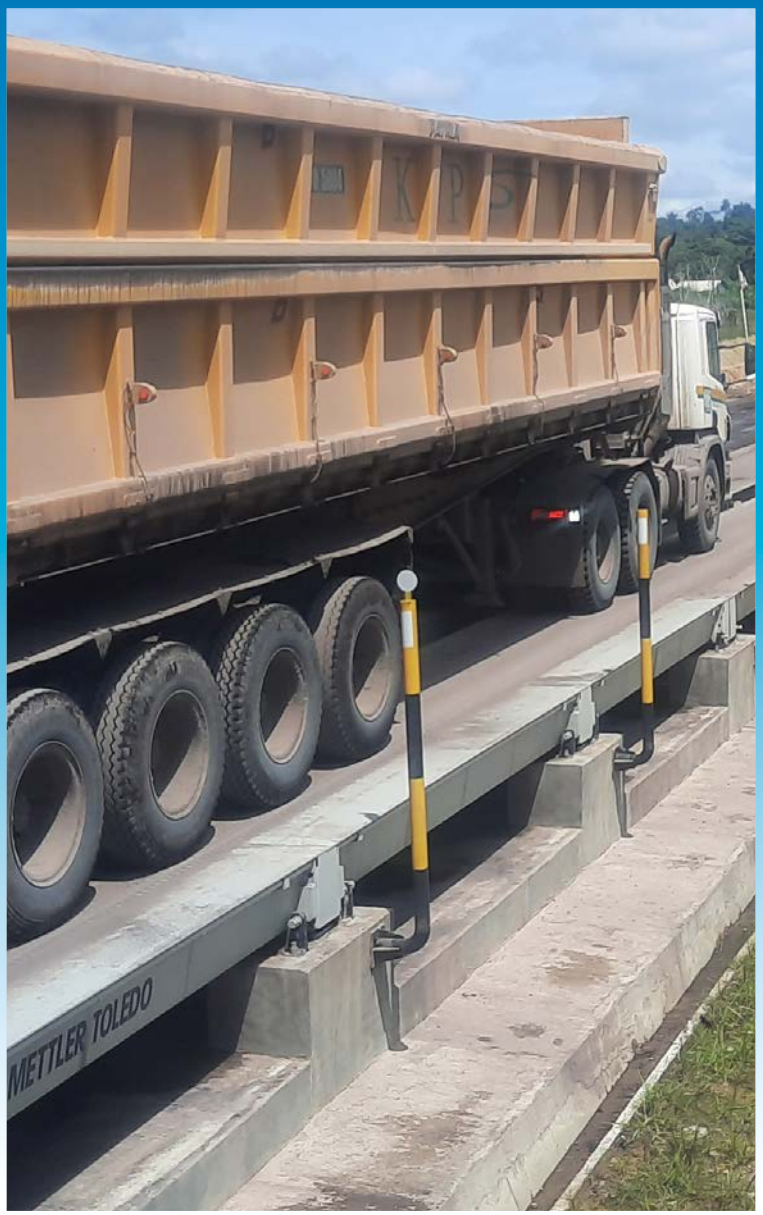
Truck Scale Project Guide



Project Management
Site Validation
Design Factors
Scale Performance

Guide Book
Edition 3

Your Next Truck Scale

Project Components and Execution

METTLER TOLEDO

Preamble

The purpose of this guide is to provide educational information to both new and seasoned weighbridge buyers. It is intended to provide more and different information than you find in sales brochures. While brochures typically discuss "who" and "what," this guide answers "how" and "why."

Most content in this guide is intended to be unbiased and universal in nature. However, there are occasional notes that reflect information about METTLER TOLEDO products. Most often, this is to explain how our systems and components work. You should have no trouble distinguishing the universal information from the information that is specific to METTLER TOLEDO.

METTLER TOLEDO is not the only company that makes good truck scales. However, we believe that our products provide exceptional quality and meaningful innovations. Our hope is that this guide will help you judge for yourself.

Find all the information you need for your next truck scale project.

Content

Weighbridge systems, including the deck, load cells, software, and accessories, should be hand-picked to suit your business and its needs. With some fairly basic considerations, you can establish your requirements for a weighbridge that should last many years.

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Introduction

Truck scales are used all over the world. Businesses large and small, as well as transportation agencies, weigh trucks carrying everything from corn and coal to durable goods and solid waste.

The most common use of a truck scale is to determine the weight of bulk goods being bought and sold in truckload-sized quantities. In those cases, information from the scale is a crucial part of the business transaction. The scale functions much like a cash register.

Enforcement agencies use truck scales to check for a truck's compliance with road-going vehicle weight limits. They are also used to monitor intake and output volumes at facilities, such as solid waste processing and recycling centers, construction sites and more.

Most truck scales are located outdoors. That means they must be able to withstand all environmental challenges while working reliably and accurately. Depending on the environment and application, most truck scale owners expect a scale to last 10 to 20 years.

Truck scales are important to the daily operations of many of the facilities that use them. They also have a relatively long useful life. That means that selecting a truck scale is an important decision – one that can benefit (or burden) its owner for decades.

Terms to Know

Beam slab foundation	A scale foundation using concrete beams poured into an excavation
CLC	Concentrated Load Capacity, a rating used by NTEP in the United States to define the maximum capacity for a single group of axles
Compensation (also digital compensation)	Typically a digital system that is designed to monitor and control for one or more variables that can affect weighing accuracy
Gross weight	The weight of the loaded truck, meaning the truck and the load combined
Handbook 44	Set of weighing equipment regulations used by NTEP/NIST in the United States
Junction box	One or more boxes, typically located at the scale, which join the cable connections of the load cells with the scale terminal
Legal-for-trade (or LFT)	A term used to describe a scale used for business transactions, which must meet certain performance guidelines
Load cells	The sensory devices used to measure the weight on the scale
Metrology	The scientific study of measurement
Net weight	The weight of the load by itself, minus the weight of the truck. Net weight is often calculated as: gross – tare = net
NIST	See NTEP
NTEP (or NIST)	Weights and Measures authority recognized by the United States and others
OIML	Weights and Measures authority recognized by many European and Asian countries
Pier foundation	A scale foundation that uses variable depth concrete piers under each of the scale's load bearing points
Pit foundation	A scale foundation that is excavated so that the driving surface is flush with the surrounding ground level
Above-ground (or open-sided) foundation	A scale foundation designed to have one or both sides open
Tare weight	The weight of the unloaded truck
Terminal	The scale interface, or control unit
Tread plate	On steel deck scales, the driving surface is often a steel plate with a diamond-tread pattern to benefit traction
Weighbridge	The structure of the scale that the truck drives onto in order to be weighed. Sometimes used to refer to the entire scale.

Section 1
Anatomy of a Truck Scale

Becoming familiar with basic components

Nearly all truck scales have some common components that work together to measure weight. Scale buyers should be familiar with these components to determine the scale that is best equipped for their needs.

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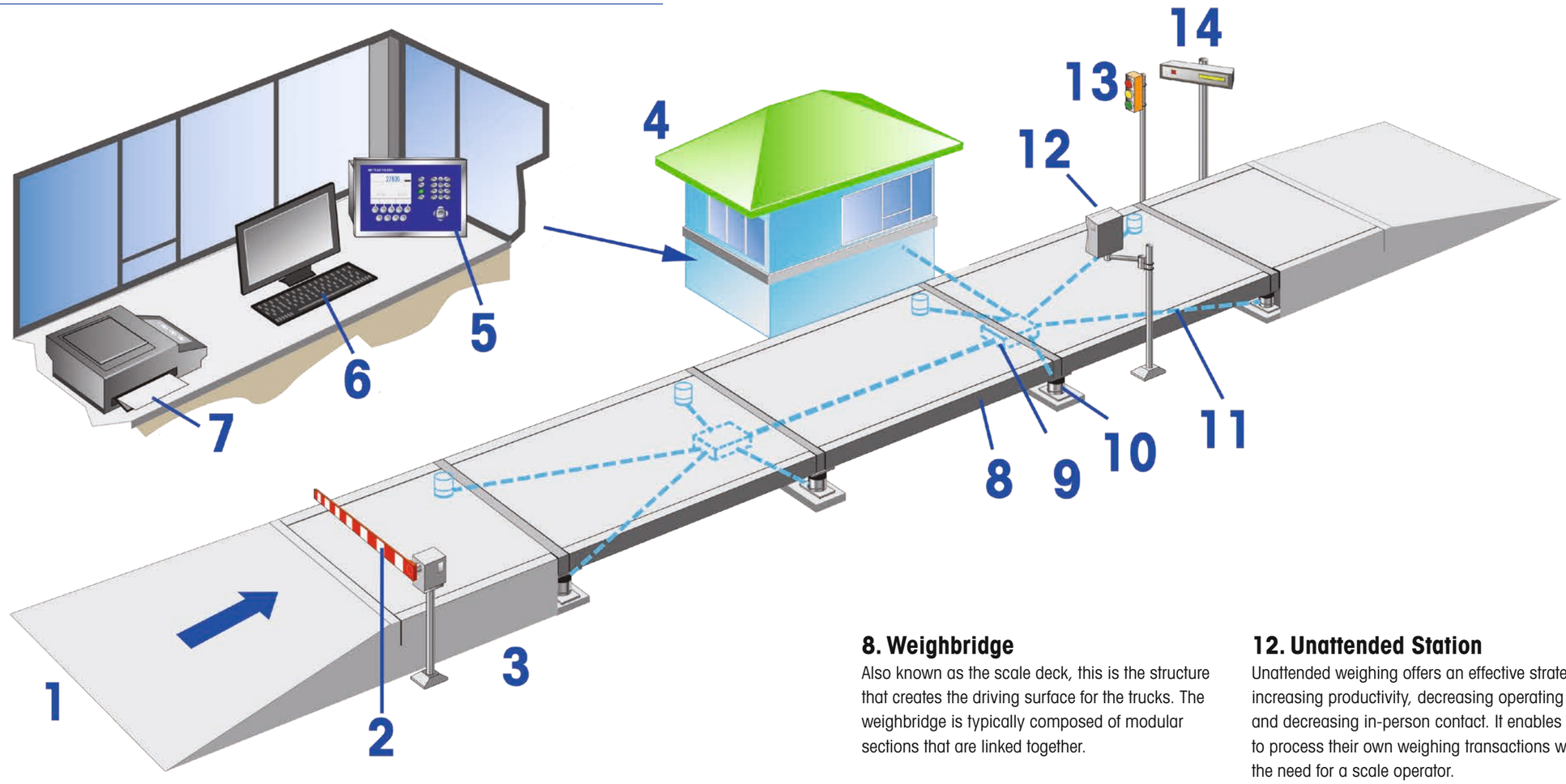
1 – Main Components of a Truck Scale



1. Ramp
Ramps are used to bring the truck to the same level as an above-ground scale.

2. Gate
Gates can be programmed to open and close at specific points during the weighing process to guide drivers.

3. Approach
The approach allows trucks to enter the scale from a level surface to ensure accuracy.

4. Scale House
The scale terminal and operator are normally located in the scale house.

5. Terminal
Also referred to as an indicator, the terminal is the control panel for the scale. It serves as the connection point for other scale peripherals.

6. Computer
Scale software on a computer plays an increased role for sites large and small, automating data capture, speeding up weighing times and reducing opportunities for errors.

7. Printer
Used for printing transaction tickets, a printer can be located in the scale house or within an unattended station.

8. Weighbridge
Also known as the scale deck, this is the structure that creates the driving surface for the trucks. The weighbridge is typically composed of modular sections that are linked together.

9. Junction Box
Many scales require numerous junction boxes as connection points for the load cell cables. However, some newer systems no longer require junction boxes.

10. Load Cells
These are the sensors that measure the weight on the scale. Modern scales use load cells as integral structural components.

11. Load-Cell Cable
The signal from the load cells must be transmitted to the terminal. In most cases, this is done with cables.

12. Unattended Station
Unattended weighing offers an effective strategy for increasing productivity, decreasing operating costs, and decreasing in-person contact. It enables drivers to process their own weighing transactions without the need for a scale operator.

13. Traffic Control Light
Traffic lights indicate to the driver whether to stop or drive forward during the weighing process.

14. Remote Weight Display
A large, digital weight reading is helpful to display a truck's weight to the driver.

Section 2
Truck Scale Applications and Solutions

Finding the right fit for your weighing application

Truck scales are used for a variety of applications, from verification of inventory to trade of high-end chemicals. The addition of truck scale software can further customize and automate your operation.

