Walk Horizon

Weigh2X

On-Board Weighing Systems

WALKHORIZON TECHNOLOGIES CO. LTD.

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High-Precision, Cost-Effective On-Board Weighing

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Executive Summary

This white paper introduces the WALK HORIZON NEW-T3000 system, a cutting-edge on-board weighing (OBW) system that sets a new standard for precision, affordability, and reliability in the commercial vehicle industry. Designed to address the critical challenges of overloading, operational inefficiency, and safety compliance, the NEW-T3000 leverages axle-strain measurement technology and sophisticated algorithms to deliver unparalleled accuracy (±1-2%). At a fraction of the cost of traditional European solutions (e.g., VPG, VEI), our system provides a rapid return on investment (ROI) by eliminating scale fees, preventing overweight fines, optimizing load efficiency, and enabling data-driven fleet management. This document details the technical architecture, innovative core technology, and quantifiable benefits of adopting the WALK HORIZON solution for modern fleets.

1. The Challenge: The High Cost of Weight Management Inefficiency

North American fleet operators face mounting pressure from stringent DOT regulations, rising operational costs, and intense competition. The traditional reliance on static scales creates significant bottlenecks:

- Overweight Fines: Costly violations and vehicle downtime.
- Operational Inefficiency: Long queue times at scales reduce daily trips and revenue potential.
- Lack of Real-Time Data: Inability to monitor loading processes leads to guesswork and suboptimal load distribution.
- Vehicle Wear and Safety Risks: Chronic overloading accelerates wear on tires, brakes, and suspensions, increasing maintenance costs and safety hazards.

While OBW systems are a proven solution, the market has been constrained by high-cost, low-accuracy options that fail to deliver a compelling ROI.

2. WALK HORIZON On Board Weighing System

The NEW-T3000 is a comprehensive, end-to-end solution comprising hardware, software, and cloud services.

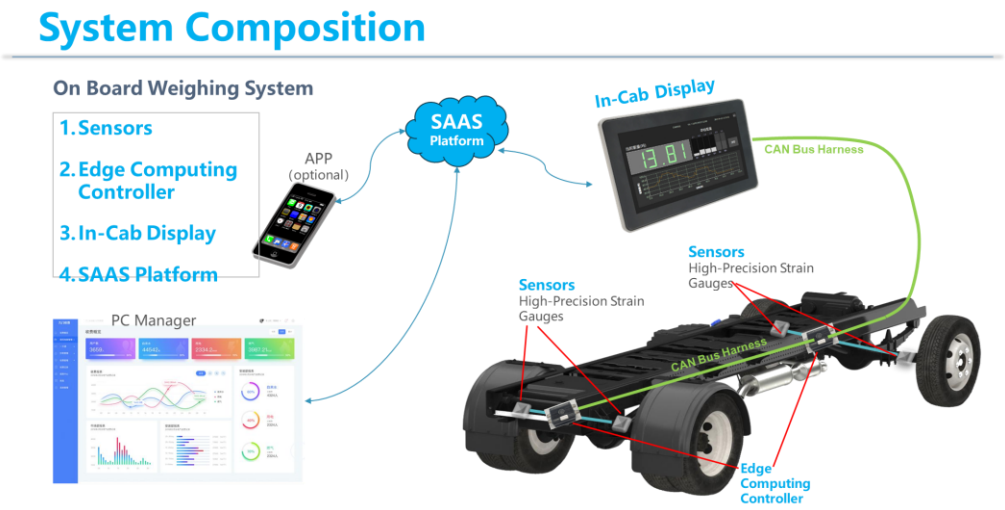


Fig1 :System Architecture Diagram

High-Precision Strain Gauges(H200): The core sensing element, securely bonded to the truck axle.

Edge Computing Controller (GC50): A robust, IP68-rated module that performs real-time signal processing and data computation.

In-Cab Display(NEW-T3000): Provides instant weight feedback to the driver.

IoT Platform: A SaaS portal offering fleet-wide data analytics, historical reports, overload alerts, etc..

3. Technical Deep Dive: Engineering Superiority

3.1 Overcoming Fundamental Measurement Challenges

Challenge: Measuring Microscopic Deflection. Axle deflection under load is minimal (~1% of leaf spring deflection), demanding extreme sensor sensitivity.

