

Case History

Sensitive Belt Scale Dramati- cally Improves Accuracy At Louisiana Wood-chipping Yard

True to its name, Riverwood International Corporation has customers around the globe. Headquartered in Atlanta, it is the world's largest producer of coated, unbleached, craft paperboard for food and beverage cartons. Riverwood also designs packaging and develops packaging machinery for bottling and canning plants worldwide.

Riverwood's paperboard mill in West Monroe, Louisiana, uses wood chips from an adjacent wood yard operated by West Monroe Fibre Processing, Inc. (WMF). The spelling of "Fibre" is French, which is appropriate to Louisiana's heritage and also reflects the name of WMF's mother company, Georgia-based Fulghum Fibres, Inc., which owns 18 such facilities under contract to paper mills throughout the South.

WMF reduces logs to wood chips and conveys the chips from the yard to the Riverwood mill, where, after digestion and conversion to pulp, they come out the other end as Bird's Eye frozen food containers or 12-pack boxes for Miller Lite, Bud Light, and Coca-Cola. Delivering an average of 1.25 million tons of chips per year at an average of 230-235 tons per hour, the WMF conveyor belt is approximately 1190 feet long and runs at 470 feet per minute.

To keep track of inventory and production (logs in compared with chips out, delivered tons per man-hour, etc.), WMF weighs the chips as they travel along the conveyor. The company gets paid by the amount of wood it delivers to the mill, therefore accuracy is a priority.

However, accuracy was a chronic problem until the summer of 2002. In July the company replaced the chip-belt's single-idler scale with a new four-idler belt scale from a different manufacturer — Thayer Scale, of Pembroke, Massachusetts. The choice of Thayer equipment was influenced by Riverwood International, which is itself a contented Thayer customer, having used five Thayer belt scales for years in its mill next door to WMF.

"The old chip scale was difficult to calibrate," recalls Charles Harrison, WMF's area manager. "Repeated servicing failed to correct the problem. We knew we needed something better, so we decided to go with Thayer."

The story illustrates the benefits of Thayer's patented Force Measurement Suspension System (FMSS) technology, which measures net material weight only.



One of two conveyors with THAYER RF (rocking-flexure) belt scales

Additionally, Thayer Scale is the only manufacturer that can provide accurate calibrations for all scale capacities using small bar-stock calibrating weights instead of heavy weights, test chains, or dummy signals.

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After the new scale was in place and calibrated, Harrison’s crew conducted a series of product tests. They weighed an empty truck on the plant’s truck scale, then filled it with chips. The chips had been weighed by the new scale as they flowed along the conveyor belt, before they reached the chute set up to divert them to the truck. The crew weighed the full truck, compared the two readings, and repeated the process four times, with the net weight of the truckloads ranging from 56,080 to 61,940 pounds.

Thayer guarantees that the scale’s error rate will be less than $\pm 0.5\%$. For the first three truckloads, the scale readings were 100, 240, and 260 pounds less than the truck-scale readings — error rates of -0.1783% , -0.4122% , and -0.4222% , respectively. At this point, Thayer technicians slightly adjusted the scale to reference it to the certified truck scale. The next two test loads showed discrepancies of only 60 pounds (-0.0968%) and 40 pounds (-0.0653%). This was a level of accuracy the WMF crew had never seen before.

“You can imagine our pleasant surprise when we saw errors below $\pm 0.10\%$,” says Harrison.

WMF also conveys bark to Riverwood International, and the company purchased a second Thayer belt scale for its bark conveyor, also known as the hog-outfeed or refuse belt. Capable of carrying 45 tons of bark per hour at a speed of 288 feet per minute, this belt is approximately 860 feet long. Riverwood burns the bark to make steam, which it uses to operate some of the paperboard mill’s machinery. Like the chip-belt scale, the bark-belt scale was installed in July to replace a less accurate, single-idler scale from another manufacturer.

At the end of every shift, WMF divides the chips-delivered weight by the chips-delivered-plus-bark-delivered weight for the same period, to come up with a chip-yield percentage. Under its contract with Riverwood, WMF must maintain an average monthly chip-yield of at least 86%. Aside from variations due to wood quality and weather, the remainder of the wood is screened out “upstream” from the conveyor because the pieces are either too big or too small; the chip conveyor is also called the screen-discharge conveyor.

At this writing, Harrison has had more than three months worth of real-world chip-yields on the new scales, and the figures confirm the greater accuracy that was indicated by the tests at installation. “Instead of seeing daily variations of a full percentage point or a percent and a half, as we used to see with our old equipment, we now see no more than a tenth-of-a-percent swing,” he says. “With the Thayer scales the chip-yields have stabilized at 88.7-88.8%.”

Both of the new scales are Thayer’s 4RF-6AR model, designed for highly accurate totalization of material as it crosses a 16-foot weighbridge. This model features



THAYER belt scales make use of small, bar-stock calibrating weights instead of heavy test weights, chains, or dummy signals.

four self-aligning platform supports with Thayer's friction-free, rocking-flexure (RF) suspension pivots mounted in the approach-retreat (AR) configuration (at the front and rear of the weighbridge). The mounts are held in place by six-inch-deep channels in the scale's steel suspension stringers. Because belt speed is measured by a narrow, precision pulley and a sealed, rotary pulse generator mounted beneath the weighbridge along the center of the trough, neither the speed reading nor the weight reading is affected by stretching, lifting, overloading, or uneven tracking of the belt. Patented scale-location compensation software provides for weight reading at the head-pulley discharge.