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1 – Common Truck Scale Applications

A truck scale can accomplish a variety of applications within your industry, from verifying inventory of goods to being the cash register that sells those goods. Below are the common uses of a truck scale. Find the right solution to fit your weighing demands.

	Compliance	Verification/Check	Trade/Transaction
Application Overview	When a customer is transporting their goods by truck and wants to ensure that they are compliant with local roadway loading requirements	When a customer is using the truck scale to track and trace the material they supply and/or receive	When a customer wants to use the truck scale to either buy or sell their commodity
Desired Outcomes	• Reduce fines • Minimize delays • Optimize loads	• Track supply and inventory • Reconcile billing/invoices • Reduce fraud and errors	• Accurate and compliant billing/payment • Reduce fraud and errors • Provide exceptional customer service

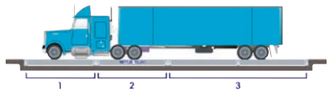
2 – Types of Scale Terminals

The design of truck scale terminals varies to suit your needs. Choosing the right terminal can help streamline your business operations.

	Scale House Truck Scale Terminal	Unattended Terminal
Overview	A standalone scale terminal is often stored in the scale house and serves as the control panel for the scale. It displays the weight value to the operator, and often serves as the connection point for other scale peripherals such as scoreboards and printers.	Unattended terminals allow you to weigh vehicles and capture information, 24 hours a day, 7 days a week, without the need for a scale operator. These highly configurable systems can be set up to match the needs of your operation.
Processing Speed	Manual processing speed due to the required interface between driver and scale operator	Fastest processing speed due to the truck driver not having to get out of the truck cab
Typical Project Cost	$ $$	$$$
Additional Information	• Performs simple transactions with gross, tare, and net weights • Can control basic traffic systems	• Performs advanced transactions • Saves yard space and cost by not having to build and staff a scale house
Typical Application	Scale house terminals are typically used at sites with 1 to 2 scales and lower daily truck traffic	Unattended terminals are most often used at sites with heavy truck volume that require a higher level of efficiency and security

3 – Types of Truck Scales

Different truck scales are better suited for certain applications. The table below can help match your application to the right truck scale for you, taking into consideration cost, volume, and truck type.



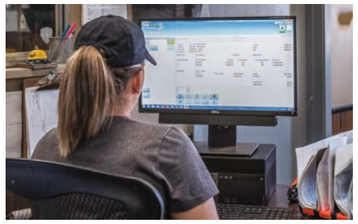
	Single-Axle Truck Scale	Full-Length Truck Scale		Multi-Axle Truck Scale	Weigh-In-Motion (WIM) Truck Scale
Overview	Composed of a single platform, large enough for a single set of truck axles. These cost-effective scales allow you to weigh each axle separately. In order to determine full truck weight, you then add all of the weights together.	Composed of multiple platforms that are connected together to accommodate an entire truck. This is the most common type of truck scale set-up because most legal-for-trade rules specify that the entire truck be weighed at once.		Similar to a full-length scale with the same profile but with one key difference: instead of interconnected modules and shared load cells, each module has its own cells. This allows for the scale to capture both full truck weight and individual axle weights.	In-ground single platform WIM scales capture axle weights while the vehicle is in motion and calculate a vehicle's gross weight. WIM scales provide an efficient way to ensure that vehicles comply with local highway weight limits. In some regions*, weigh-in-motion technology for full-length truck scales is available for legal-for-trade weighing.
Processing Speed	Lowest processing speed due to multiple stops by the truck	Medium processing speed due to only a single stop by the truck		Medium processing speed due to only a single stop by the truck	Fastest processing speed due to no stops by the truck
Typical Project Cost	$ $ $	$ $ $		$ $ $	$ $ $
Additional Information	• Profile is ideal for sites with space restraints • Solution is not accurate enough for legal-for-trade weighing	• Can be used bi-directionally for legal-for-trade weighing • Cannot capture individual axle weights		• High performance due to more load cells being used in the system • Not designed for bidirectional weighing	• Profile is ideal for sites with space restraints • Solution is not accurate enough for legal-for-trade weighing
Typical Application	Single-axle scales are most often used to check compliance against local roadway limits	Full-length truck scales are often used in applications that require a legal for trade transactions		Multi-axle scales are most often used in legal-for-trade applications that also want to check for compliance against local roadway limits	WIM scales are most often used in applications with heavy truck traffic that require a compliance check against local roadway limits

*Currently approved in the US, with other regions to follow.

How Your Static Truck Scale Can Enable Over-the-Road Compliance
Over-the-road regulations can be difficult to keep track of, and costly to violate. Did you know you can use your weighbridge to ensure over-the-road compliance? By using a software module for your indicator, you can gain insight into axle group weights in addition to gross weights to ensure that your truck is loaded evenly and legally, helping to avoid fines and delays.

4 – Types of Scale Software

Every business uses software to perform daily tasks. Truck scale software can complement your weighing needs by keeping digital records or performing transactions.



	Basic Scale House Software	Advanced TruckScale Software
Overview	Basic truck scale transaction software is used at a single site with 1 to 2 truck scales. It interfaces directly with the scale terminal and can support the pretransaction process by storing customer, vehicle, and product information in a secure database.	Advanced truck scale software is highly customizable and is best suited for sites with multiple scales that want a greater level of visibility into their truck scale process. It offers advanced reporting that can be delivered quickly to back office operations for review.
Processing Speed	Medium processing speed due to storing presets of vehicle, product, and customer data	Fastest processing speed due to customized set up and advanced transaction features
Typical Project Cost	$ $$	$ $ $
Additional Information	• Typically a single-user network • Electronically stores standard reports and transaction tickets	• Can be networked across multiple workstations, and even multiple sites
Typical Application	Basic software is used at sites that want to improve the accuracy of their scale data by eliminating manual data entry	Advanced software is used at sites that are focused on improving both the accuracy and speed of their transaction process

5 – Automate the Scale House

Automating your business processes increases productivity and accuracy while decreasing human error. This increase in efficiency results in a timely return on your investment.

	Compliance	Check/Verification	Trade/Transaction
Solution Productivity / Truck Scale Automation	**Scale Type:** Weigh-in-motion **Terminal Type:** In-motion weighing terminal **Software:** WIM application software	**Scale Type:** Weigh-in-motion **Terminal Type:** In-motion weighing terminal **Software:** WIM application software	**Scale Type:** Full-length **Terminal Type:** Unattended terminal **Software:** DataBridge transaction software
	Scale Type: Multi-axle **Terminal Type:** Unattended terminal **Software:** Transaction management software	**Scale Type:** Full-length **Terminal Type:** Unattended terminal **Software:** Transaction management software	**Scale Type:** Full-length **Terminal Type:** Unattended terminal **Software:** Transaction management software
	Scale Type: Single-axle **Terminal Type:** Standalone indicator **Software:** Transaction management software	**Scale Type:** Full-length **Terminal Type:** Standalone indicator **Software:** Transaction management software	**Scale Type:** Full-length **Terminal Type:** Standalone indicator **Software:** Transaction management software

Solution Accuracy

Section 3
Site Planning

Ensuring operational efficiency

Most buyers expect their truck scale to last 10 to 20 years, depending on their application. That means that when it comes time to develop a plan for the scale site, it is important to consider your future needs. The layout should be adequate, efficient and able to accommodate growth in your operation.

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1 – Site Conditions

There are a few site condition considerations that must be accounted for: subsurface obstructions, drainage, and soil bearing pressure.

Obstructions
Subsurface obstructions include human-fabricated obstacles, such as water lines, gas lines, power lines, sewers, drains, and old landfills. They must be moved or avoided. Natural obstacles that must be considered include high water tables, boulders, bedrock and sinkholes. If you have any doubt about what's under your site, consider ordering test borings before you start excavation.

Drainage
Every scale located outdoors needs adequate drainage. You do not want excessive storm water or snow-melt flowing over, through, or into your scale. Open-sided scales usually allow water to flow off the foundation naturally. Pit scales, on the other hand, need sufficient drain piping and/or sump pumps.

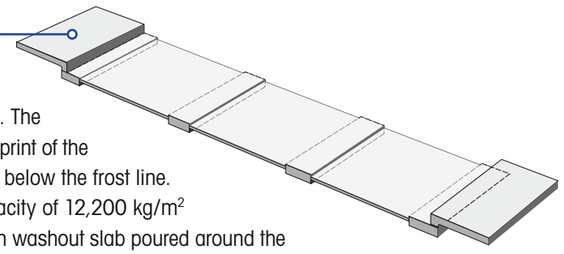
If your area experiences freezing temperatures, also consider frost heave. Damage to the scale foundation can result from the subsurface around the scale expanding and contracting. Adequate subsurface drainage reduces that risk.

Soil Bearing
The soil at the site needs to be strong enough to support the foundation, the scale and the loads the scale will weigh. That is determined by establishing the soil bearing pressure at the site. Many facilities will have this information on file from construction records when the site was developed. If not, and depending on your area, a civil engineering agency can assess the soil. The soil's strength may have an impact on the design of the foundation to be used. Specific requirements will be noted on your scale company's foundation drawings. These typically range from 7,300 kg/m^2 to 12,200 kg/m^2 (1,500 psf to 2,500 psf). If the soil bearing capacity is too low, the foundation design may need to be modified to compensate.

2 – The Foundation

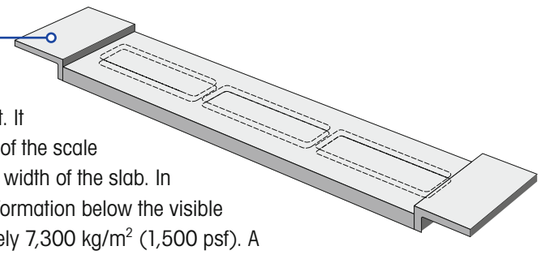
A stable foundation is critical. Any movement or settling may throw your scale out of adjustment and necessitate recalibration, or worse. Continued movement would mean a continuing need for recalibration. Over time, an unstable foundation could move enough to exceed the scale's corrective capacity, in which case you must start all over again and build a new one. The foundation must be designed and installed properly. Work closely with your scale supplier. They can advise you on acceptable foundation designs for your locale and they probably have the names of several contractors who have done good foundation work in the past – those who can get the foundation in straight, plumb and level. There are several types of foundation designs. Here, we discuss the most common ones.

Pier Foundation



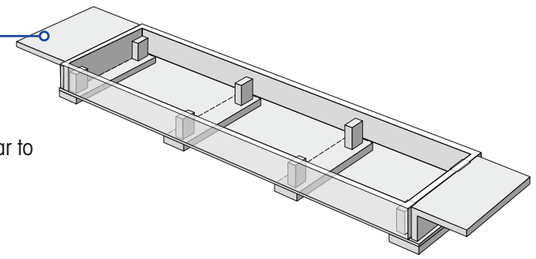
The least expensive foundations use variable depth piers. Concrete piers are poured under each of the scale's load-bearing points. The total capacity of the scale determines the footprint of the piers, which are then dug to undisturbed soil below the frost line. The soil must have a minimum bearing capacity of 12,200 kg/m^2 (2,500 psf). It can be helpful to include a thin washout slab poured around the piers to aid in periodic cleaning.

Beam Slab



The beam slab foundation has extra excavations beneath the slab into which additional concrete is poured for added support. It will typically include beams running the length of the scale along each side, as well as beams running the width of the slab. In combination, those beams make a ladder-bar formation below the visible slab. Minimum bearing capacity is approximately 7,300 kg/m^2 (1,500 psf). A beam slab foundation is stronger than a pier-style foundation.

Pit Foundation



Pit foundations may be designed to allow service technicians adequate space to access components beneath the weighbridge. The recommended soil bearing capacities are similar to the beam-slab foundation.

3 – Approaches and Ramps

The approach is the part of the scale foundation that the truck drives over just before driving onto the weighbridge or scale deck. In addition to the approach, the scale may need a ramp where the road transitions to the scale foundation. Guidelines for the approach are defined by the Weights and Measures authority in some areas.

For example, in the United States, a general recommendation is to make the length of the approach twice the width of the weighbridge. However, specific requirements for approaches often are defined by local authorities depending on the types of trucks you are weighing and the materials they are carrying. There may be a maximum grade (slope) for approaches and ramps – for example, ½ inch per foot in the United States. Be sure to check the standards for your location.

Approach requirements like these are minimums and do not guarantee that every truck can maneuver onto the scale without difficulty. You may need longer approaches if the trucks are coming off a turn and you are installing your scale above ground. Your scale supplier can give you advice on approaches.