Our Innovation: Proprietary sensors with high sensitivity (2V/ε) coupled with ultra-low-noise amplification circuitry (0.02% resolution) capture micro-scale changes.

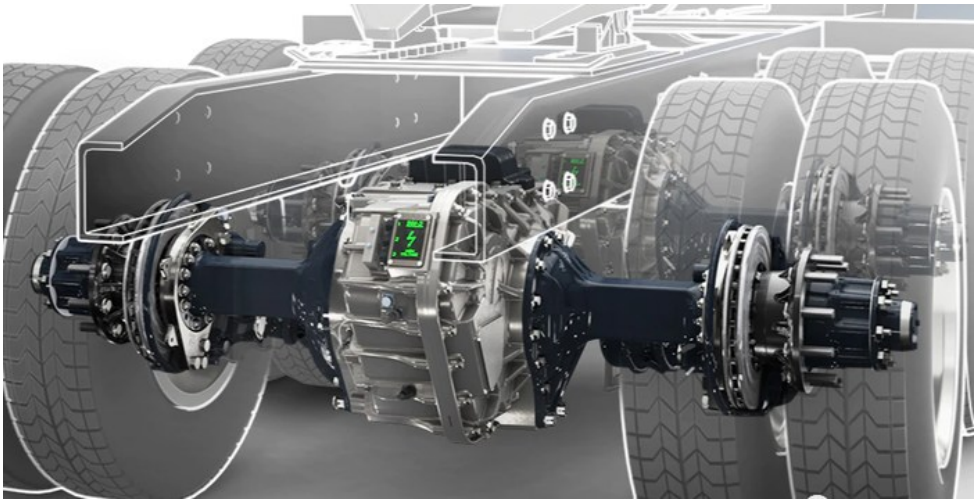
Challenge: Ensuring Environmental Stability. Temperature fluctuations and vehicle vibration are primary sources of measurement error.

Our Innovation: Proprietary Intelligent Temperature Compensation and Vibration Compensation Algorithms neutralize thermal drift (<0.05%FS/°C) and mechanical noise, ensuring reliability from -20°C to 60°C.

Challenge: Guaranteeing Manufacturing Consistency.

Our Innovation: Pre-packaged sensor technology and a symmetric bridge design ensure consistent performance and durability across mass production.

4. Why Axle-Strain Measurement is the Superior Technical Path



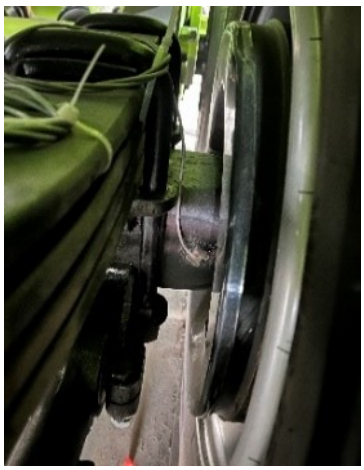
Technology	Principle	Limitations / Challenges	Impact on Accuracy & Notes
Strain Gauge-Based (Axle)	Direct measurement of strain on the load-bearing axle.	Requires high-sensitivity sensors and precise installation.	**Minimal.** Compensated by advanced algorithms. Achieves stable accuracy of **±1-2% FS** (Full Scale).
Leaf Spring Strain	Measures bending deformation of the leaf spring using strain gauges.	**Material Creep and Hysteresis:** Causes signal drift. **Aging:** Accuracy degrades with fatigue.	**Significant.** Inherent material limitations. Typical accuracy **3-5% FS**.
Air Suspension System	Infers load by measuring pneumatic pressure within the air springs.	**Indirect measurement:** Affected by **friction**, **temperature**, and **vehicle inclination.**	**Severe.** Prone to systemic errors exceeding **10% FS** on slopes or with temperature fluctuations.

Conclusion: The NEW-T3000's Axle-Strain method provides a direct, fundamental measurement free from the systemic errors that plague alternative technologies.