At the heart of any belt-scale system is the load cell. Belt scales are unusual in the field of weight measurement in that they do not tend to achieve their highest performance with standard force transducers such as strain-gauge load cells. It is too difficult for a strain-gauge system to distinguish the actual material load from the dead load (tare weight) of the belting and carrying idler, especially when handling material with a relatively low bulk density, such as wood chips. More than 16 years of experience led THAYER to develop a load cell uniquely suited to conveyor belts. The basic Thayer transducer is a linear variable differential transformer (LVDT) with an isoelastic element as the force reactor.

In a THAYER belt scale, mass counterbalancing of tare weight and an isolation lever suspended by pre-stressed, stainless-steel cable protect the load cell from extraneous forces and boost the cell's utilization factor,

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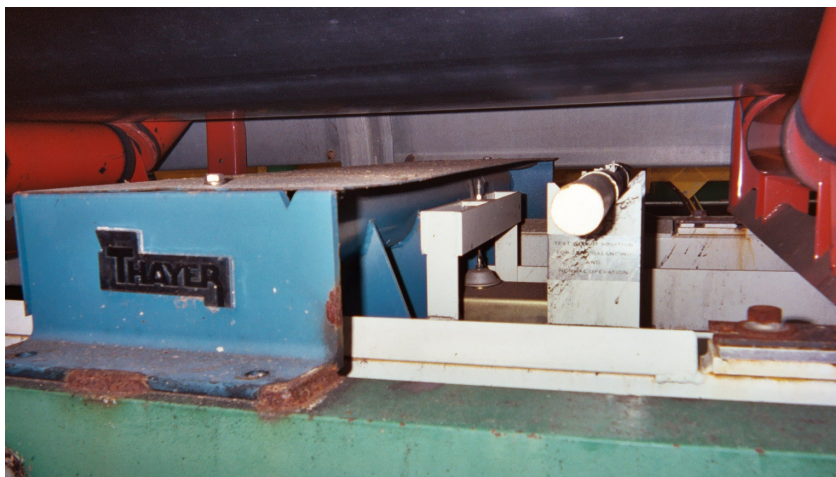
which is greater than 90% regardless of the application.

This superior signal-to-noise ratio is orders of magnitude better than ratios obtained with strain gauges and other sensors that support full tare load. Overall, the result is maximum sensitivity combined with long-term stability and service life. Thayer load cells are guaranteed for 15 years.

To obtain optimal performance, THAYER custom configures its equipment for the job at hand. Every load cell is custom designed, using proprietary software to ensure that its size is precisely suited to its intended use, and its capacity range steps up in fine increments.

After visiting WMF, THAYER application engineers returned to Thayer's Material Test Center in Massachusetts to design the new weighing systems. The bark-carrying belt is shorter and slower than the wood-chip belt. The bulk density of bark differs from that of chips. At 42" wide, the chip belt is broader than the bark belt, which measures 36" across. So that material doesn't fall off the edges of the conveyors, the WMF belts both bow lengthwise when loaded, at a troughing angle of 35°. These were among the many specifications the men had to take into account.

Initial calculations confirmed their choice of the 4RF-6AR as the most appropriate model for both conveyors, but their work was just beginning. Optimal load-cell utilization was a prime concern, but there were many other decisions as well. Determining what 16-foot loads of bark and chips were likely to weigh, for example, the technicians calculated the best suspension configuration for each scale and chose the best location for the 16-foot weighbridge along each of the two conveyor belts.



Beneath each conveyor belt, Thayer's Model 4RF-6AR belt scale weighs material as it crosses a 16-foot weighbridge. Mass counterbalancing of tare weight gives the load cell a utilization factor of more than 90%.

Prior to installation of the new scales, Harrison and his crew at WMF built a special enclosure and mounting stand for the instrumentation, to isolate it from vibration. WMF had chosen Thayer's PI-164 Programmable Integrator, a microprocessor-based system that employs patented digital concepts to keep the scales operating at maximum efficiency. A 40-character, alphanumeric display panel provides a tons-per-hour reading and other performance data at a glance, plus diagnostic, performance-history, programming, and calibration information as needed. The PI-164 continuously compares actual performance with preset limits for minimum and maximum rate, material load, and belt speed. If a problem is detected, an alarm message will show both the nature and extent of the problem, with reference data included. The PI-164 can be configured to interface with a personal computer or a programmable logic controller through an RS-422 port. It also permits remote monitoring/control from up to 10,000 feet away.



Because a THAYER belt scale measures belt speed with a narrow pulley and a rotary pulse generator mounted below the center of the belt trough, neither the speed reading nor the weight reading is affected by stretching, lifting, overloading, or uneven tracking of the belt.

“We here at West Monroe Fiber have been impressed with the care and attention we received from Thayer's technicians throughout the design/installation process,” Harrison says. “And now that we experience the exceptional performance of the THAYER equipment every day, its purchase can be seen for the wise investment it was.”

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