meeting or exceeding ASTM 1318 Type III and COST 323 B+(7) WIM requirements.

TOLLING (ETC)

Tolling based on weight or axle configurations is done with Weigh-In-Motion (WIM) technology. Integrated into existing lanes in the mainline or slower traffic areas, vehicles can be measured rapidly without stopping. Automated systems provide accurate information in real-time for vehicle processing.

Typical Sensor Configurations



4-Sensor In-line Installation

8-Sensor In-line Installation

TOLLING | CASE STUDY

THESSOLONIKI, GREECE: FEE COLLECTION

Gathering WIM Gross Vehicle Weights (GVW) in individual traffic lanes allows for revenue determinations to be made for weight based vehicle transactions. Customers in the Greek area of Macedonia required a WIM system capable of obtaining vehicle weight data in existing vehicle lanes and to integrate into their current system.

Highly accurate performance was required for this site, with 4 rows of sensors installed in each lane of traffic. Speeds at this WIM site are 5-10mph (8-16kmh), and the Intercomp products were ideal for the site as they do not require drains compared to other strain-gauge based technology. The sensors were integrated into systems with other peripheral equipment, increasing site efficiency by working to process transactions without vehicle stoppage.

WIM performance at installation was consistent across all vehicle lanes, demonstrating under 1% GVW error compared to a test vehicle with a known static weight. This allows the operators to calculate and manage fees rapidly and accurately with the strain gauge strip sensors. As a result of this experience, operators in Greece are looking into integration of the Intercomp strip sensors into additional locations in the region.

Strip sensors for tolling incorporate strain gauge sensor technology:

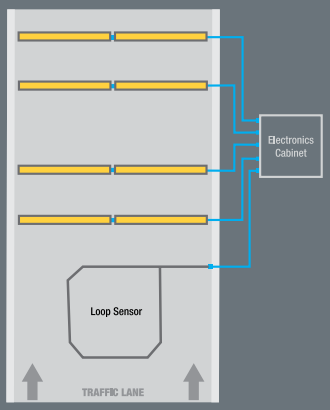
- WIM Site Installation Employs Four to Eight Sensors, Loop & Electronics
- Automate Tolling Process
- Detection of Vehicle Weights for Weight Based Tolling
- Detection of Axle Configuration for Vehicle Classification Based Tolling
- Use Sensors in Low or High Speed tolling Applications, including Mainline Installations

Performance of these WIM sites for tolling applications have a Gross Vehicle Weight (GVW) accuracy meeting or exceeding ASTM 1318 Type III and COST 323 A(5) WIM requirements.

PORTS/GATES

Screening for vehicle and cargo weights allows for identification of unloaded, loaded, and overloaded vehicles. When integrated into existing processes, dynamic weighbridges with Weigh-In-Motion technology allows for rapid processing of vehicles without stoppage and delays.

Typical Sensor Configuration



8-Sensor In-line Installation

PORTS & GATES | CASE STUDY

PUERTO CORTEZ, HONDURAS: SEAPORT

Safety standards defined by the International Maritime Organization (IMO) include a verified gross mass specification for cargo as part of Safety Of Life At Sea (SOLAS) requirements. As port systems are also increasing automation throughout all stages of the supply chain of goods, WIM technology is an excellent fit to achieve the required accuracy by the government without interrupting the flow of cargo into and out of the port.

WIM sites within the terminal were installed in existing vehicle traffic lanes, with 4 rows of sensors to provide the accuracy at low speeds of 5-10mph (8-16kmh). The Intercomp sensors were coupled with RFID vehicle identification, stoplights and gate separation, and the terminal integrated the WIM system data into their gate operating system.

The systems weigh vehicles upon entry and within the terminal for Gross Vehicle Weights, and use tare weights to obtain cargo weights.

The Intercomp strip sensor WIM system provides weighing accuracy with an error of less than 2% with loaded vehicles. These systems and their performance comply with Honduran regulations regarding automated cargo weighing in terminals. As a result, further ports in the region are integrating WIM technology for gate operations.

Strip sensors for ports and gates incorporate strain gauge sensor technology:

- WIM Site Installation Employs Eight Sensors, Loop & Electronics
- Weigh Vehicles & Cargo without Stopping
- Integrate Sensors into Existing Automated Process
- Couple Sensors with Gate Arms, RFID & Camera Technology
- Installation does not Require Pits or Drains

Performance of these WIM sites meets or exceeds OSHA requirements in the U.S., ASTM 1318 Type III and COST 323 A(5) Weigh-In-Motion (WIM) requirements, and IMO and SOLAS Verified Gross Mass (VGM) in regions around the world.