Performance Benchmarking Table

Parameter	**WALKHORIZON** NEW-T3000 / GC-50	Typical Leaf Spring Strain-Based OBW	Air Suspension / Gyro-Based OBW
Accuracy (Full Scale)	± 2%	±3% - 5%	±5% - 10%
Response Time	<1 ms	Slow, with hysteresis (drift)	Slow (requires stabilization)
Installation Complexity	**Low** (Adhesive Mount)	Medium (Mechanical Clamping)	**High** (Plumbing & Calibration)

Parameter	**WALKHORIZON** NEW-T3000 / GC-50	Typical Leaf Spring Strain-Based OBW	Air Suspension / Gyro-Based OBW
Lifespan	Life of the Axle	Limited by spring fatigue	Limited by mechanical wear of components
Cost (Hardware + Integration)	~$2,000	$5,000+	$5,000+



5. Products

■ GC-50 Intelligent Edge Computing Module

Datasheet

General Description

The GC-50 Strain Signal Processor is a high-performance data acquisition system designed for material strain measurement. By pairing with various dedicated sensors, this device can be applied to monitor strain in structures such as buildings, bridges, highways, and other large-scale structural components. It features high sensitivity, precision, stability, and low noise performance, making it suitable for a wide range of applications across industries that require precise strain measurement.

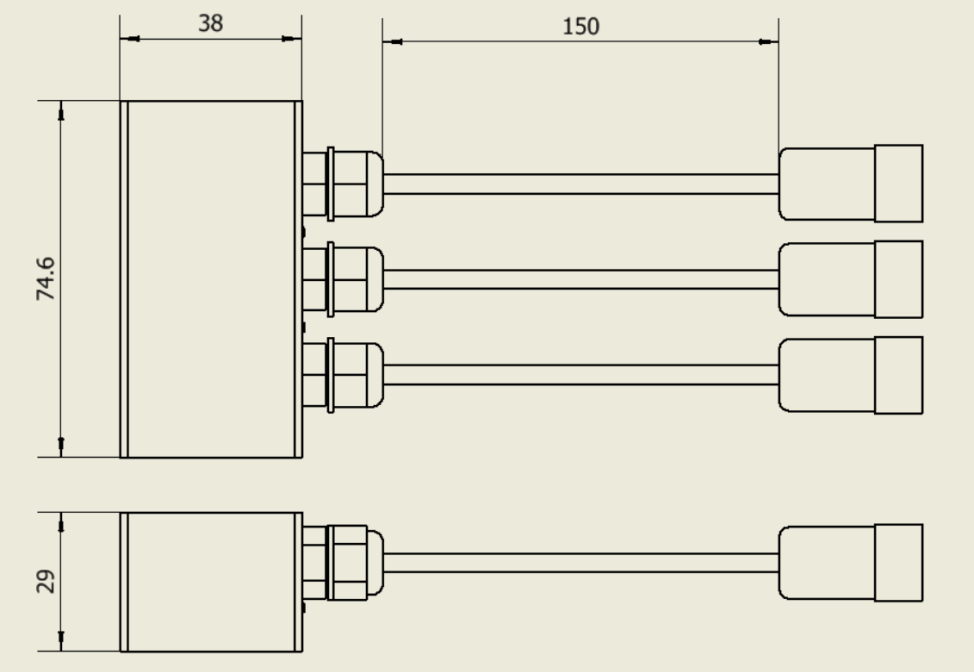
Features:

- High accuracy
- High sensitivity
- Excellent stability
- 255 steps adjustable gain
- Fast response
- Rigid and durable
- Compact size, easy install
- Uniq ID
- Programmable device address
- Up to15 devices on one bus

Parameters

- Power Supply: DC 9V-14.5V 60mA
- Communication Port: RS485 9600bps
- No. of sensor channels: 2
- Response time: <10ms
- Sampling resolution: 12 bits
- Analog resolution:0.02%
- Analog accuracy: <0.1%
- Overall accuracy：<2% after calibration
- Working mode: Master->slave aquiring
- Max number of device on bus: 15
- Dimension: L x W x H = 75mm x 29mm x 38mm
- Weight: 105g

Appearance & Dimension

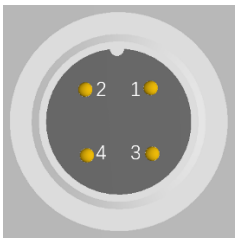


Connector and pinout

Port function:

COM	Power and communication
CH1	Sensor Port 1
CH2	Sensor Port 2

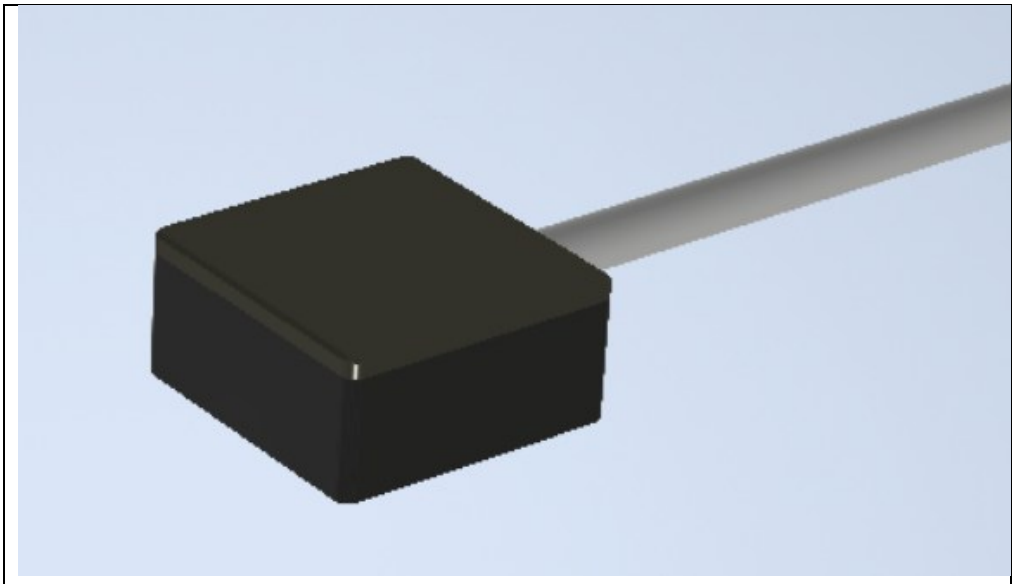
COM port is used for RS485 communication and power supply. Multiple devices can ben connected to one bus in parallel. Pin map defined as followed:



Pin No	Function	Notes
1	RS485+（A）	
2	VCC	DC 9-12V
3	GND	
4	RS485-（B）	

■ GH-200 Strain Gauge Sensor

Datasheet



General Description

The GH-200 strain sensor is a high-sensitivity, high-reliability, and highly environmentally adaptable strain sensor specifically designed for truck onboard weighing applications. It can also be widely used in various other fields requiring the measurement of minute material deformations, such as bridges, railways, buildings, pressure vessels, chemical equipment, and various types of engineering machinery.

The GH-200 features a fully sealed design with waterproof and dustproof capabilities, enabling it to adapt to various harsh environments. When used with a specialized adhesive (KN907Ti), it can be easily mounted on surfaces of various materials, including steel, aluminum, glass, concrete, and fiberglass. After curing, it can accurately measure minute material strains with high precision.

The GH-200 incorporates an innovative and unique structural design, making it more convenient to use and suitable for various on-site working environments where directly attaching strain gauges is challenging. This significantly expands the application scenarios for strain measurement.

When paired with the specially designed GC-xx series high-gain strain-specific signal processor, the GH-200 can perform a series of processes such as sampling, amplification, digitization, and low-pass filtering on various weak strain signals. The processed results are then transmitted to an upper computer via an RS485 interface for further storage and analysis.

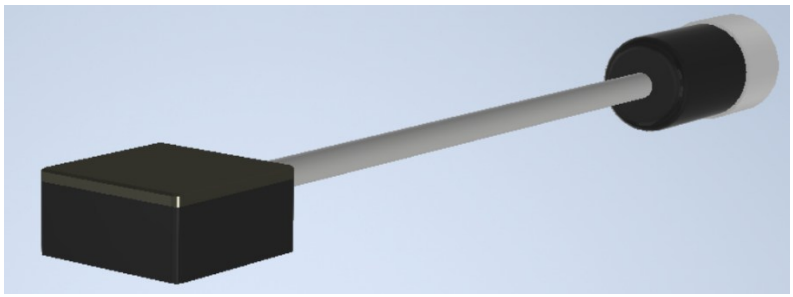
Parameters

Parameter	Unit	Value
Sensitivity	ε	2xε
Max Strain	με	2000
Max Out Voltage	mV	±4
Overall Error	%FS	±3
Repeat Accuracy	%FS	±1