A popular recommendation is to have an approach on each end of each scale (required in some areas). That minimizes the lateral forces generated by trucks driving off. It also gives you the option of two-way traffic over the scale, which is an added measure of flexibility in your traffic pattern.

4 – Scale Site Layout

Let's consider the number of trucks you will be weighing each day. In most cases, each truck will be weighed twice: Once loaded and once unloaded.

Small Commercial
Small commercial operations typically make 50 to 100 weighments per day. Unless all trucks arrive at the same time, the requirements for parking and maneuvering will be minimal. One scale should accommodate this volume well, so plan on two-way traffic over it. Make sure there is a bypass around the scale as well.

Moderate-Volume
Moderate-volume operations typically make 100 to 200 weighments per day. These sites should determine when trucks will be arriving and departing because a parking/staging area may be required. The scale queue should not extend onto public streets or highways. These sites may be able to operate with a single scale and bypass if the traffic flow at peak times is manageable. However, two scales can offer advantages.

High-Volume
High-volume operations typically make more than 200 weighments per day. Planners at these sites should be thinking in terms of traffic patterns (control lights and gates, marked roadways, etc.) not just a parking area. These sites require two or more scales. If you expect to handle a significantly higher volume of traffic, you should consider more than two scales. For maximum flexibility, the scales should be able to handle loaded or empty trucks from either direction. There should also be a sufficient bypass around the scales.

Layout Drawing
Draw a complete plan of the area and think about an average day.
- Where do the trucks go when they arrive?
- Will there be a queue (either or both ways) to use the scale?
- Where do trucks go after being weighed?
- Is there enough maneuvering room between the scale and the loading docks, considering the turning radius of your largest vehicles?
- Do you need a trailer storage area?

Then Consider the What-Ifs
- What if a scale is down for maintenance or repair during the day?
- What if you get a heavy snowfall, or a heavy rainfall?
- What if the capacity of the plant is increased?
- What if drivers are forced to wait before they can load or unload?
- What happens during the busy season?

Testing the Location
It can be worthwhile to perform a test of your selected site before breaking ground. That can be done with the help of traffic cones or other markers to signify the intended location of the scale and accessories. If possible, drive a truck through the configuration to check for issues. Ask experienced drivers if you are unsure of the space they need to maneuver.

Housekeeping
The buildup of spilled material, packed debris, frozen snow/ice, road mud, etc., under or around the scale can have a significant impact on its life and performance. That is why many suppliers and customers advocate

for an open-sided design that can be regularly cleared of stray material. Locating a water hydrant near the scale can aid in regular cleaning operations, so long as pressurized water spray does not present a problem to the load cells, cables, and/or junction boxes at the scale.

Mining and aggregates facilities in particular have had success installing wheel/truck wash lanes before the scale. With an automatic wash lane for cleaning the trucks before they approach the scale, the amount of dirt, mud and gravel falling off the trucks is greatly reduced. It limits the chances for the debris to interfere with the operation of the scale. It also allows for a more accurate weight reading.

Filling Applications
Some sites use their scale as a filling tool, where exact amounts of product need to be dispensed into the truck. These locations may have overhead filling equipment that can limit the vertical space the scale can occupy. Share intentions to use your scale in filling operations with your scale supplier. They may be helpful in suggesting the best configuration and additional scale accessories for these operations.

When estimating the amount of traffic, consider how your operation will use a scale. Consider whether traffic flow is constant, or if it is significantly greater at certain times of day, month, or year. How long will a truck remain on the scale? Plan your installation to handle the peak periods.

5 – Locating the Scale House

The scale house is typically near the scale and may contain indicators, printers and other control devices. Data from the scale can be transferred online or in batches as needed to other locations.

With the scale house adjacent to the scale, the scale operator can:
- Monitor traffic
- Communicate with drivers
- Transfer paperwork to drivers
- Make sure the truck is on the scale properly
- Identify the truck and inspect cargo

Ideally, the scale house should be situated so that the operator inside can see the truck to ensure that it is completely and properly on the scale. The driver may not notice if the rearmost axle is not entirely on the scale. Or, some sites with pit scales have had issues with the placement of a truck's tires along the side of the scale. If the tires are not 100% on the scale, the weight reading will be inaccurate. To ensure proper placement of the truck on the scale, some have even used optical sensors. Video monitoring and voice intercoms can also work well if you are unable to put the scale house near the scale. Many scale companies now offer unattended terminals for driver self-service. These terminals often take the form of a drive-up kiosk that allows a driver to complete a transaction and log data without assistance from a scale operator. Unattended terminals can be advantageous in situations in which 24/7 access is required or when an organization processes repeated similar transactions.

6 – Peripherals and Traffic Control

Terminals
Your scale will have a control unit, often called a terminal or indicator. It can range from simple to elaborate. Below are some of the advanced features you may consider when choosing a terminal:

- Control more than one scale with a single terminal
- Connect with USB/Ethernet to computers and networks to interact with scale software, transfer data across company networks, and take advantage of remote diagnostics
- Benefit from wireless connectivity with the scale and other accessories
- Automate other scale accessories, such as gates and lights for traffic control
- View data on graphic displays with varying levels of detail
- Store tare/net weights with various memory capacities for transaction logging
- Connect to various compatible ticket printers

The terminal also may serve as the power supply to some or all the load cells. Some will specify how many load cells they are able to support. If the power supply to the terminal is subject to fluctuation in your area, consider using an aftermarket power conditioner.

Gates
Some sites place gates at one or both ends of the scale. Whether controlled manually or automated, these gates can indicate when a vehicle should drive on or off the scale. This can also be accomplished with traffic lights.

Lights
Often a green and red traffic light is placed alongside the scale to control the flow of traffic. These lights can be controlled manually or automated.

Remote Displays
A remote display is a numerical display unit that indicates the weight on the scale. They are often placed at the front of the scale so the drivers and/or filling operators can see the weight of their truck when it is on the scale. In some regions, a remote display may be required in legal-for-trade applications.

Guide Rails
Also called guard rails or rub rails, guide rails are an option for most truck scales, although some industries and safety regulations require them. They are frequently used with above-ground (pitless) scales as a safety device to prevent trucks from driving off the edge of the scale. There are two styles of guide rails.

- Scale-mounted guard rails are attached to the weighbridge, by either bolting them to a bracket or welding them to the side of the weighbridge modules. They often can be supplied and installed by the scale supplier.
- Standalone guard rails are built alongside the scale, but are not attached to the weighbridge. In most cases, guardrails will offer superior protection from driving off the side of the scale.

7 – Hazardous Areas and Materials

If you will operate the scale in hazardous areas (flammable or explosive atmospheric concentrations of gases, vapors, mists, dust, or fibers), you will need a scale that has approval (generally from FM, UL, or ATEX) for use in your environment based on its classification. Hazardous area approvals typically are noted on the specifications data for load cells and terminals.

For example, some hazardous area classifications place a limit on the amount of voltage that can be used in equipment. Some regulations require the use of energy-limiting barrier boxes to isolate signals. A good scale supplier should be familiar with these requirements and the types of peripherals that may be used in various areas.

Please note: Hazardous area classification is not the responsibility of the scale supplier. A qualified safety officer at a customer site or local industry regulator must make that determination.

Section 4
Truck Scale Selection Basics

Decisions every scale buyer must make and what to know before talking to suppliers

The size, style and configuration of a truck scale can depend on the needs of the purchaser. However, there are also choices that are more subjective. This section discusses some of the fundamental aspects that differentiate one scale from another.

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1 – Truck Types and Volume

The truck scale is mechanically and structurally designed to support the volume, gross vehicle weight (GVW), and axle group weight of the trucks that will be weighed. Two truck types often weighed by truck scales are over-the-road trucks and off-road trucks. Trucks that are designated to travel over roads must adhere to federal transportation weight and load restrictions. For example, the U.S. Federal Highway Administration (FHWA) of the Department of Transportation sets GVW and axle load limits based on the length of the vehicle. Bridge formula weight calculations set truck weight limits to protect roads and bridges from premature wear and failure.

Truck Traffic Type

A fundamental determination for selecting the correct truck scale is determining traffic type:

- Over-the-road vehicles
- Off-road vehicles
- Combination over-the-road and off-road vehicles

Truck scales for off-road vehicles are designed to the specifications of the vehicle. For example, a CAT 797B off-road vehicle has a gross vehicle weight of 1.375M pounds or 687 tons on a 23.5-ft wheelbase, requiring a highly specialized weighing structure.

Truck Volume

Scale weighbridge structures are designed for the average loads that will be applied over the life of the structure, which is typically 20 years. High volume loads can prematurely wear out the mechanical structure.

The typical truck scale processes <100 trucks per day on average and is considered low volume (<25,000 per year). High volume operations processing 200 to 500 trucks per day (50,000 to 125,000 trucks per year) may require heavier duty weighbridge structural designs. Seasonal operations may see high truck volumes during harvest or construction seasons, but on average may have lower annual truck volumes.

Important Operational Considerations

- Scale traffic flow: Whether traffic is unidirectional or bidirectional, both will affect truck queuing, traffic control systems, and scoreboards.
- One-pass or two-pass weighing: Capturing empty and full truck weights versus using stored tare weights can double scale house weighments per truck but provides a more accurate net weight per truckload.
- Scale house and after-hours operation: Processing trucks after normal operational hours may require duplicating scale house systems.
- Target truck processing time: Typical manual scale house processing can take up to 5 minutes per truckload. This can create a bottleneck with inbound and outbound trucks causing inefficiency and lines. Automating scale house operations can reduce truck processing to <1 minute.

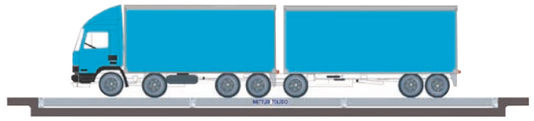
2 – Configuring and Sizing the Weighbridge

The most common truck scale configuration is a full-length scale which provides a single, legal-for-trade weight per truckload. Multi-axle truck scales provide legal-for-trade gross truck weight, as well as separate legal-for-trade sectional axle group weights to ensure proper distribution of loads. Axle scales check axle group loads as a non-legal-for-trade load compliance check. Axle scales can be used as static weighments or in-motion at lower speeds, typically <5 to 8 mph (8 to 12 kph).

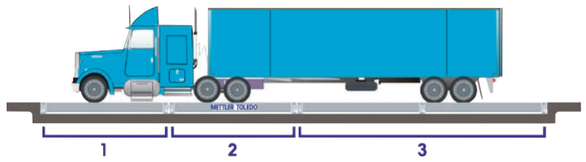
The deck of your weighbridge needs to physically accommodate the footprint of the largest truck you plan to weigh. It is recommended to size the truck scale by adding 10 feet to the length of the largest truck you plan to weigh. This allows faster and easier positioning on the scale for each driver.

Many scale manufacturers will offer standard-sized weighbridges, but will also accept custom dimensions. If you are replacing a pre-existing scale and utilizing an existing foundation, you will need your new scale to fit those dimensions.

Single-Axle Truck Scale



Full-Length Truck Scale



Multi-Axle Truck Scale

3 – Site Conditions, Construction, and Foundation

A truck scale is a large construction site requiring up to 200 ft (60 m) in length and 20 ft (6 m) in width of yard space, not including the scale house. Positioning and placement of the truck scale for each site is critical to the efficiency and safety of the operation. Below are the site specific considerations for new truck scale installations.

Site-Specific Considerations

Truck scales can be installed either flush to the drive surface (in-ground) or raised above ground. There are advantages and trade-offs to both types.

A pit-style scale is placed in an excavated foundation

In-ground considerations:

- Requires less yard space
- Allows cross traffic
- More expensive foundation
- Susceptible to material build-up in the pit
- Requires active drainage system
- Maintenance in the pit requires confined space safety considerations

Some sites find an open-sided scale easy to clean

Above-ground considerations:

- Requires more yard space
- Less expensive foundation
- Less susceptible to material build-up
- Raised driving surface can create driving and driver safety issues
- Better maintenance and service access

Suitable scale placement can increase the efficiency of a site

Other site considerations:

- Turning radius for truck alignment
- Hazardous area classification
- Truck traffic flow and queuing
- Driver and scale house operator safety

4 – Weighbridge Selection and Options

A truck scale is a long-term capital asset purchase. Consider trade-offs in asset life, durability, performance, and price.

Design Requirements and Considerations

Scale Capacity/Scale Accuracy

All truck scales are certified by the local Weights and Measures authority. This authority defines the capacity and accuracy limitations for legal-for-trade applications. Scale division size is based on load cell weighing sensor performance and W&M certification testing. Typical truck scales have a standard division size of 20 lb (10 kg). Higher performance systems can be certified to 10 lb (5 kg) divisions for improved accuracies on smaller vehicles and higher value material.

