ON BOARD WEIGHING SYSTEMS

Introduction

How They Work

New Features

The Benefits of Using Them

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Introduction

On Board Weighing Systems

The purpose of this presentation is to familiarize attendees of the seminar with some of the basic types of on board weighing devices, advantages of on board weighing and the new features available.

It is not my intent to prioritize one company's product or weighing method. Every company offering an on board weighing system has its own proprietary technology and programming.

Many of the principals used today in on board weighing systems are not new. They have been around for years. What is new is the advanced technology that allows for the very minuet measurements of strain these systems are now capable of measuring.

Many of the problems with early on board weighing systems have now been improved using today's new electronics and programming technology. Past problems with repeatability, temperature variance, terrain limitations and calibration issues have been improved or solved. Some of the systems available today offer sophisticated digital displays, have wireless capabilities and are capable of recording, printing and transmitting weight data in real time.

On Board Weighing Systems Rely on Measuring Some Type of Strain

Below are several types of strain gauges used in On Board Weighing Systems.

Pressure – Air Transducer (converts air pressure to analog electrical signal)

Pressure Transducer

Pressure is the ratio between force (weight) acting on a surface and the area of that surface. Pressure is measured in units of force divided by area (pounds vs. square inch) or (PSI). When an external force (pressure) is applied to an object causing a reduction in its volume, this process is called compression. This method is used to measure weight on vehicles using the vehicles air ride suspensions. This type of system uses an air (pressure) transducer converting the pressure into an analog electrical signal. The transducer is connected to a device that converts the analog electrical current to a digital number proportional to the magnitude of the volt or current for measurement.

Load Cell (converts strain to analog electrical signal)

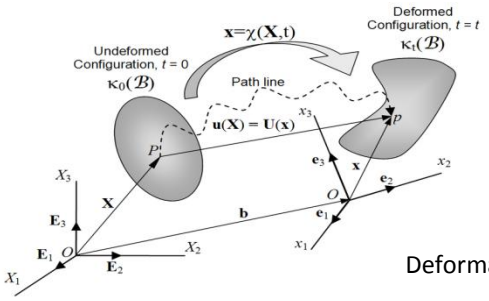
Bending Beam

Shear Beam

When external forces are applied to a stationary object, stress and strain are the result. Stress is defined as the objects internal resisting forces and strain is defined as the displacement and deformation that occur. The spring elements in a load cell (also called the beam) can respond to direct bending and shear stress. Strain is defined as the amount of deformation per unit length of an object when a load is applied. Typical

values for strain are less than 0.005 inch/inch and are often expressed in micro-strain units. Strain may be compressive or tensile and is typically measured by strain gauges like load cells. Fundamentally all strain gauges are designed to convert mechanical motion into an electrical signal. When a load is applied to a surface, the resulting change in surface length is communicated to the resistor and the corresponding strain is measured in terms of the electrical resistance. A Load Cell is a transducer which converts force (weight) into a measurable electrical output. Strain gauge based load cells are the most commonly used type of strain gauge and probably the most widely used type of weighing instrument in the waste industry.

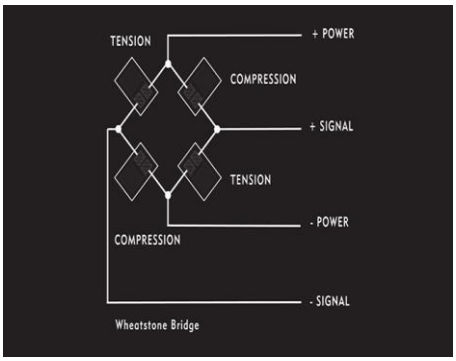
The strain or deformation is the change in the metric properties of a continuous body from initial placement to final placement. It implies a change in shape from undeformed to deformed or a changed configuration.



