LCWM Glossary

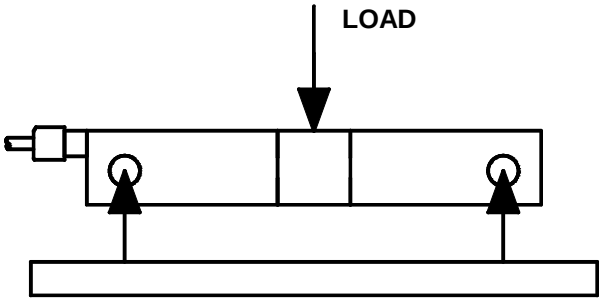
Accuracy — A measure of a **Scale**'s ability to provide a weight reading equal to the actual weight placed on the **Scale**. A **Scale**'s accuracy is usually measured against a recognized standard, such as NIST Certified Test Weights.

A.L. — See **Applied Load**

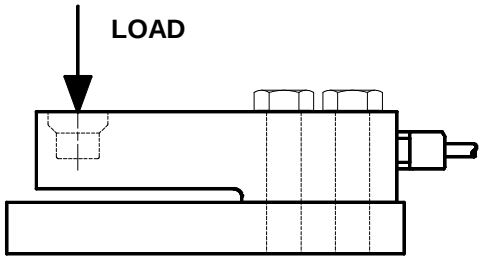
Applied Load (A.L.) — Is the load applied to a **Load Cell**, **Weigh Module** or **Scale** at any given time. For example, in generating the **Calibration Curve** for a **Scale** its **Applied Load** is increased from zero to **Rated Capacity** and back to zero again, or in conducting a **Creep** test, **Applied Load** is simply the load applied to the **Scale** for the duration of the test.

Axis of Action — See **Primary Loading Axis**

Beam Load Cell, Double Ended — Double ended shear beam **Load Cells** are used in multiples under truck and floor **Scales** and in tank, hopper and silo weighing. The longitudinal axis of the **Load Cell** is positioned horizontally with both ends supported; illustrated is one style where the ends have cross-drilled holes that rest on horizontal pins typically supported from a base plate. The load is introduced at the center of the **Load Cell** (the **Primary Loading Axis**) typically by a clamp that provides liftoff protection also. There are many variations on this design, for example, in truck **Scales** it is common to use a design where the **Load Cell** is supported at a single point in the center, while the load is introduced at both ends through swing-links hanging over "ears" on the ends.



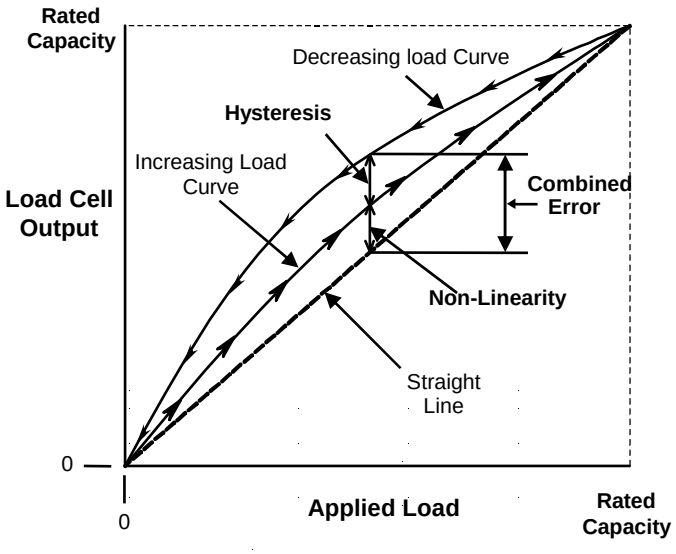
Beam Load Cell, Single Ended — Referred to variously as beam, cantilever beam, bending beam and shear beam **Load Cells**, these are used in multiples under floor and conveyor **Scales** and in tank, hopper and silo weighing. The longitudinal axis of the **Load Cell** is positioned horizontally with the dead end of the **Load Cell** screwed to a horizontal base plate; the load is introduced along the center line of a vertical hole (the **Primary Loading Axis**) at the free end of the cell. Ball/cup and rocker pin arrangements are commonly used as the interface between the **Load Receptor** and **Load Cell**; this allows the **Load Receptor** to expand/contract without imposing unwanted side forces on the cell, and produces a restoring force to keep the **Scale** centered. Some **Load Cells** have a threaded hole for load introduction; this provides a tight coupling of the **Load Receptor** to **Load Cell**, which must be protected from extraneous forces



to avoid poor performance. The **Load Cell** can also be rotated 180° from the position shown here, for example, when screwed upwards to the underside of a floor **Scale**.