Durability/Scale Life Factors

- Structural design life (typically 20+ years)
- Estimated load cycles per year (# of truck loads per year)
- Safety factor of designed loads (axle group loading, typically 1.5X to 2.5X legal over-the-road)
- Verified life cycle testing of designs (typically 2M load cycles at design load)

Concentrated Load Capacity (CLC)

Sectional load test during W&M certification. This is not a measure of design durability.

Load Cell/Weighing System

Selecting the right load cell system is critical for the truck scale buying process. Typically, the load cell system is the truck scale component that is most susceptible to environmental damage and critical for accurate weighing.

Design requirements to consider:

- No junction box or load cell termination enclosure at the weighbridge
- No legacy strain-gauge analog load cells (50+ year old sensor technology)
- Digital, smart sensor network only

Environmental Protection

The truck scale is typically positioned outside in the environment and thus can be affected by water, flooding, extreme temperature changes, lightning strikes, rodents, and material build-up.

Critical environmental criteria to consider:

- IP68 (high pressure washdown)/IP69K (submersible) rated load cells
- Stainless steel hermetically sealed load cells
- 3rd party lightning tested and certified electrical system
- Stainless steel shrouded cables to protect against rodents

Concrete Deck vs. Steel Deck Drive Surface

Truck scales are designed with either steel tread-plate or poured concrete drive surfaces. The customer should select their driving surface based on these differentiating factors.

Concrete Deck

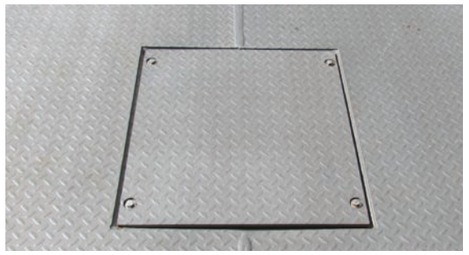
- Weighbridge mass is heavier and more stable to withstand the dynamic loading of over-the-road trucks, 1.5 × the weight of a typical over-the-road tractor trailer
- Reduced slip hazard in wet or icy conditions

Steel Deck

- 2 to 3 week faster installation time
- Portability options available for easy transport from one location to another with simple assembly

Scale Options

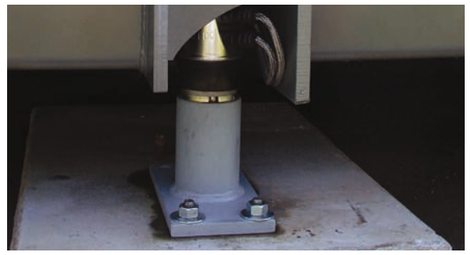
Guide Rails:
Scale mounted guides provide a visual aid to ensure drivers keep the truck on the scale.



Manholes:
Pit foundation access may be provided through manhole access in the weighbridge.

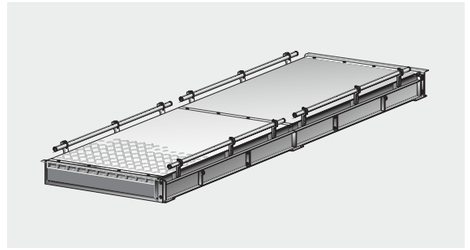
Scoreboards/Driver Displays:
Provides drivers with a large visual display of active weight reading.

Dump-Through Scales:
Trucks are emptied through the center of the scale to lower conveyer systems.



Scale Risers:
Risers raise the weighbridge to prevent material build-up and to allow easier cleaning.

Custom Finishes:
Weighbridges are protected against corrosion with special paint and steel finishes.



Portability Frames:
Steel outer structure that allows the weighbridge to be moved for short-term use.

Traffic Control:
Automated lights, loops, and photo eyes manage traffic near the scale.

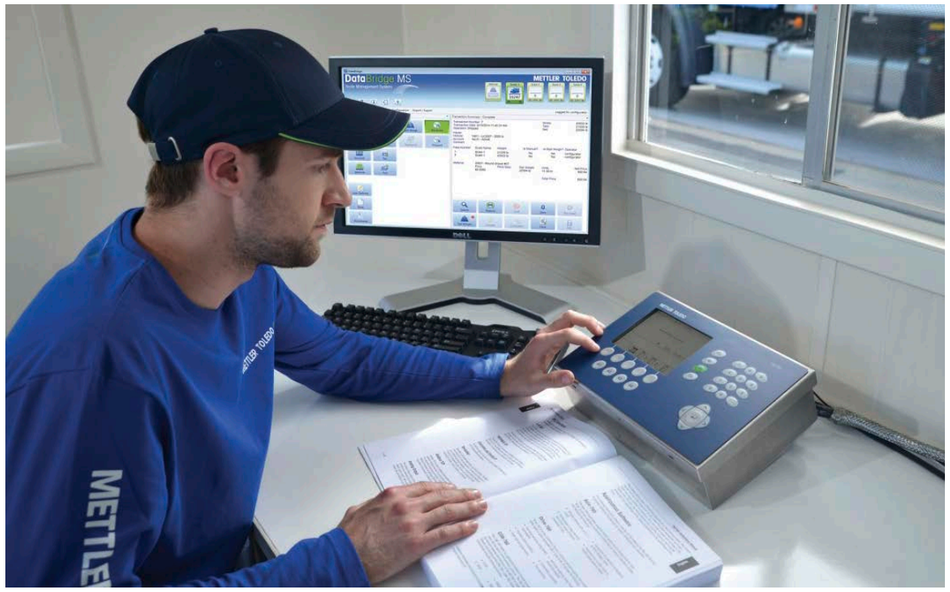
5 – Scale Terminal Selection and Operator Tools

The scale terminal is the primary weight display of the scale. It is typically mounted in the scale house and is an integral element of a Weights and Measures certified system.

Typical Scale Terminal Functions
- Displays weight value
- Performs simple transactions with gross, tare and net weights
- Stores tare weights to calculate net weights
- Calculates simple accumulations, for example, daily tonnage per truck or commodity
- Outputs data to a printer, remote display, and other peripheral devices
- Stores limited data and transaction information
- Offers self-diagnostics

Optional Scale Terminal Capabilities
- Ethernet/TCP/IP network connectivity
- Serial interfaces to common peripherals – printers, remote displays
- PLC/process control connectivity
- Manage basic traffic control system
- Operates multiple scales with a single unit

Typical information captured at the scale house includes:
- Material type
- Price
- Truck weight (tare)
- Net weight
- Customer/account number
- Purchase contract
- Third-party hauler information
- Driver identification number
- Truck identification number
- Surcharges, fees, taxes
- Material grade
- Material origin



6 – Transaction Management and Automation

The scale house and truck scale system often operate as the cash register for bulk material operations. Effectively managing truck scale transactions is critical to the business.

Automation solutions for your truck scale can help you streamline your weighing process, enabling higher productivity, throughput, safety, and sustainability onsite.
Automation can exist in many forms, including:
- Transaction management software
- Unattended systems
- App-enabled transactions

Transaction Management Software
- Manages inbound and outbound truck processing, reducing the chance of errors
- Interfaces with scale indicator to control the scale, traffic, lights, loops, and gates
- Provides one-pass, two-pass, and multi-pass weighing transactions
- Offers a database to store information about vehicles, products, accounts, etc. enabling detailed analysis for improved decision-making
- Configures reports and ticket printing
- Speeds up transactions with presets and group information
- Imports and exports data, including automated data exchange with other business systems (ERP, MES, etc.)

Unattended Systems
- Operate similarly to a banking ATM system
- Offer card/RFID reader for quick identification
- Prompt drivers to enter data via the display
- Print tickets
- Offer wireless networking
- Provide voice intercom capability (standard or voice-over-IP)
- Enable remote monitoring via camera systems

App-Enabled Transactions
- Allow drivers to process their own weighing transactions
- Can be completed through a mobile app on a smartphone or other mobile device
- Enable drivers to scan the QR code at the scale and follow the transaction instructions
- Store transaction records in the company's transaction management software
- Deliver a ticket to the driver via email directly
- Improve productivity through quicker transactions
- Reduce operating costs
- Improve safety by keeping drivers in their cabs
- Help prevent fraud through increased communication with software

Section 5
Load Cells

Understanding the most important components in your scale

Load cells are the heart of any truck scale. They are the sensors that measure the weight of objects on the scale deck. Most truck scales require 6 to 12 load cells. They must work together flawlessly to provide accurate weight readings.

There are a few popular types of load cells currently being sold for use in truck scales. Understanding the differences in their operation and features can help you choose a system that will be accurate and reliable, providing the most value from your investment.

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1 – Evaluating Load Cells

You have a number of choices when it comes to load cells. Because load cells are the components that most closely affect scale performance, it is worthwhile to understand how they work and the guidelines they must meet.

Do regulations require that they all perform similarly?
Most scales are built to comply with the legal-for-trade requirements of Handbook 44, OIML R76, and/or other Weights and Measures regulations. Does that mean that different types of load cells perform the same because they meet the same guidelines? No.

Load cell performance guidelines in Handbook 44 and OIML R76 include accuracy tolerances, or error thresholds, used for calibrations. However, the performance standards included in Handbook 44 and OIML R76 still reflect the capabilities of mechanical scales, which are largely antiquated. Mechanical scales have limited capabilities compared to more modern load-cell technologies. In other words, some load cells are capable of performing significantly better than the minimum required. So, what benefits do newer systems offer the scale buyer?

- **Accuracy**
  A system that is designed to establish and maintain a high level of accuracy means that a business can avoid product or profit loss due to weighing errors.
- **Reliability**
  A stable and resilient load-cell system means a more reliable scale with less downtime, fewer repair expenses and a lower cost of ownership.

Now, let's briefly discuss the various scale technologies in terms of their accuracy and reliability.

Keep in mind that METTLER TOLEDO has designed, built and/or serviced scales with each of these technologies.

2 – Types of Load Cells

There are five predominant types of load cell systems used in vehicle weighing applications: analog load cells, hydraulic load cells, hybrid analog/digital systems, digital load cells and POWERCELL load cells.

Analog
Analog load cells have been used in truck scales since the 1960s. Each cell contains a precision-shaped piece of metal, often steel or stainless steel, that changes its shape slightly as a force (weight) is applied. The change is monitored by electrical strain gauges and is sent as an analog voltage signal to one or more junction boxes. The combined signal is then transmitted to the scale house where it is measured and converted to a digital signal that indicates the weight.

Hydraulic
Hydraulic load cells are hydraulic pistons that compress a reservoir of fluid. The compressed fluid flows through individual hydraulic lines to a mechanism, sometimes called a "totalizer," that is located in or near the scale house. This mechanism then exerts the accumulated force of the combined fluid pressures onto an analog load cell. This load cell generates an electrical signal that indicates the total weight on the scale.

Analog/digital hybrid
Here, analog load cells are connected to a junction box that converts the analog signal to digital. A digital signal is stronger and less susceptible to the weighing errors that can occur due to interference from external influences.

Digital
This is a load cell that generates an analog voltage, which is converted into a digital signal within the load cell enclosure. The data from the cells is processed to determine the total weight. Utilizing a digital signal at the load cell and beyond provides advantages because the signal is not susceptible to interference as analog load cell signals are.

POWERCELL®
These load cells utilize digital electronics and are equipped with signal-processing capabilities at each load cell. The load cell can eliminate errors by monitoring and adjusting the weight measurement based on a number of criteria. This process is called digital compensation. POWERCELL load cells have also introduced features such as predictive diagnostics, self-monitoring, breach detection and remote diagnostic that help ensure accuracy and eliminate downtime.

Special Note:
Before the introduction of electronic components, all vehicle scales were mechanical, supported by numerous levers and pivot components. Today's designs require less steel, are more easily installed, and are more accurate and reliable than their mechanical predecessors. Some surviving mechanical scales can be upgraded to full load cell systems.