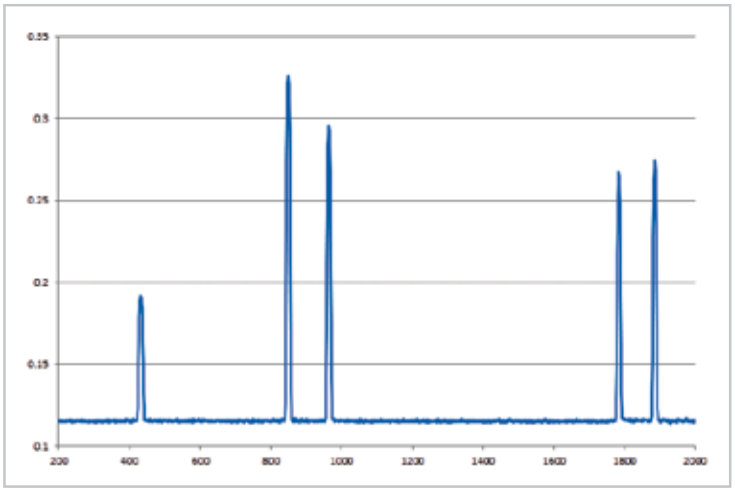
Intercomp Strip Sensors are offered as Components to be Integrated with Third-Party Electronics or as Part of a Complete WIM System

Strip Sensors Only with Analog Output

The strain gauge strip sensors are designed to be used in pairs and can be integrated directly into customers' electronics. The sensors are shipped with variable length cables attached.

The analog output is a mV/V output ratiometric to the excitation voltage used. In the waveform for a 5 axle vehicle (see example), the signal is proportional to the wheel weights experienced by each sensor.

For this option, the customers' electronics needs to provide signal conditioning and transmission of the differential signal to an Analog/Digital Converter.



Example: 5 Axle Tractor Trailer Vehicle

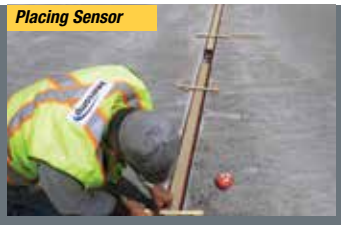
Sensor

Sensitivity (Nominal)	0.75 (0.825)m V/V at 6000lb (3000kg)
Output Variance over the Length of Sensor	<0.5±%
Linearity	<0.1±% FSO
Hysteresis	<0.2±% FSO
Operating Temperature Range	-40 to 175 ˚F (-40 to 80˚C)
Temperature Coefficient of Sensitivity	0.002 (0.0036) ±% of Load/˚F (˚C)

Electrical Specifications

6-Conductor Cable:	± Excitation, ± Signal, ± Sense, plus Shield Ratiometric mV/V output, 1mV/V @ 8,000lb Typical
Bridge Resistance:	150 to 205 ohms
Recommended Excitation:	5-10V

Installation Notes


Placing Sensor


Sanding Flush

Installation of the Strip Sensors is a straightforward process that takes a single day in the existing roadway. Performance of any WIM system is dependent on the quality of the installation and condition of the adjacent roadway surface. Intercomp recommends site conditions that comply with ASTM1318-09 section 6 and COST 323 section 5 standards when selecting the proper site in order to achieve optimal performance.

The Intercomp WIM system is less susceptible to poor road conditions like rutting. Strip sensors have been installed in asphalt with significant rutting yet can still exceed ASTM Type III or COST A(5) accuracy standards. Regular inspection of the road service should be made and rutting progression may require additional grinding of the sensors to match the road surface followed by recalibration. Intercomp recommends adherence to local WIM standards.

Strip Sensor Signal Converters and CPUs

A/D signal processing and data communication for software or web applications

WIMLOGIX MODULE

Strip Sensors with WIMLogix Electronics

Intercomp strip sensors connect to the WIMLOGIX module, which provides signal conditioning, data acquisition, and basic processing. The table below illustrates data and communication options for the WIMLogix modules.

The **WIMLogix Standard** performs the A/D signal conversion, and data from multiple inputs are passed directly via protocol, or communicated via Windows™ based API to separate operating software.