Deformation Diagram

It defines the amount of stretch or compression along the material line which can be measured in length. If there is an increase in length of the material line, it's referred to as tensile strain and if there is a decrease, it's referred to as compressive strain. Deformations which recover after the strain is removed are called elastic deformations. Load cells can be used to measure various types of strain such as compressive, shear, bending and tensile.

The gauges themselves are bonded onto a beam or structural member that deforms when weight is applied. In most cases several gauges are used, usually in both tension and compression referred to as a Wheatstone Bridge.



Wheatstone Bridge

When weight is applied, the strain changes the electrical resistance of the gauges in proportion to the load. The analog current is attached to a devise that converts the analog current to a digital number proportional to the magnitude of the volt or current.

Different applications of load cells can be found on refuse vehicles. Shear beam – between the truck frame and body, Deflection transducers - on axles and equalizer beams, spring hanger – on spring suspensions and load cells incorporated into the front forks on front loaders.

Mechanical Pencil Sensor (converts frequency to digital measurements)

Mechanical Sensor

The Mechanical Pencil Sensor as it's referred to, is a device used to measure strain. Its name comes from its resemblance in size and shape to a pencil.

It is a non load cell measuring device and does not convert strain to an electrical output as do most other strain measuring devices. It is considered to be one of the best available sensors due to its long term reliability. In its On Board Weighing application the sensor is connected to the structural member of the vehicles suspension. It can be used on steer axles, equalizer beams, straight axles and trunions.

This type of sensor is using sound or resonate frequency to measure strain or deformation. The frequency is then used to calculate the structural members (in this case the suspensions) physical properties (strain, load, deflection) through a calculating algorithm. The response is then digitized (converted to a numeric measurement).

The higher the pitch or frequency, the heavier the load; the lower the pitch or frequency, the lighter the load. This is much the same as when you tune a guitar string.

This type of gauge is capable of minuet strain measurements measured in micro-strains and can measure both tensile and compressive strain. The gauge itself is protected from outside noise and compensates for the effects of temperature.

New Features

Wireless handheld displays, on board printers, data loggers and weight data transmission are a few of the new features now available with some On Board Weighing Systems.

Today an on board weighing system can do much more than just provide weight data to the vehicles operator. Now that same data can be sent to fleet operations in real time.

Web Based data acquisition weighing systems can connect to the Internet in much the same way as a portable laptop computer does via cellular communication. Or a weighing system equipped with a RS-232 serial port can connect directly into an existing GPS system, which is a common feature in refuse vehicles today.

Terminal Based data acquisition weighing systems using data loggers are able to record critical weight events, store them and then transmit the data at the end of day to a dedicated computer where it can be sent via the Internet to a specific address or addresses for review. The information can be exported in a text form so it can be easily used by multiple platforms like Word or Excel.

Many companies today are working to incorporate real time weight data into other on board computer systems for purposes of improving efficiencies in fuel consumption, horsepower, torque and air monitoring.

The Benefits of Using On Board Scales

In today's environment what business can afford to operate at less than maximum efficiency? If there were a tool that could help optimize vehicle capacity, help reduce fuel consumption, reduce down time, save on unnecessary maintenance cost, help limit liability and improve safety, would you buy it? And what if that tool would pay for itself in just a few months or even a few weeks, would you be even more interested in owning it? Now, imagine that tool allowed managers and supervisors to monitor improperly and illegally loaded vehicles, making drivers accountable for the vehicles proper operation and loading. Would it make even more sense? That's what todays on board weighing systems can do for the waste industry.

If you send a driver on his route but he has no on board weighing system in his vehicle, how does he know when he reaches his maximum legal axle weight. How does the company know? No matter what the vehicles configuration or use, it's important to maximize its payload to the legal limit without over loading it.

The waste industry in particular has a unique problem in that the commodity being loaded can vary greatly from one day to the next. It's almost impossible to know the vehicles Gross Vehicle Weight, let alone its individual axle weights, just by how many cans or containers have been loaded.

On board weighing systems can be an economical and practical solution to an ongoing and potentially very expensive situation.