3 – Load Cell Technology Comparison

	Accuracy	Reliability		Price	Service	Active Alerts
	Short-term and long-term load cell system performance	Load cell designed to protect against environmental factors and failure		The initial acquisition cost of the load cell system	Ease of maintenance and product replacement	Proactive alarm system to alert the user of potential errors
POWERCELL 	★★★★★	★★★★★		$$$$$	★★★★★	★★★★★
	Strong digital signal combined with in-cell compensation algorithms delivers consistent accuracy	Stainless steel, hermetically sealed design protects the sensor circuits from harsh environments		Compared to other load cell systems on the market POWERCELL has a high initial cost	Onboard processors allow users and technicians to quickly identify service needs	Self-monitoring system that alerts the user of any inconsistency in load cell performance
Digital 	★★★★☆	★★★☆☆		$$$$$	★★★★★	★★★★☆
	Strong digital signal that is less prone to interference from RFI, temperature, and other hazards	Varies by manufacturer but the stronger digital signal leads to less system vulnerability		Compared to other systems on the market digital cells have a high initial cost	Some systems offer diagnostic features that can assist with both regular and emergency service	Some systems have self-monitoring features that alert you of communication interruption
Analog 	★★☆☆☆	★☆☆☆☆		$$$$$	★★☆☆☆	★☆☆☆☆
	Analog cells are accurate enough to meet most metrology standards but lack long-term consistent performance	Prone to failure due to low signal strength which is easily influenced by the surrounding environment		Analog cells are highly commoditized and have the lowest initial cost	No diagnostic features, which leads to time-consuming manual adjustments	Cannot check the status of individual load cell signals in the system, no alerts available
Hydraulic 	★★★☆☆	★★★★★		$$$$$	★★☆☆☆	☆☆☆☆☆
	By using hydraulic fluid these load cells are protected from outside interference leading to an accurate weight signal	Being non-electronic, hydraulic systems hold up well in harsh conditions		Compared to other load cell systems on the market hydraulic cells have a high initial cost	Requires specialized maintenance procedures such as changing or bleeding fluid lines	Mechanical with no modern or advanced features such as self-monitoring or diagnostics

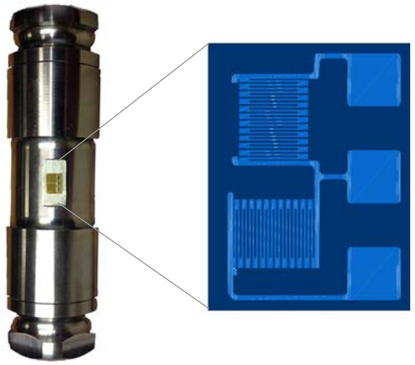
* This information is based on METTLER TOLEDO service records from 50,000+ in-field performance tests covering a wide range of load cell technologies

4 – Load Cell Geometry

There are two predominant geometries for load cell systems: compression (vertical) and shear beam (horizontal).

Compression load cells
Compression load cells (analog and digital) measure loading with strain gauges on vertical columns running through the center of the load cell. Typically, those load cells are used in a "rocker pin" design, allowing the weighbridge a small amount of free movement within the restraints of a checking system. That checking system can include shock-absorbing bumpers, adjustable bolts and check rods. When adjusted correctly, the system allows just enough movement that the weighbridge and load cells are self-centering. That prevents the scale from binding on the foundation or approaches. It also limits the opportunities for physical wear to the components. The rocker pin design should also include anti-rotation features so that the load cells cannot rotate in their positions.

Shear beam and double-ended shear-beam
Shear beam and double-ended shear-beam (including cantilever) load cells also use strain gauges, except they are mounted to a horizontal beam. Single-ended shear beams are fixed on one end and linked to the weighbridge on the other. Double-ended shear beams are typically fixed or supported in the center and linked to the weighbridge on both ends. Either way, those beams typically are linked to a lower mounting point on the weighbridge, creating a suspension system. There, the weighbridge is able to swing slightly in two or more directions. That system is designed to be self-centering, thanks to the gravitational pull downward on the beam ends. However, the links between the beam ends and the scale structure should be regularly inspected for signs of wear.



Shown here is the internal column of a compression load cell, sometimes referred to as a canister load cell, noting the placement of the strain gauge(s). As load is applied to the scale, the column compresses, which changes the electrical output of the strain gauge to measure weight.

Video: How It's Made – POWERCELL® PDX®

See how industry-leading POWERCELL PDX load cells are manufactured for accurate and reliable weighing.
www.mt.com/VEH-POWERCELL-PDX

Section 6
Weighbridge Specifications

Scale designs, ratings, capacities and your choices

The weighbridge, consisting of the scale deck modules, is an important part of the scale. With some fairly basic considerations, you can establish your requirements for a weighbridge that should last many years.

We previously discussed the two basic choices in weighbridge styles: steel deck versus concrete deck, and pit foundations versus above-ground configurations. Beyond these choices are capacity ratings, as well as duty cycle and lifecycle considerations.

Some scale providers focus their sales presentations on the merits of their weighbridge. Keep in mind that weighbridges are rarely a source of ongoing ownership costs. While selecting a weighbridge that meets your needs is important, be cautious of being sold a more expensive model of weighbridge than you really need.

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1 – Weighing Increments

Before discussing capacity ratings, we need to explain the weighing increments used by truck scales. This helps the buyer later understand the legally required scale setup formulas used to determine a scale's capacity.

It is important to understand weighing increments and scale divisions (sometimes called scale resolution). Many truck scales weigh in increments of 20 kg in OIML locations and 20 lb in NTEP locations. That is because Weights and Measures regulations in most areas specify the number of divisions (units of the scale's capacity) a scale must use. For truck scales, often this is 3,000 for OIML and 10,000 for NTEP.

This is determined using the following formula:

$$\frac{\text{Scale capacity}}{\text{Number of divisions}} = \textbf{Weighing Increment Size}$$

OIML $\frac{60{,}000\ \text{kg}}{3{,}000} = \textbf{20 kg}$ in OIML locations

NTEP $\frac{200{,}000\ \text{lb}}{10{,}000} = \textbf{20 lb}$ in NTEP locations

Because the number of divisions is set forth by Weights and Measures authorities, the relationship between scale capacity and weighing increment size is fixed. In other words, if the scale's capacity increases, the weighing increment size also must increase.

Why does this matter? With a smaller weighing increment, the scale has a better potential for accuracy because it isn't rounding the weight value in large intervals. The scale terminal typically can be configured to adjust the maximum capacity, but it must follow the legal formula. Some scale companies will mention that their scales can be configured for small increment sizes, citing this as an advantage. However, keep in mind that this may not be acceptable for your application, based on these formulas.

2 – Scale Capacity

To discuss your capacity needs, you will need to know how many trucks per day you will be weighing, their types and sizes, and the maximum weights. Look at both your current needs and your future needs.

The capacity of a vehicle scale can be expressed in multiple ways.

- Gross Capacity (or Nominal Capacity) – The total weight that can be evenly distributed over the entire surface of a weighbridge.
- Concentrated Load Capacity (CLC) – A declaration of a scale's ability to handle a load utilizing a limited footprint, intended to represent the load applied by a dual tandem axle.

Let's elaborate on what each of these measures means to the scale buyer.

Gross Capacity

Make sure the gross capacity of your scale exceeds the total weight of the heaviest loaded trucks that you will be weighing. However, be aware of how scale companies discuss gross capacity in sales presentations.

Some scale companies will list very large capacities on their scales to appear superior to their competition. However, if you configure your scale for an extra-large capacity, but you do not actually utilize that capacity, weighing regulations still require that the weight increment size also be increased. This is undesirable as it increases the need for the terminal to round weights up or down in larger values.

Some salespeople will discuss gross capacity as a correlation to strength. However, gross capacity is determined by formulas that don't truly correspond to strength verification.

How is Gross Capacity Determined?
Gross capacity is not determined in the way some customers might think. The scale company does not test a scale by loading it until it fails. Gross capacity is typically based on a standard Weights and Measures formula that may take into account the number and capacity of load cells in the scale, the weighing increment size and/or number of divisions, number of scale deck modules and the concentrated load capacity (CLC) rating of the modules.

However, gross capacity is not a true measure of the actual strength of a weighbridge. In the real world, trucks don't distribute their loads evenly over the entire surface of a weighbridge. They concentrate loads on their axles, which is why, in some regions, truck scales may also have a CLC.

Video: Plant Visit

Take a video tour of one of METTLER TOLEDO's vehicle scale manufacturing facilities.
www.mt.com/INDplantvisit

Concentrated Load Capacity (CLC)

CLC is a specification required by NIST/NTEP, outlined in Handbook 44, applicable to the United States and other regions that recognize these requirements. Weight limits for road-going vehicles are often expressed as the maximum weight allowed for a dual tandem axle (two axles positioned next to each other in a fixed area of about 2.5 by 1.2 meters, or 8 by 4 feet). CLC is the intended maximum dual tandem axle weight that the scale will support as designated by the scale manufacturer.

How is CLC determined?
The scale manufacturer declares the intended CLC value for a scale model. That value then is verified with a simple test using flat weights representing the intended maximum value. These weights are placed at various locations on the scale when it is new. Typically, the scale is then used for a short period of time (30 to 45 days), during which it is required to perform a minimum of about 300 registered weighments. The scale is then tested again to see if the original test results are repeatable in terms of weighing accuracy. If so, the Weights and Measures organization grants that CLC value to the scale model. That testing does not measure physical stresses or fatigue on the scale structure as it is only checked twice in the first few months of the installation.

The CLC rating is frequently misunderstood. It is often cited by salespeople as a sign of the scale's strength. While the CLC test is useful in some ways, it is not a true measure of the "strength" of the scale. Most scale buyers want a "strong" scale because they want the scale to last as long as possible, even with constant use. Unfortunately, this CLC test does not predict a scale's resistance to fatigue, or performance over time. The truth is, even a poorly manufactured scale could pass with a high CLC rating.

How much CLC do I need?
The answer to this question depends somewhat on your location and the maximum legal weight limits defined by your government and/or transportation authority. For example, in the United States, most state transportation regulations limit dual tandem axles to a maximum of 34,000 lb (15,422 kg). In most cases, you need a CLC that is designed to meet or exceed that value. However, rarely will you encounter a scale option that does not provide an adequate CLC for your area. For a company to offer a scale that doesn't meet local ratings just doesn't make much sense.

Safety factor
A truck scale with a 30-ton CLC rating offers more than 150% of the actual CLC loading the scale will encounter, providing the necessary safety factor for legal roadway weights.

Common axle group weigh limit (USA)	~20 tons
150% of limit (recommended CLC)	**30 tons (60,000 lb)**

Let's say you are evaluating two truck scales – one has a CLC rating of 80,000 lb (36,287 kg) and the other has a CLC rating of 100,000 lb (45,359 kg). Both offer more than twice the CLC rating needed to weigh the typical maximum legal dual tandem axle weight for over-the-road trucks in the United States. So is the scale with the higher CLC rating better than the other? No. CLC by itself is a poor means of comparison because it doesn't reflect the scale's quality or performance over time.

Note: In recent years, some scale manufacturers have begun having their scales certified for very large CLC weights so they can use this figure in sales discussions. In reality, many sites have used older truck scales rated at 60,000 or even 45,000 lb CLC for 20 years or more without weighbridge issues. This, combined with the limited nature of the CLC test, makes it easy to see that a higher CLC does not translate to longer scale life.

3 – Lifecycle Testing

To evaluate a scale's longevity through years of constant use, lifecycle testing must be performed. A lifecycle test involves repeatedly loading and unloading the structure of the scale to replicate the stresses it will experience over its life. That can involve more than two million dynamic cycles. Though some scale makers will claim that their scales are "designed" to handle two million cycles, few can say that their scales are "tested" to two million cycles. These physical tests can be expensive and time-consuming, which is why many truck scale makers do not perform them.

Ask your prospective scale suppliers about the lifecycle testing they perform. Some salespeople will simply point to the CLC verification and nothing more. Remember, CLC ratings are only a very small part of the story. The CLC test verifies performance after 300 weighing cycles. That is a small fraction of the total number of weighments a truck scale should be expected to make in its lifetime.

Similar to CLC, some people misinterpret deflection (bend) as a sign of the weighbridge's strength. All weighbridges deflect when a load is placed on them. The stress caused by deflection is not a critical factor as long as the weighbridge does not have welds or other weak spots in high-stress areas. If the weighbridge is too stiff, the stress of repeated loading can be transferred to weak spots, causing them to fail. How deflection will affect a scale design is best evaluated by proper lifecycle testing.

When evaluating weighbridges for strength, look for a design that has been thoroughly tested and meets lifecycle expectations for the types of loads you will be weighing. These tests provide more comprehensive evidence of the effectiveness of a scale's design and manufacturing.

What is a Module Masher?

Take a look at our specially designed lifecycle testing that directly simulates the loading of dual tandem axles.
www.mt.com/weighbridgetesting

Section 7
Initial Scale Costs and Ongoing Performance

What a scale means to your business

An informed truck scale buyer considers more than just the initial purchase price when comparing scale systems. While price is important, it is the accuracy and reliability of the scale that will have a direct impact on the owner's business for decades to come. Selecting a reliable scale can lower many years' worth of maintenance and repair costs. Choosing a highly accurate scale protects against hidden product or profit losses due to scale errors.