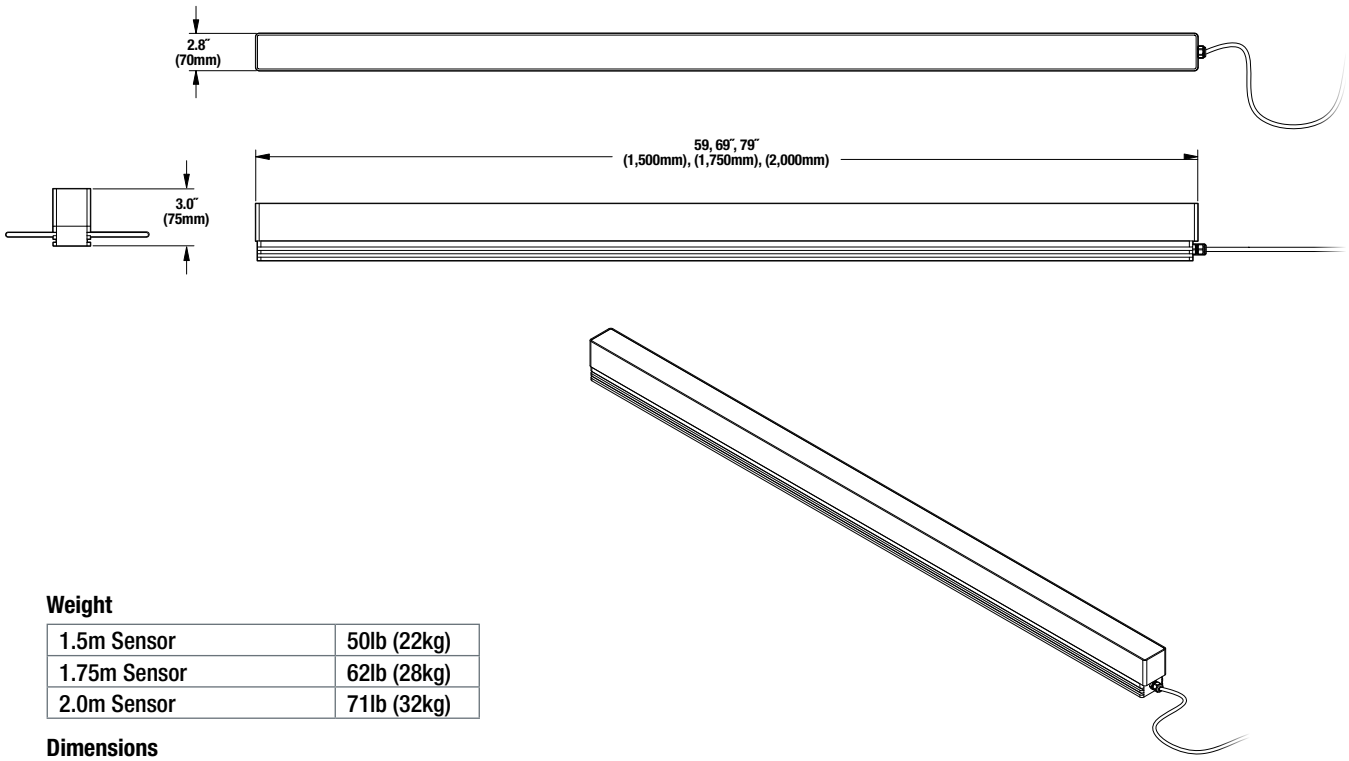
The **WIMLogix Pro** performs A/D conversion, and creates and stores vehicle records for output. Multiple inputs are synchronized, with onboard processing and storage enabling operation as a data logger. Data may also be passed into separate operating software or web applications hosted on or off-site.

	WIMLOGIX Standard		WIMLOGIX Pro	
Output	**Protocol**	**API**	**SOAP**	**Data Logs**
Wheel Load				
Axle Load				
Gross Vehicle Weight				
Speed				
Center-to-Center Spacing				
Vehicle Class (via Axle Arrangement)				
Site Identification Code				
Lane & Direction of Travel				
Date & Time of Passage				
Sequential Vehicle Order				
Violation Code				
Axle-Group Load				
Equivalent Single-Axle Loads (ESALs)				
User-Definable Weight Violations				
System Requirements	ANY	.NET	ANY	ANY
Time Frame	REAL TIME	REAL TIME	REAL TIME	DAILY

***Data Fields & Output Format are Customizable**

Fully Provided

Handled by Customer Software



Weight

1.5m Sensor	50lb (22kg)
1.75m Sensor	62lb (28kg)
2.0m Sensor	71lb (32kg)

Dimensions

Length	59, 69, 79in (1.5,1.75,2.0m)
Width	2.80in (70mm)
Height	3.0in (75mm)

General Data for Sensor

Cable Length	100 to 328ft (30 to 100m), Custom Lengths Available
Connector	MIL-C-26482 (8-pin Metal Cylindrical Connector, Bayonet Quarter Turn Lock)
Degree of Protection	IP 68EN60529

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