Bending Beam Load Cell — See **Beam Load Cell, Single Ended**

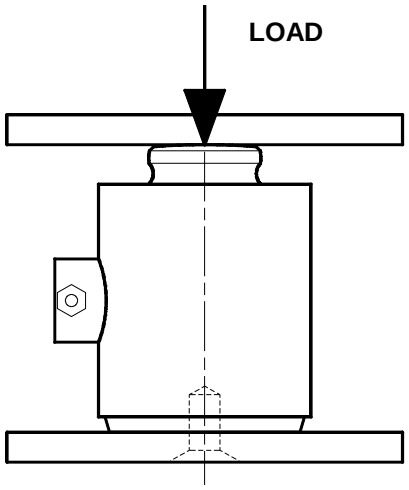
Calibration — The process of equating the graduations on a **Scale** to the actual weight values that they represent. It involves adjusting the **Scale**'s indicator so that it reads zero when no weight is on the **Scale** and reads the full weight capacity when that weight is placed on the **Scale**.



Calibration Curve

Calibration Curve — The characteristic curve obtained when **Load Cell** or **Scale** output is plotted against **Applied Load**, as Applied Load is increased from zero to **Rated Capacity** and decreased to zero again.

Canister Load Cell, Compression — This was one of the first commercially available **Load Cells** and it remains in production despite the availability of competing designs today. Illustrated is a compression canister cell typical of those used in multiples under large platform **Scales** such as truck and railroad track **Scales**, and in tank, hopper and silo weighing. The longitudinal axis of the canister (the **Primary Loading Axis**) is mounted vertically with the flat base sitting on a base plate and usually secured to it by screws from the underside. The upper surface has a button with a spherical radius and load is generally introduced using a hardened flat plate. Expansion and contraction is accommodated by the slippage of this plate on the **Load Cell**'s button; the **Scale** structure is generally held in position using horizontal check rods. Also available (though less common) is a tension canister used in tension applications.



Cantilever Beam Load Cell — See **Beam Load Cell, Single Ended**

Cap — See **Rated Capacity**

Capacity — See **Rated Capacity**

Clevis — A U-shaped connector with holes drilled through the arms. A pin is fitted through the holes to attach the clevis to another component.

Combined Error — Error due to the combined effect of **Non-Linearity** and **Hysteresis**. It is the maximum deviation (±) of a **Load Cell** or **Scale**'s **Calibration Curve** from a straight line drawn between the output at zero load and at **Rated Capacity**, stated as a percentage of **Rated Capacity**.

Compensated Temperature Range — The temperature range over which a **Load Cell** or **Scale** is compensated to comply with its published metrological specifications, stated in ℃ (or ℉).

Compression — The act of squeezing or pressing down on a material or device.

Compression Disk Load Cell — See **Pancake Load Cell**

Compression Weigh Module — A **Weigh Module** designed so that its top plate and base plate will be squeezed toward each other when equal and opposite compression loads are applied along its **Primary Loading Axis**.

Creep —The change (±) in **Load Cell** or **Scale** output occurring in a specified period of time while under constant load and with all environmental conditions and other variables remaining constant, stated as a percentage of **Applied Load** in a certain period of time, usually 30 or 60 minutes.

Decreasing Load Curve — See **Calibration Curve**

Deflection — The bending or twisting of a material when force is applied to it.

Distributed Loading — A type of loading in which an object is placed on a **Scale** so that its full weight is spread over all of the **Scale**'s **Load Cells**.

Dynamic Loading — A situation in which the weight applied to a **Scale** is in motion. One example is a conveyor system used to weigh objects as they move along the conveyor.

Electromagnetic Interference (EMI) — The disturbance of an electrical device's operation that is caused when the device picks up electromagnetic radiation from an outside source.

Emax — See **Rated Capacity**

Full End Loading — A type of loading in which an object is placed on a **Scale** so that its full weight is temporarily concentrated over the **Load Cells** at one end of the **Scale**. Full end loading is common with conveyor systems, where the object to be weighed moves across the **Scale** from the front end to the back end.

Hermetic Seal — A metal cover welded or soldered in place to protect the strain gauges in a **Load Cell**. This type of watertight seal is commonly used for harsh environments.

Hockey Puck Load Cell — See **Pancake Load Cell**

Hysteresis — The maximum difference between **Load Cell** or **Scale** output readings for the same **Applied Load**; one reading obtained by increasing the load from zero and the other by decreasing the load from **Rated Capacity**, stated as a percentage of **Rated Capacity**. In other words, it is the maximum

difference between the Increasing and Decreasing Load Curves at a single **Applied Load**. See **Calibration Curve**.