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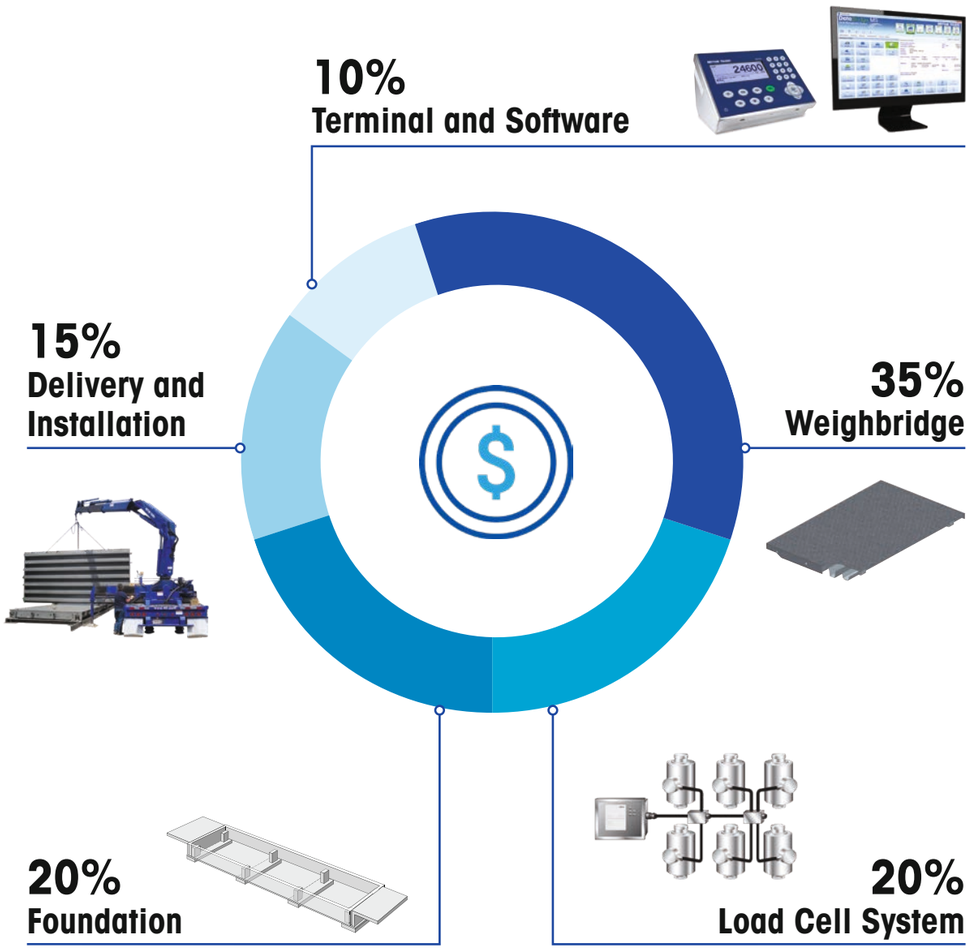
1 – Truck Scale Project Costs

As you familiarize yourself with the various components of a new truck scale installation, you can start to see how each contributes to the total cost of the project. The most variable cost in a new truck scale system is the construction and concrete. The scale foundation pricing can vary from $20,000 to $100,000 USD based on the local site soil bearing pressure, drainage, and site preparation. What follows are the typical percentages of component costs that make up a new truck scale system.

A common budget estimate for new truck scale systems is $1000 to $1500 USD per foot of scale length. Major variables that affect the system cost are:

- In-ground vs. above-ground foundations
- Poor soil-bearing pressure at scale site
- Legacy analog load cell vs. digital smart sensor technology
- Environmental protection of load cell system – stainless steel vs. painted load cells
- Scale house automation and traffic control systems
- Regional concrete and construction costs



2 – Operational Value and ROI

The operational need of the truck scale defines the value of the capital asset purchase. Most customers need a truck scale for controlling the custody transfer of bulk material in and out of an operation. The value of the investment can be quantified based on the material processed. Below are ways a truck scale can be operationally beneficial to your business.

1. Know the value of the material that will come into and out of your operation.
2. Verify the weight of incoming shipments to identify losses/leaks or outright fraud.
3. Check inventory of your business by recording the inbound and outbound weights of materials.
4. Load the maximum quantity to maximize your load but avoid exceeding highway weight limits.

Many capital business expenses are justified by calculating the amount of time it would take to recoup that expense, known as return on investment (ROI). The ROI of purchasing a truck scale can be quantified based on two system factors: reliability and system accuracy.

System Reliability

- Lowering cost of ownership by reducing failures, downtime, and unplanned service events
- Improving sensor (load cell) technology for longer life and reducing failures due to environmental factors
- Improved manufacturer's comprehensive warranty helps to control long-term maintenance costs of parts, labor, travel, and recalibration
- Quantifying the cost of one day of downtime

System Accuracy

- Quantifying the initial cost of sensor (load cell) technology vs. long-term cost of scale inaccuracy
- Measuring the cost of missing material due to scale inaccuracy
- Comparing the impact of scale error on operational shrink and efficiency measurements

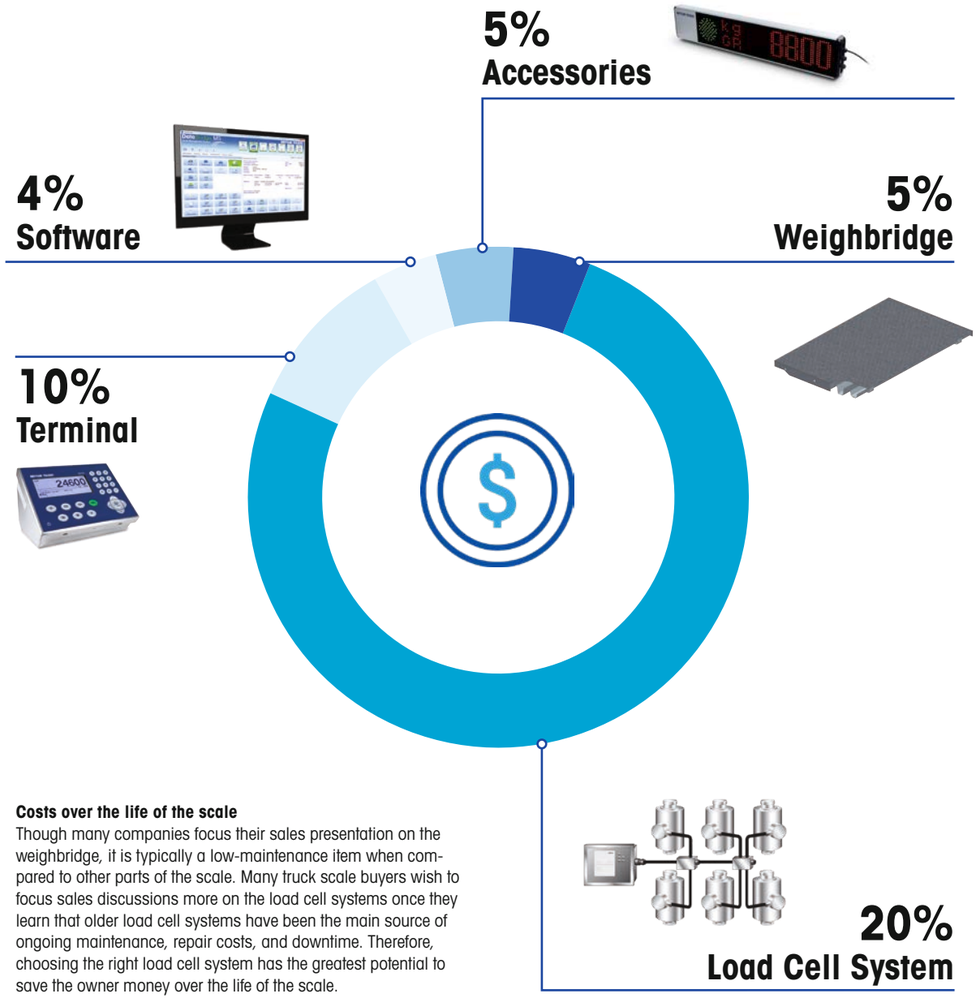
See the value for yourself!
The best way to see how a new piece of equipment will improve your operation is by looking at the real-life numbers. Use our ROI calculator to see the impact of advanced technology at your weighbridge.

3 – Reliability – Technology vs. Price

It can be difficult to think about a new scale being unreliable because you don't expect a new piece of equipment to fail. However, truck scales face a number of challenges, often resulting in frequent repairs. Because scale downtime can be detrimental to business operations, think about reliability up front. Designs and features that protect against scale failures can be well worth the initial investment to give you peace of mind later on.

Causes of Scale Downtime

Extensive long-term service data over time provide statistical analysis on scale failures and long-term system performance. This analysis indicates that approximately 75% of maintenance and repair costs for legacy truck scales is based in the load cell system. The conclusion is the selection of the load cell and environmental protection is the most critical technology decision to be made in the selection of a new truck scale system.



Costs over the life of the scale
Though many companies focus their sales presentation on the weighbridge, it is typically a low-maintenance item when compared to other parts of the scale. Many truck scale buyers wish to focus sales discussions more on the load cell systems once they learn that older load cell systems have been the main source of ongoing maintenance, repair costs, and downtime. Therefore, choosing the right load cell system has the greatest potential to save the owner money over the life of the scale.

The following list names the most common historical sources of scale repairs across all makes and models. The forthcoming sections of this guide explain many of these components and situations in more detail.

Environmental impacts
- Lightning damage
- Frost-heave, ice damage or debris buildup
- Water damage

Junction boxes and cable connections
- Moisture in a junction box
- Failed connections in a junction box
- Damage to a load cell cable (rodents, accidental severing, etc.)

Load cells
- Moisture ingress damaging internal components
- Physical damage and corrosion
- Physical wear due to misalignment or poor preventive maintenance
- Leaking hydraulic fluid (hydraulic systems)

Calibration or recertification required
- Expired Weights and Measures certification
- Change in major components
- Change in location (portable scales)
- Weighbridge misalignment requiring adjustment

Protection from Environmental Challenges

Flooding and Moisture
An extreme situation such as a flood can easily show the value of water protection. A scale with inadequate protection may require the replacement of numerous expensive parts. However, some scales have been designed with conditions like flooding in mind. Help prevent damage by choosing load cells that can offer hermetic (airtight) seals created from precision manufacturing technologies, such as laser welding. Additionally, load cells and cable connections can carry an Ingress Protection (IP) code rating to note their resistance to the ingress of dust and water. The level of protection is signified with a two-digit number.

- **IP68**
  The number 6 indicates that the enclosure is dust tight, providing complete protection from dust. The number 8 indicates that the component is suitable for continuous immersion in water.
- **IP69K**
  This rating indicates that the enclosure is suitable for high-pressure, high-temperature washdown applications. However, the components most vulnerable to water or other moisture damage are typically not load cells but junction boxes. Junction boxes include access panels that are difficult to seal.

Temperature
Temperature changes can also present challenges to a truck scale. Over time, thermal cycles can cause the scale to require more frequent calibrations and service. Some load cells can experience signal fluctuations due to temperature, causing the scale's accuracy to suffer.

Lightning

Passive and Active Systems
Lightning is one of the largest risks for a truck scale owner. If a scale is damaged by a lightning strike, the cost of repairs and downtime can be extensive. Most truck scale providers offer weighing systems with passive grounding features, which provide the lowest level of protection. METTLER TOLEDO provides unique active grounding systems that can re-route the current of a lightning strike away from major components, protecting your investment.

Lightning Protection Validation
The best way to validate a truck scale's lightning protection system is at a lightning laboratory. Lightning labs often are used to test critical aircraft components by shocking them with the same voltage and amperage levels seen in lightning strikes. These labs essentially fabricate lightning power surges and release the current directly to the truck scale electrical system. For example, METTLER TOLEDO has been able to validate the effectiveness of the StrikeShield™ protection on POWERCELL® load cells and scale terminals at such a facility. There, components were hit with 80,000 amperes – twice the current of a typical lightning strike – and protective systems behaved as designed.

Video: POWERCELL® PDX®

See how POWERCELL PDX load cells are equipped to perform even in the harshest environments.
Watch POWERCELL PDX Lightning Video

4 – Accuracy and Weighing Performance

There are many reasons a business owner should care about accuracy. Among them:
- Accuracy affects your business.
- A conventional truck scale may not be as accurate as you think.
- Legal-for-trade scale error tolerances don't protect you from profit losses.
- Not all scales offer the same level of accuracy.