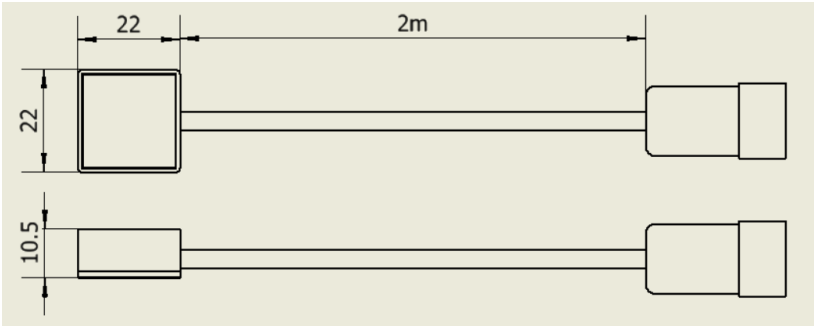
Nonlinearity	%FS	±1
Temp Drift	%FS/℃	0.02
Working Temp	℃	-20-60
Storage Temp	℃	-40-85
Case Material		PA66
Cable Length	m	2
Connector		5Pin Din Male
Weight	g	80 (w cable)
Dimension	mm	22x22x10.5
Water Proof		IP68

Appearance & Dimension

3D View



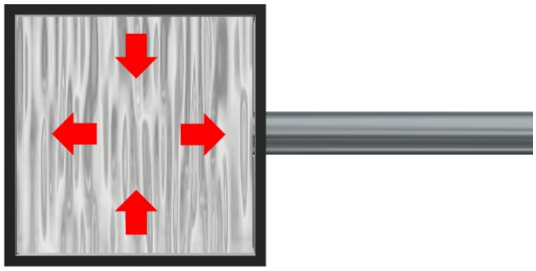
Dimension



Mechanical and Electrical Features

4.1 Strain Direction

During use, the installation direction should first be determined based on the actual deformation direction of the workpiece being measured. When used in conjunction with the GC series strain signal processor, the positive strain direction of the GH-200's signal output is as shown in the figure below:



That is, the system output value of the GH-200 + GCxx series signal amplifier combination increases when the sensor is compressed perpendicular to the cable orientation or stretched parallel to the cable orientation. If used with other types of signal amplifiers, identification based on the specific amplifier’ s characteristics is required.

The sensor must be attached to the measurement target using specialized adhesive and allowed sufficient curing time before measurements are taken. The maximum strain on the workpiece must not exceed the limit value (±2‰), otherwise irreversible damage may occur to the sensor.

4.2 Electrical Characters

The GH-200 is a full-bridge type four-terminal device that can be driven by either constant voltage or constant current. The relevant parameters are as follows:

- Single-arm impedance: 1 kΩ
- Maximum constant voltage drive: 5V
- Maximum constant current drive: 5mA

The GH-200 strain sensor is a highly sensitive device and is relatively susceptible to external electromagnetic interference. The GH-200’ s built-in cable uses high-quality shielded wiring, which effectively blocks various external interferences. When the sensor is used in conjunction with the GCxx series signal amplifier, the amplifier’ s cable and structure also feature excellent shielding design, ensuring strong suppression of external electromagnetic interference.

If the GH-200 is used with other signal amplifiers, special attention must be paid to shielding. Additionally, as the amplifier is a highly sensitive device, the conductor resistance of the connecting cables and the contact resistance of the connectors should also be taken into consideration, as these factors may introduce significant system errors if neglected.

4.3 Connector and Pinout

GH-200 use DIN-5 Circular Connector:

Pin map:

Pin No	Description
1	V+，Power Supply+
2	V-，Power Supply-
3	Out A
4	Out B

The power supply's negative terminal is connected to the cable shield. The cable should ideally not be extended, as doing so may compromise measurement accuracy and introduce excessive interference. If extension is necessary, a shielded cable must be used for the extension, and its shield must be connected to Pin 2.

■ Quantifiable Benefits and ROI

1. **Eliminate Overweight Fines:** Prevent thousands of dollars in fines and downtime by ensuring compliance in real-time.

2. **Maximize Load Efficiency:** Optimize every trip to approach legal limits safely, increasing revenue per journey.

3. **Reduce Operational Costs:** Cut scale fees and reduce vehicle wear and tear, lowering total cost of ownership.

4. **Enhance Safety & Security:** Prevent overloading hazards and monitor high-value cargo.