Increasing Load Curve — See **Calibration Curve**

Increment — The smallest change in weight that a digital **Scale** can detect (also called a division).

Indicator — In a digital **Scale**, the indicator is the part of the **Scale** that receives analog signals transmitted by the **Load Cells** and displays them as weight readings.

Linearity — See **Non-Linearity**

Live Load — The downward force exerted by an object or material being weighed on a **Scale**.

Live-to-Dead Connection — A mechanical connection between a **Scale** and an object that you do not want to weigh. A common example is piping connected to a tank **Scale;** if the piping is not flexible enough to allow the **Scale** to move freely, it can apply vertical forces to the **Scale** and produce inaccurate weight readings.

Load — General term used to refer to an object that is exerting a weight force. An object that is placed on the **Load Receptor** of a **Scale** is generally referred to as the **Load** because its weight effect is essential for the weighing operation.

Load Cell — Electromechanical measurement transducer for determining mass, in which the weight force exerted by the weighed object is converted into an electrical signal.

Load Receiver — See **Load Receptor**

Load Receptor — That part of a **Scale** that carries or accommodates the Load, e.g. weighing pan, load pan, load hook, platform, bridge or container (weighing container).

Max. Horizontal Force — The maximum horizontal force that can be applied to the top plate of a **Compression Weigh Module**, usually stated in lb or kN; it is usually specified independently for longitudinal and transverse directions.

Max. Horizontal Shear Force — See **Max. Horizontal Force**

Max. Top Plate Travel — The maximum allowed movement of a **Compression Weigh Module**'s top plate in a horizontal plane relative to its base plate, stated in mm or inches; it is usually specified independently for longitudinal and transverse directions.

Max. Uplift Force — The maximum vertical uplift force that can be applied to the top plate of a **Compression Weigh Module**, usually stated in lb or kN.

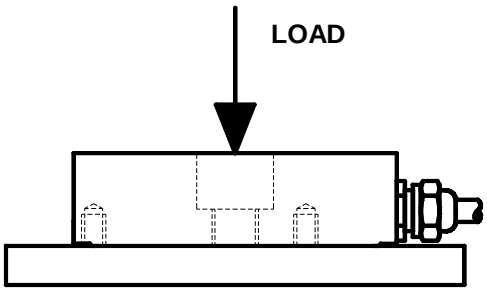
Maximum Capacity — See **Rated Capacity**

Moment Insensitive Load Cell — See **Single Point Load Cell**

Non-Linearity — The maximum deviation (±) of a **Load Cell** or **Scale**'s **Increasing Load Curve** from a straight line drawn between the output at zero load and at **Rated Capacity**, stated as a percentage of **Rated Capacity**. See **Calibration Curve**.

Non-Repeatability — See **Repeatability Error**

Operating Temperature Range — The temperature range over which a **Load Cell** or **Scale** will operate without permanent adverse change to any of its performance characteristics, but may not comply with published specifications, stated in ℃ (or ℉).



Pancake Load Cell — Pancake is a generic term used to describe low profile cylindrical **Load Cells**; other terms used are torsion ring, compression disk, shear web, wheel spoke and hockey puck. These **Load Cells** are used in multiples under truck, floor and conveyor **Scale**s and in tank, hopper and silo weighing. The **Load Cell** typically sits firmly on a flat plate while the load is introduced along the cylinder's axis (the **Primary Loading Axis**). Typically a ball/cup or rocker pin arrangement is used as the interface between the **Load Receptor** and **Load Cell**; this allows the **Load Receptor** to expand/contract without imposing unwanted side forces on the cell, and produces a restoring force to keep the **Scale** centered. Other designs have a raised button with spherical radius or a threaded hole for load introduction; these designs must be protected from extraneous forces to avoid poor performance or damage to the **Load Cell**. The **Load Cell** can also be rotated 180° from the position shown here, for example, when screwed upwards to the underside of a floor Scale.

Potted Seal — A layer of organic sealing compound used to protect the strain gauges in a **Load Cell**. It is not as effective as a hermetic seal, which is often preferred for harsh environments.

Primary Axis — See **Primary Loading Axis**

Primary Loading Axis — The axis along which a **Load Cell**, **Weigh Module** or **Scale** is designed to be loaded.

Principal Axis — See **Primary Loading Axis**

R.C. — See **Rated Capacity**

Radio Frequency Interference — The disturbance of an electrical device's operation that is caused when the device picks up radio frequency emissions from an outside source.