All truck scales are accurate the day they are calibrated and certified by local Weights and Measures officials, but it is critical to the customer's bulk material operation that the scale maintains accuracy over time. For a better understanding of the expected accuracy performance of a truck scale, let us first review the Weights and Measures legal tolerances.

In commercial or legal-for-trade applications, scales must be regularly inspected, tested, and recertified by Weights and Measures authorities. Many scale owners (and even scale providers) assume that these recertifications will provide them with sufficient accuracy. In reality, the error tolerances for minimum requirements can be significant. That means even a recently certified scale could still actually be losing money for the owner with every weighment.

The size of the legal accuracy tolerance for your scale depends on your location and whether your region recognizes NIST/NTEP or OIML standards. The tolerance is a function of the percentage of the scale's capacity being utilized and the size of the scale's weighing increment. Here, an important distinction to note is the capacity of the scale is the maximum weight value for which the terminal and load cells are configured, not the physical maximum capacity of the structure.

NTEP (United States standard) 1 scale division = 20 lb

Scale capacity (lb)	**Truck weight (lb)**	Allowable error (lb)
200 000	40,000 – 50,000	100
	50,000 – 60,000	120
	60,000 – 70,000	140
	70,000 – 80,000	160

NIST/NTEP Accuracy Tolerance
Handbook 44 outlines a step-based tolerance that increases with every additional 5% of the scale's capacity being utilized.

OIML (Global standard) Using C3 load cells

Scale capacity (kg)	**Truck weight (kg)**	Allowable error (kg)
60 000	10,000 – 40,000	40
	40,000 – 60,000	60
80 000 (multi-range)	10,000 – 40,000	40
	40,000 – 60,000	60
	60,000 – 80,000	100

OIML Accuracy Tolerance
There are various accuracy specification levels defined by OIML: C3, C4, and C6 are seen in truck scales. Most truck scale applications are C3 (used in the chart above). A very small percentage of truck scales are C6, which provides a stricter accuracy tolerance.

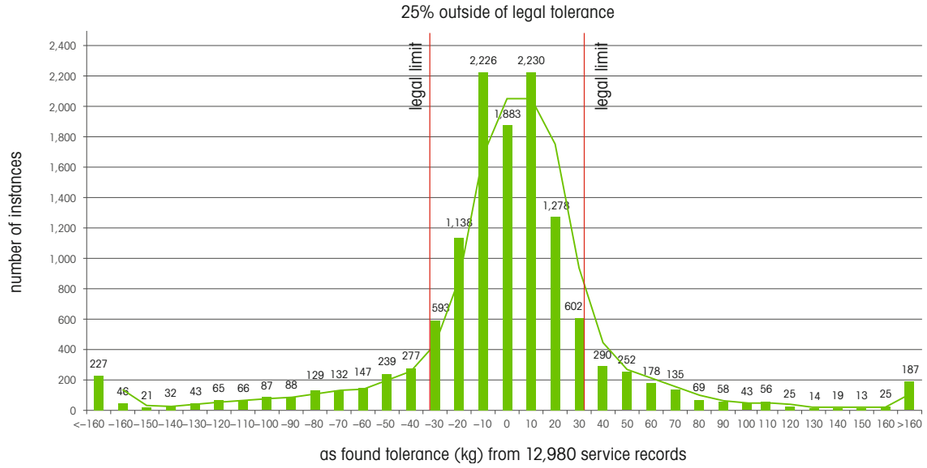
Understanding Long-Term Truck Scale Performance

Like all calibrated measuring devices, truck scale accuracy will drift over time. Common factors that affect scale accuracy drift over time are:

- High frequency dynamic mechanical loading: ≥80,000 lb trucks, 100+ times per day
- Material buildup under the scale
- Temperature changes
- Electrical degradation due to moisture
- Sensor (load cell) technology type

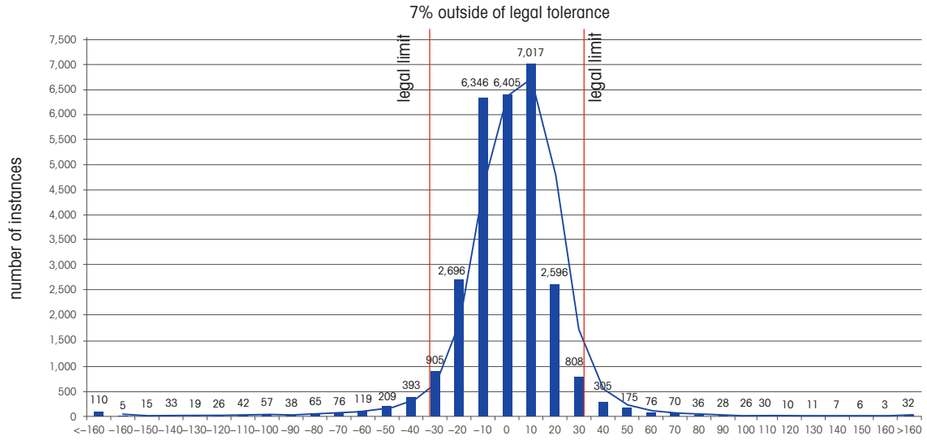
Long-term service statistics show that truck scales drift between the typical semi-annual preventive maintenance and re-calibration. For example, in-use accuracy tests find 25% of the most common type of truck scales with legacy strain-gauge analog load cell technology are weighing outside of legal-for-trade tolerances. This is based on 10,000+ as-found accuracy tests. A large statistical sample of as-found accuracy data gives the customer an accurate assessment of the expected long-term accuracy performance of a truck scale. The following charts use this data to highlight the superior and consistent accuracy of POWERCELL based technology as compared to Analog.

As Found Tolerance for Analog Truck Scales



as found tolerance (kg) from 12,980 service records

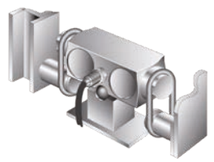
As Found Tolerance for POWERCELL Truck Scales



as found tolerance (kg) from 28,800 service records

Long-Term Accuracy Performance by Load Cell Technology

The following statistics were gathered from 50,000+ in-field service tests which used 20,000 to 25,000 lb test loads. The projected error on a fully loaded truck is nearly linear to the long-term tested error. Below are the statistical results by load cell technology type:



	Analog Load Cells	POWERCELL Sensors	Hydraulic Load Cells
Nr. of test records	12,984	28,799	662
Nr. outside legal tolerance	28%	8%	13%
2 Std. Deviations (95%)	±472 lb	±172 lb	±550 lb

Operational Cost of Scale Inaccuracy

Proper maintenance and calibration testing is critical to ensuring the truck scale is performing accurately and legally. The potential operational costs of scale inaccuracy can be significant in terms of lost material, measuring operational efficiency, and customer confidence. Below are examples of potential costs of missing material with just a small-scale error.

Operational Cost of Scale Inaccuracy:
100 fully loaded trucks per day on a scale weighing 100 lb, under per load

Bulk Material	Price per ton	Price per lb	1 Day Loss	1 Week Loss	1 Month Loss	1 Year Loss
Crushed stone fill	$ 20,00/t	$ 0,01/lb	$ 100	$ 500	$ 2,200	$ 26,400
Cement	$ 130,00/t	$ 0,065/lb	$ 650	$ 3,250	$ 14,300	$ 171,600
Waste (MSW)	$ 60,00/t	$ 0,030/lb	$ 300	$ 1,500	$ 6,600	$ 79,200
Baled Cardboard	$ 70,00/t	$ 0,0350/lb	$ 700	$ 3,500	$ 15,400	$ 184,000

Estimating the potential cost of scale inaccuracy for your operation is an important element of quantifying the total cost of ownership and return on investment for a truck scale capital asset. In summary, the impact of scale accuracy is extremely important for businesses. Sites processing high volumes of trucks or goods of considerable value should be particularly aware of their scales' accuracy.

Section 8
Installation and Certification

Getting your scale up and running

Once the foundation is complete and has cured (if concrete), the scale can be installed. This process can include activity from various providers in a relatively short period of time. Most of this may be coordinated by the scale provider, but the customer needs to be closely involved to provide on-site support. Knowing what to expect can help you develop a reasonable timeline for your installation.

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1 – Delivery and Installation

Some manufacturers deliver and install scales with their own equipment and personnel. Other manufacturers rely to some extent on third parties, which can mean coordinating delivery schedules, crane rentals, concrete companies, etc.

The scale modules typically arrive on a truck trailer once the foundation is prepared. In some cases, they may also travel by rail, or even a standard cargo container (helpful for some remote locations). A crane is then used to lift the modules from their transport vehicle into the scale foundation.

Foundation preparation
- Excavate
- Form foundation and rebar
- Pour foundation concrete
- Allow concrete to cure

Scale installation
- Survey the foundation and mark for baseplate installation
- Place the weighbridge modules (requires a crane and rigging)
- Align and level
- Place load cells into the scale, run cables and add junction boxes (if required)
- Adjust the checking or suspension systems for proper tolerance
- Install the terminal and scale peripherals or software
- For concrete decks, pour the concrete and allow concrete to cure

Setup and calibration
- Shift adjustment
- Calibrate
- Certify with the local Weights and Measures department

2 – Testing and Calibration

Initial testing and calibration typically is the responsibility of the manufacturer or distributor. The procedure is rather simple. The test team adds incremental weights until they reach the capacity of the scale, taking readings after the addition and the removal of each weight. The readings must fall within a pre-established tolerance. If they do not, the scale is recalibrated and the test is performed again. The calibration/test cycles continue until the scale performs within specifications.

Most legal-for-trade applications require the scale to gain certification of compliance from local Weights and Measures authorities at certain intervals (annually, semi-annually, etc.). They may witness or play a role in the initial calibration. As the scale owner, you should ensure that this initial test is coordinated with any required inspection visits from regulatory agencies. That way, you avoid repeating the test if someone who needed to witness the test wasn't notified.

This same type of test/calibration procedure is used throughout the life of the scale for regular scale calibrations and recertifications. Those procedures may be performed by the company that provided the scale or by a third party. Most companies that provide standard testing services are qualified to work on any type of vehicle scale. However, the level of service they provide for maintenance and repairs can vary.

3 – Approval and Certification

Any truck scale used in public or private commercial transactions must be inspected and certified by your regional and/or local Weights and Measures department. Local laws typically require you and/or the scale supplier to notify the W&M department when a new scale is installed. That prompts an inspection by a department official to check the installation and test scale accuracy. Typically, that must be done before the scale can be used.

Many manufacturers have their scale designs certified by NTEP, OIML, or other metrology organizations. In some cases, buying a certified scale can simplify your approval process. But some state and local authorities have their own, more stringent, certification processes. You may also have to satisfy the scale requirements of other regulatory agencies depending on your location and the business you operate. Examples include state and local building code enforcement; the Federal Grain Inspection Service; and state and federal departments of agriculture, customs, departments of transportation and others. An experienced scale supplier knows which agencies are applicable to your project.

Also keep in mind that the scale may need to be recertified after performing repairs or replacing failed components. For example, replacing a single load cell can require you to pay for your local Weights and Measures department to test and recertify your scale. That is just one of the many reasons to properly maintain your scale and become familiar with scale service and warranties.

Section 9
Maintenance, Service and Warranty

Extending the life of your scale with a preventive maintenance plan

Once your scale is installed, operational and certified for use, you may be ready to consider your truck scale project a success. However, taking the time to develop a scheduled maintenance program while the scale is still new can keep it performing optimally and increase its longevity. This is also the perfect time to utilize the expertise of your scale supplier to discuss plans for service and repairs to your scale – both planned and unplanned. It pays to think about how you will handle service and repairs before you actually need them.

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1 – Scheduled Tests and Maintenance

There are two types of ongoing scheduled activities that need to be performed on a legal-for-trade truck scale.

1. Weights and Measures Checks/Calibrations/Recertifications
In many locations, the scale supplier is permitted to perform the initial calibration and accuracy check on the scale when it is installed. However, typically after 60 days the scale's accuracy will be verified with tests performed by the local Weights and Measures (W&M) authority. W&M tests typically happen at predetermined intervals, most often once per year. Those tests are done in one of three ways:

- The W&M agency is equipped to perform those tests and does so with its own truck and technicians
- The tests are performed by a scale service provider but must be witnessed by a W&M agency representative
- The tests are performed by a scale service provider and the scale owner must provide proof of the test and the results to the W&M agency

Your scale supplier can tell you how this is done in your location.