5. **Data-Driven Management:** Leverage cloud analytics to benchmark driver performance, plan routes, and optimize fleet operations.

6. Case Study: Proven Results in the Field

Case Study 1: Bulk Terminal Operator Achieves 20% Efficiency Gain

Background:

A bulk handling operator at a major port sought to boost the efficiency of its existing fleet through digital transformation. Its trucks averaged approximately 10 daily trips between the dock and the yard, but the reliance on static scales provided no real-time guidance for loading operations.

Solution:

The fleet was integrated with the NEW-T3000 onboard weighing system, which enabled high-precision, real-time weighing during the loading process.

Result:

Real-time data allowed for precise optimization of loading operations, entirely eliminating delays previously caused by over- or under-loading estimations. This intervention increased average daily trips from 10 to 12 per truck, corresponding to a 20% increase in daily hauled tonnage and a significant boost in operational productivity.

Case Study 2: Electric Truck Fleet Establishes Data-Driven Energy Benchmark

Challenge:

An operator of an identical-model electric truck fleet observed significant monthly variations in energy consumption. However, differing workloads and a lack of precise load data made it impossible to establish a reliable energy efficiency benchmark or identify underperforming vehicles.

Solution:

Integration of the NEW-T3000 system provided accurate data on the cumulative weight hauled by each vehicle per month.

Result:

The fleet manager gained the ability to perform precise, load-normalized comparisons of energy consumption across the fleet. By calculating the median energy use and identifying maximum deviations, a credible performance benchmark was established. This data-driven approach enables targeted performance reviews and maintenance for outliers, driving down the fleet's overall energy consumption.

Case Study 3: **Empowering Port Autonomous Trucks with Enhanced Algorithm Stability and Intelligent Control through Real-Time Load Analytics**

Challenge: A leading L4 autonomous trucking company specializing in port operations faced a critical gap in their perception system. Their existing approach relied on indirect mass estimation through powertrain torque output and acceleration response modeling—a method that yielded errors exceeding ±15%, suffered from significant response lag, and failed to provide axle-specific load distribution data. This uncertainty in real-time vehicle mass severely limited their ability to optimize braking and steering algorithms across varying load conditions, creating safety margins that compromised operational efficiency. Without accurate, instantaneous weight data, their autonomous systems couldn't differentiate between an empty and fully-loaded vehicle quickly enough to adjust control parameters—a fundamental requirement for safe autonomous operation in dynamic port environments.

Solution: We deployed our GH200 strain sensors with GC50 signal processors directly on the vehicle axles, transforming weight measurement from estimation to direct sensing. The system achieves ±2% accuracy in static conditions and maintains within ±5% accuracy during vehicle operation through advanced Kalman filtering algorithms. Unlike indirect methods, our solution provides instant, axle-specific load

data via CAN bus integration into the autonomous vehicle's perception layer. This real-time mass and center-of-gravity information enables dynamic adjustment of control parameters with no lag—a 3x improvement in accuracy and elimination of the response delay that plagued their previous approach.

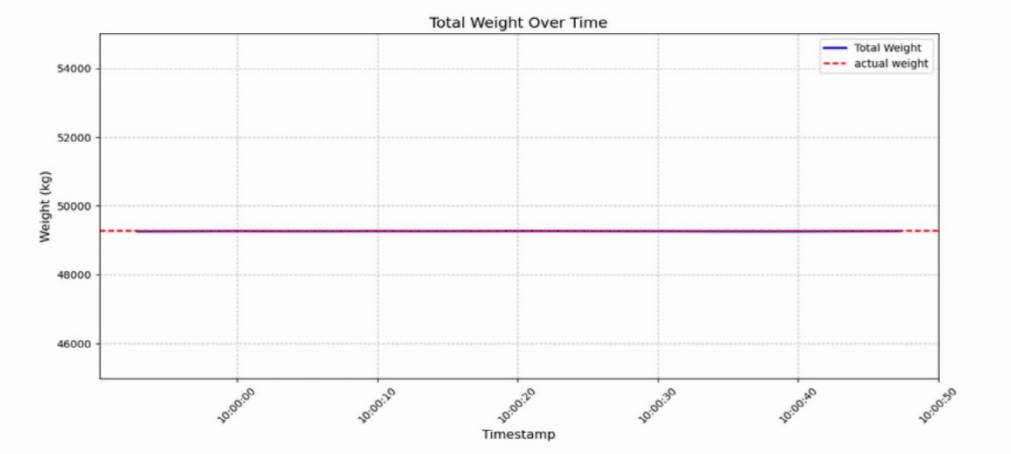
Result: The precision weight data transformed the autonomous system's performance. With accurate mass information replacing unreliable estimates, the vehicle achieved 35% reduction in braking distance variance and 28% improvement in steering response consistency across load conditions (0-40 tons). The elimination of the ±15% weight uncertainty allowed the engineering team to tighten control tolerances, improving both safety and efficiency. The system now maintains stable performance whether running empty or fully laden, accelerating the client's path to commercial deployment. This implementation has become the reference architecture for autonomous port vehicle weight sensing, with the client reporting it as a "game-changing enhancement" to their perception stack.