Rated Capacity (R.C.) — The maximum load that can be applied to a **Load Cell**, **Weigh Module** or **Scale** on the **Primary Loading Axis** if its performance is to remain within specification, stated in units of mass or force. Also referred to as Maximum Capacity with the abbreviations Max and Emax used for **Scale**s and **Load Cells** respectively. The **Rated Capacity** should not be exceeded; in the selection of **Load Cell**s it is common practice to not exceed 50% to 80% of the **Rated Capacity** in use.

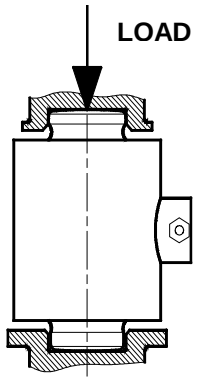
Rated Output — The change in output signal from an analog **Load Cell** when **Rated Capacity** is applied along its **Primary Loading Axis**, stated in mV/V (mV of signal per V of excitation voltage applied to the **Load Cell**).

Repeatability Error — The maximum difference between **Load Cell** or **Scale** output readings taken from consecutive tests under the same loading and environmental conditions of measurement, stated as a percentage of **Applied Load**.

Ring Load Cell — See **Pancake Load Cell**

Rocker Column Load Cell — See **Rocker Pin Load Cell**

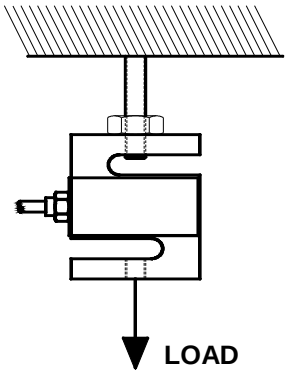
Rocker Pin Load Cell — A rocker pin (or rocker column) **Load Cell** is a compression cell used in multiples under large platform **Scale**s such as truck and railroad track **Scale**s, and in tank, hopper and silo weighing. The longitudinal axis of the pin (the **Primary Loading Axis**) is mounted vertically and its ends have spherical radii which contact hardened receivers; these hold the **Load Cell** and introduce the load at the central point of contact. This arrangement allows the **Load Cells** to rock (tilt) to allow the **Load Receptor** expand/contract and to absorb horizontal shocks. The radii on the pin are selected so that the **Load Receptor** is lifted progressively with increasing tilt of the **Load Cell**, thus producing a restoring force which acts to "restore" the **Load Cells** to their optimum upright position and the **Load Receptor** to its centered position.



Resolution — A **Scale**'s ability to detect changes in weight. For a digital **Scale**, resolution is measured in increment size, which is the smallest weight change that the **Scale** can detect.

S-Beam Load Cell — See **S-Type Load Cell**

S-Type Load Cell — S-Type (or S-Beam) **Load Cells** are typically used in tension individually or in multiples to weigh various **Load Receptor**s such as suspended tanks and hoppers. Load is introduced to the **Load Cell** along the centerline passing through the threaded holes (the **Primary Loading Axis**) in the upper and lower surfaces; threaded rods or various forms of hardware can be screwed into these holes for this purpose. With suspension rods of sufficient length, any amount of expansion/contraction can be accommodated without affecting performance. Suspended **Scale**s are considered when an overhead support structure already exists or where the floor area under the **Scale** must be kept clear. **S-Type Load Cells** are also used to convert mechanical **Scale**s to electronic particularly when digital output is required for control purposes; in this case an **S-Type Load Cell** is inserted in the steelyard rod between the lever system and the original beam.



Safe Load Limit — The maximum load that can be applied to a **Load Cell** or **Weigh Module** (along the **Primary Loading Axis** in the normal direction of loading) without producing electrical or mechanical damage, or a permanent shift in performance characteristics beyond those specified, stated as a percentage of **Rated Capacity**.

Safe Overload — See **Safe Load Limit**

Safe Temperature Range — See **Operating Temperature Range**

Safe Storage Temperature Range — The temperature range within which a **Load Cell** or **Scale** may be stored without electrical connection or mechanical loading, without causing deterioration of published specifications, stated in ℃ (or ℉).

Scale — A weighing instrument intended predominantly for medium to high capacity weighments, with moderate to low resolutions used indoors or outdoors in office, industrial and retail environments.