2. Manufacturer's Recommended Preventive Maintenance
Your scale supplier will probably offer you a maintenance program that includes periodic visits from a scale technician who will test and inspect the scale and perform preventive maintenance. While that type of maintenance may not be legally required, to many scale owners, the largest benefit is protection from costly unplanned downtime. This program may or may not cover the Weights and Measures requirements, depending on your location. Note that the manufacturer may require preventive maintenance as a condition of the scale's warranty.

Tip:
Remember that standard calibration checks and recalibrations only ensure that the scale's accuracy is within the legal tolerance. They do not ensure that the scale's accuracy is perfect. To monitor your scale's accuracy, ask your service provider to note the scale's accuracy "as found" and "as left." This helps you stay aware of problems with the scale's performance and minimize revenue loss.

Testing the Scale

To test the scale, the technician or agency will bring a special truck equipped with certified test weights to the scale site. These weights will be applied to the scale in specific weight intervals and in different locations on the scale deck. The technician will monitor the weight indicated by the scale to check its accuracy and consistency. The technician will provide the customer with a report noting the scale's level of accuracy, as well as findings from the inspection.

What happens if the scale does not pass the Weights and Measures accuracy test?
If the scale's error is beyond the legal tolerance, the W&M agency may issue a yellow tag or a red tag (or something similar). A yellow tag is a warning that gives the scale owner a period of time (often 60 days) to have the scale recalibrated by a service provider and allows the scale to be used normally during this time. In contrast, a red tag requires that the scale be closed immediately. It cannot be used until it is recalibrated. Avoiding that situation is another reason that a scale owner may wish to be proactive about preventive maintenance.

When discussing a maintenance program, ask the supplier exactly what services are covered. Also ask:

- How often should scales be inspected? How long does it take?
- How much time does a test require?
- How often should we test?
- How difficult is recalibration when we find an error?

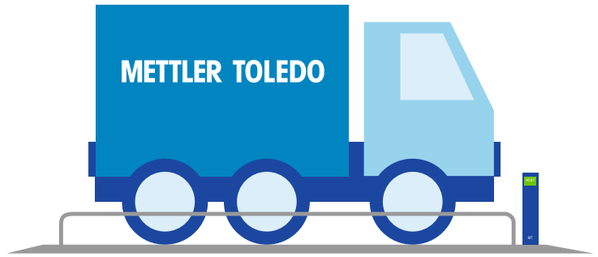
Recommended preventive maintenance procedures can vary between the needs of a specific make and model of scale, as well as the application and amount of traffic using the scale. However, a universal recommendation is that, in addition to W&M tests, any truck scale should undergo a thorough service inspection at least once each year.

Who can perform service on my scale?
A reputable company that is qualified to perform scale services can typically do so on any make and model of truck scale. You may wish to gather multiple quotes for maintenance and service programs. Be sure to compare the content of those programs and not just the price. Just as the prices may vary, so too can the level of service and expertise you receive. Good questions to ask can include:

- Are there fixed rates for service calls?
- Is there a guaranteed response time for service calls?
- What are the technicians' qualifications?
- How do they source common replacement parts?

Special Note:
Be aware that some scale companies generate most of their profit from performing scale service. Those companies may sell customers new scales at a very small profit margin, hoping that they will make their profit on servicing and repairing the scale later. Seeing a very low purchase price, some scale buyers purchase service-prone systems that leave them budgeting large amounts of money each year for service and repairs. That is one of the reasons to look at more than just the initial purchase price when buying a scale.

2 – Weighbridge Routine Care



Weighbridge Routine Care – Extend the Life of Your Equipment

Services an owner/operator can perform	
Daily	• Visually inspect around the scale. Look for and clear any obvious debris. • Control traffic flow to ensure scale safety.
Monthly	• Clean the scale, including washing around and under the scale to remove debris such as packed mud, snow or fallen product.
Alternate Months	• Conduct a partial-weight test – only if safe and test weights are available. • Order a full-service calibration if accuracy discrepancies show.

Services a certified technician must perform	
Every 6 to 12 Months	• Schedule calibration through service provider certified by Weights and Measures. Failure to do so can mean fines and forced scale shut-down.
Every 3, 6 or 12 Months	• Schedule recommended preventative maintenance performed by your service provider.
As Recommended	• To extend the life of your weighbridge, your service provider may recommend a load cell system upgrade.

Download White Paper: Preventive Maintenance

For step-by-step information on how to execute each of the above activities and prolong the life of your equipment, download the free Preventive Maintenance White Paper.
www.mt.com/Veh-PM

3 – Understanding Scale Performance

As truck scale technology has advanced, the amount of information/performance data that can be accessed from the load cells and provided to the customer has expanded. On an annual basis, your service provider should be providing you with a detailed report that addresses:

- Physical scale condition
- Foundation/pit review
- Accuracy performance
- Maintenance/repair spend

These reports equip you, the truck scale owner, with powerful cost-of-ownership information that gives you greater visibility into scale health and budget management. It can allow you to move your scale downtime from unplanned (scale failure) to planned (scheduled service calls) by proactively managing your equipment upgrades and scale re-calibrations.

4 – Emergency Service

If your scale is down unexpectedly, your business could be losing money with every hour that you wait for repairs. Ideally, you want a service provider with the right tools, equipment, knowledge, and replacement parts to fix a problem in a single visit.

Additional questions for your potential service supplier:

- What kind of parts inventory do they carry?
- What is the travel time from their location to your scale?
- What sequence of tests does the technician perform when they are faced with a scale that isn't operating properly? How long do they take?
- How long does it take to switch out a common part, e.g., a load cell, a cable or hydraulic line, a printer, etc.?
- Is after-hours service available?
- How fast can the manufacturer get parts to the local service organization?
- What equipment does the local organization have, e.g., jacks, test equipment, test trucks, booms and welding equipment?
- Is it possible to perform remote diagnostics rather than traveling to the scale site?

5 – Warranties

Your scale should come with a manufacturer's warranty. As a customer, this is an area in which you should take time to evaluate options, as warranties can vary considerably. Some manufacturers offer a very limited standard warranty with expanded warranty coverage at an added cost. Take the time to actually read the fine print of the warranty and analyze the following categories.

What does the warranty cover?

Determine the specific level and duration of coverage for the following:

- Types of components covered
- Types of failures covered
- Replacement parts
- On-site labor
- Travel costs for technicians
- Lightning (typically addressed in its own section in the warranty)

There may be certain components that are excluded from the warranty, or that may be covered under their own separate warranty, such as printers.

How long is the warranty?

Some manufacturers prorate their level of coverage as the scale ages. That means their warranty may only cover a percentage of any covered repair after a few years.

How responsive is the manufacturer to warranty coverage?

Does the scale manufacturer have a local sales/service entity or distributor? If not, someone may need to be dispatched from another location. It may be up to you to consider the "what ifs" and determine how responsive you think a company will be in an emergency situation.

In summary, all truck scales will eventually require service. Most scale owners want to have a reliable partner for service and a plan to ensure the scale's performance. The time it takes to develop this plan can be well worth the effort in the resulting peace of mind.

Section 10
Scale and Weight Regulations

Understanding legal agencies and weighing guidelines

Weight is a universal measurement. Businesses, federal and local agencies, scale manufacturers and more have an interest in ensuring accurate weight information. Regulations for using weight in business transactions, roadway travel laws and equipment verification provide standards with which scale users should be familiar.

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4 – Metrological Regulatory Agencies	p. 83

1 – Road-Going Weight Regulations

Regardless of what your trucks are transporting, regional and/or federal transportation authorities define the maximum allowable weight allowed on public roadways. This is often defined as a maximum allowable weight for a specific configuration of axles. There may also be a maximum overall gross vehicle weight, but sometimes the axle-based regulations stand alone.

Check with the transportation authority in your jurisdiction to find out the legal roadway limits for the type of trucks you will be using. Some sites use their truck scale to load their vehicles with the maximum weights allowable without going over. Overweight trucks can result in steep fines. Ensure the scale configuration you choose is capable of providing the information you need, especially if you plan to load your trucks close to legal limits. For example, a scale designed to weigh the complete truck may not provide the weights of each axle group unless it is a multi-axle scale.

2 – Legal-for-Trade Applications

If your scale is to be used in business transactions, your application needs to be "legal for trade." Most often, legal-for-trade applications most often are required to meet a set of federal, local and/or regional requirements. This can include criteria for construction, scale specifications, operation principles and calibration intervals intended to protect business transactions from scale inaccuracy or fraud. Non-legal-for-trade applications can include scales used exclusively to check for proper axle loading and/or compliance with maximum roadway weight limits. While those are important uses, they are not trade-related applications, and therefore might not be required to meet the same guidelines.

3 – Metrology Authorities

Metrology is defined as the "scientific study of measurement." Most locations look to a recognized metrology authority for measurement standards to ensure equality in business transactions. When it comes to truck scales, those agencies will provide certifications to equipment and components that meet their performance requirements.

OIML
In many European and Asian countries, the International Organization of Legal Metrology (OIML, www.oiml.org, headquartered in France) provides the standards that measuring devices must meet for commercial applications. That includes vehicle scales and their components, such as load cells.

OIML regularly updates its series of recommendations, guides and other reports and documents. Devices that comply with OIML specifications will carry an OIML classification. For vehicle scale components, such as the weighbridge and load cells, this will define tolerances for their accuracy and capacity, which are verified by standardized testing. For example, OIML document R 60 outlines performance characteristics for load cells.

NIST and NTEP
In the United States, regulations are defined by the National Institute of Standards and Technology (NIST www.nist.gov) Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices." It is most often referred to as Handbook 44 or simply H-44 and is revised annually. H-44 provides the federal specifications for the performance of a truck scale. It also covers the user requirements or tasks that the scale user and owner are to do.

Devices that are intended for commercial applications will carry the National Type Evaluation Program (NTEP) certification issued by the National Conference on Weights and Measures (NCWM). This signifies that the product or component has been tested to conform to the NIST HB44 requirements.

Other Locations

Many other federal and provincial Weights and Measures authorities around the world acknowledge the standards of the aforementioned organizations. Many will accept devices carrying certification from one of those agencies. Your regional weights and measures authority can provide further details regarding the certifications it accepts for commercial vehicle weighing equipment.

Canada
The Canadian agency, Measurement Canada, notes that load cells in trade devices must conform with NTEP or OIML regulations.
Source: Bulletin M-25

Australia
The National Measurement Institute (NMI) in Australia performs supplemental testing and certifications for commercial weighbridge load cells based on OIML standards.
Source: NMI R 60

4 – Metrological Regulatory Agencies

While the metrology authority may provide certifications for new product designs, ongoing enforcement of measurement standards is left to a local metrological regulatory agency, often known as a department of Weights and Measures. These departments conduct annual tests of petrol/gasoline pumps, deli counter scales, truck scales and more.

You will need to contact your local W&M department, as representatives will often need to perform inspections, tests, calibration and certification before your new scale can be used. It can be best to contact them early in the process to ensure you are familiar with their requirements. Inform them that you will be installing a truck scale and ask for all regulations pertaining to the installation and operation of truck scales in your state or province. You will likely be in contact with them periodically throughout the life of the scale, as they may need to perform regular inspections and tests to recertify the scale.

Depending on your location and business, you may also have to meet the requirements of other regulatory bodies. For example, this may include state and local building code authorities, the Federal Grain Inspection Service, state and federal departments of agriculture, federal customs agencies and departments of transportation. Compile your own list and make sure the appropriate regulations are addressed. Your scale supplier should be able to help you understand which agencies should be involved.

Discover Additional Resources

Industrial Weighing Solutions

POWERCELL® technology is now available in truck scales, tank scales, and floor scales that serve applications across your facility including shipping/receiving, inventory control, material processing, production/formulation, and packaging. Watch the video to learn more!

www.mt.com/powercell-video

Costs and Savings Calculators

These interactive calculators demonstrate how advanced vehicle weighing systems can help businesses save money. Users enter basic information about their business and the form calculates results.

www.mt.com/VEH-Savings-Calc

Weighbridge Routine Care

Overlooking routine scale maintenance can lead to unplanned scale downtime, poor reliability, inaccuracy, and a scale that ages prematurely. Take steps to ensure your investment will last.

www.mt.com/VEH-Routine-Care

Vehicle Automation eBook

Automating your weighing process clearly has a lot of benefits. What is maybe not so clear, is how automation could fit in your operation. Download the eBook to learn more.

www.mt.com/automate-scalehouse

www.mt.com/vehicle

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Document No. 30522212 B
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