7. The Foundation for Adaptive Driving: Mass as a Critical State Variable

■ Field Measurement chats and Filtering

The field measurement primary data source is a six-axle tractor-trailers.

Over the course of the 50-minute test, the sensor output maintained strong linear correlation and exceptional stability.

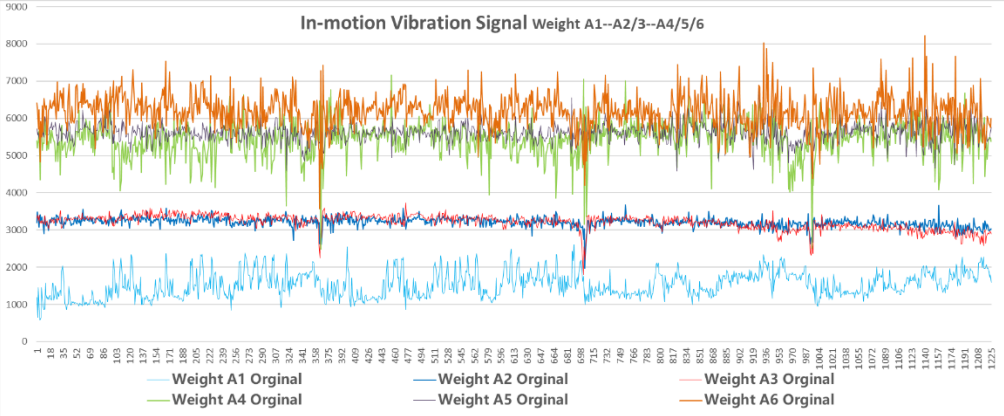


Real-time vehicle control requires high-frequency data, the accurate knowledge of a vehicle's static total mass is the foundational parameter upon which all dynamic calculations are built. Our Weigh2x system provides this critical baseline with industry-leading ±2% FS Composite Error, ±1% FS Linearity Error and ±1%Repeatability Error accuracy.

Total mass directly determines a vehicle's inertial properties. By providing this data via vehicle CAN bus, our system enables Advanced Driver-Assistance Systems (ADAS) to proactively adjust stability control (ESC), anti-lock braking (ABS), and traction control (TCS) thresholds before a maneuver is initiated, significantly enhancing safety for heavy-duty vehicles.

■ In-motion Vibration Signal

The in-motion vibration signal contains signatures of both road excitation and vehicle body resonance.



Now the **0.5Hz data** provides exceptional accuracy for static and quasi-static load monitoring. While **insufficient for vibration analysis**, as a critical input for calculating vehicle stability metrics.

Our current system provides a highly accurate baseline vehicle weight at a 0.5Hz rate. The essential next phase of development involves adding high-frequency motion sensors (IMUs). By fusing our trusted weight data with these rapid motion measurements, we will create a real-time picture of dynamic forces—such as load transfer in a turn or during braking—providing the critical data required for autonomous vehicle control.

8. About US: A Trusted Technology Partner

With over 15 years of excellence, we are an award-winning high-tech enterprise with a demonstrated history of serving internationally renowned clients.

Elite Academic & Industry Pedigree: Our R&D core is composed of top Tsinghua University graduates specializing in precision instrumentation, complemented by a management team with deep operational expertise from global technology leaders such as Oracle and Huawei.

The Weigh2x TRUCK3000 deliver high-grade accuracy at an accessible price point, finally making advanced weight management technology a viable and profitable investment for every fleet operator.

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