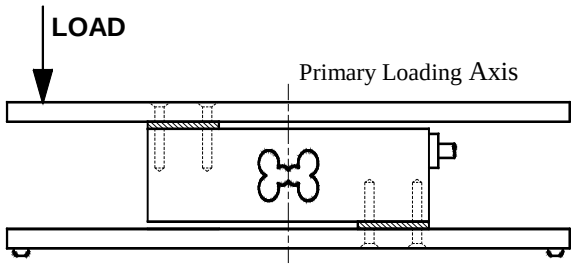
Seismic Loading — Forces exerted on a **Scale** or its support structure by earthquakes or other vibrations of the earth.

Shear Beam Load Cell — See **Beam Load Cell, Single Ended**

Shear Force — A horizontal force exerted on a **Scale**.

Shear Web Load Cell — See **Pancake Load Cell**

Shock Loading — Forces exerted on a **Scale** or its support structure when an object strikes it. Shock forces can be created when an object is dropped on a **Scale** or when a vehicle runs into a **Scale**.



Single Point Load Cell — Single point (or moment insensitive) **Load Cells** are used individually to make bench **Scale**s and to weigh small conveyors, tanks and hoppers. They are mounted with their longitudinal axis horizontal typically between 2 plates or frames, the upper one being the **Load Receptor**. Ideally the **Load Cell**'s vertical center line (the **Primary Loading Axis**) is placed at the center of the **Load Receptor**; the unique feature of this cell is that it weighs within specification regardless of where the load is applied to the receptor. The upper and lower frames are usually mounted to the **Load Cell**'s horizontal surfaces as shown, typically with spacer plates to create clearance to accommodate **Load Cell** deflection under load. Some models require mounting to the end faces (model IL, for example).

Spring Rate — A measure of a material's flexibility. The spring rate constant for a **Load Cell** is its rated capacity divided by **Load Cell** deflection at **Rated Capacity**.

Static Loading — A situation in which the load applied to a **Scale** will be weighed while not in motion.

Storage Temperature Range — See **Safe Storage Temperature Range**

Strain Gauge — A wire or series of wires that measures the strain that results when a force is applied to an object. When a strain gauge is attached to a **Load Cell**, it measures how much an **Applied Load** causes the **Load Cell** to deflect. The strain gauge stretches as the **Load Cell** deflects, increasing the wire's resistance to an electric current passing through it.

Temperature Coefficient of Span — See **Temperature Effect on Sensitivity**

Temperature Coefficient of Zero— See **Temperature Effect on Zero**

Temperature Effect on Minimum Dead Load output — See **Temperature Effect on Zero**

Temperature Effect on No Load Indication — See **Temperature Effect on Zero**

Temperature Effect on Sensitivity— Change (±) in **Load Cell** or **Scale** sensitivity due to a change in ambient temperature, stated as a percentage of **Applied Load** per ℃ [or ℉] change in ambient temperature.

Temperature Effect on Span — See **Temperature Effect on Sensitivity**

Temperature Effect on Zero — The change (±) in **Load Cell** or **Scale** zero reading due to a change in ambient temperature, stated as a percentage of **Rated Capacity** per ℃ [or ℉] change in ambient temperature.

Temperature Effect on Zero Load Balance — See **Temperature Effect on Zero**

Temperature Limits —See **Compensated Temperature Range**

Tension — The act of stretching a material or device.

Tension Weigh Module — A **Weigh Module** designed to stretch when equal and opposite **Tension** loads are applied along its **Primary Loading Axis**.

Torsion Ring Load Cell — See **Pancake Load Cell**

Type Evaluation — The procedure used to test a particular type (or model) of weighing device. In the United States, the National Type Evaluation Program (NTEP) tests a sample of each model of **Load Cell** or **Scale**. If the tests show that the device complies with the requirements of NIST Handbook 44, NTEP issues a Certificate of Conformance for that model.

Ultimate Load Limit — That load applied to a **Load Cell** along its **Primary Loading Axis** in the normal direction of loading, beyond which structural failure will result, stated as a percentage of **Rated Capacity**.

Ultimate Overload — See **Ultimate Load Limit**

Weigh Module — A device that can be used to support a **Load Receptor**, e.g. a tank, hopper or other structure, to convert it into a **Scale**. Usually multiple Weigh Modules are attached the **Load Receptor** so that they support its full weight. A Weigh Module system should be designed to provide accurate weight readings and support the structure safely.

Weighbridge — A **Scale** platform. It is designed to transfer the load placed on it to the **Scale**'s **Load Cells**.

Wheel Spoke Load Cell — See **Pancake Load Cell**

Wind Loading — Forces exerted on a **Scale** or its support structure by wind currents.

Zero Load Output — The maximum output (±) from the **Load Cell** when no load is applied along its **Primary Loading Axis**, stated as a percentage of **Rated Capacity.**