Automation Improves Aggregate Handling

SPECIAL TOPIC

PRIMARY METALS, STONE, CLAY & GLASS

West-Coast Sand and Gravel Plant Cuts Costs, Accelerates Production, and Improves Safety with Automated Material Handling System.

The Romans were the first to master the complexities of making concrete. Some would argue that their proficiency with concrete was just as important in the empire's expansion as Rome's armies and political system. Everywhere they went, the Romans constructed concrete buildings and bridges, concrete roads and dams, concrete aqueducts and viaducts.

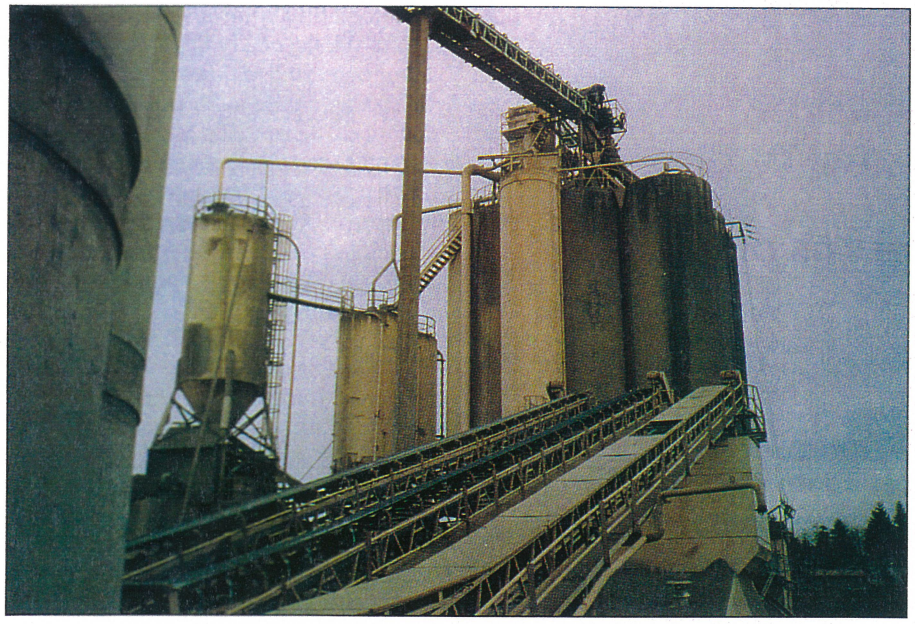
And just think: the Romans did it without automation!

Today, Associated Sand & Gravel's 300-acre quarry and concrete pipe manufacturing plant in Everett, Wash., operates under no such technological constraints.

For the past 18 months, Associated has integrated signal switches and silo hardware monitors with personal computer (PC-based) control software to automate bulk inventory and processing operations. The company's use of automated material handling has improved operations at the facility in four ways:

- Plant safety has been enhanced by extensive alarms and controls in the system.
- Labor costs are lower because automatic conveyor belt controls have replaced manual switching operations.
- Production downtime has been reduced by the elimination of product spills and overflows as well as the inefficient use of labor used to remove massive spills.
- Not only has production accelerated, but product quality is better because the automated system has eliminated mixing errors related to the blending of concrete.

Associated Sand & Gravel began operations in 1939. Today, the modernized quarry and plant produces upward of two million tons per year—half of which is sand and gravel products. The other half is crushed materials used in road-surfacing products. The company supplies the housing industry, state road contractors, various cities and counties, and individual firms. The company supplies sand and gravel in a wide variety of blends according to customer specs, and has a concrete pipe manufacturing plant on site.



Because of the plant's extensive operations, it resembles a spider web of 24-in. wide conveyor belts running from beneath 10 large piles of crushed materials to 23 silos—as well as to the concrete pipe plant. All of the plant's silos are made of concrete, measure 12-ft. in diameter, and range from 23-ft. to 50-ft. in height.

To continuously measure levels in the silos, the company recently installed on top of each silo a Sonologic ultrasonic transducer from Kistler-Morse of Redmond, Wash. They aim an ultrasonic pulse at the material below, and then measure how much time it takes for the echo to return to the sensor. The time elapsed determines the level of material in each silo. These stainless steel ultrasonic sensors provide the company with accurate level readings, typically within 1.0% of material span.

With a hardware system in place, Rex Welsh of CRW Inc., a systems integrator based in Bothell, Wash., was called on to integrate the level sensors with PC-based process control software, also supplied by Kistler-Morse. The level sensors communicate with the host computer via RS-485 communication connections.

With this system, plant management sets priorities on product flow from the 10 material piles to the 23 silos. At any point in time, an operator can change material flow paths by using a computer mouse to click the cursor onto a material pile, then clicking onto a silo (or vice versa). Just by looking at the screen, an operator can see approximately how much material is in

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A spider's web of conveyor belts complicates the movement of materials among the plant's multiple silos.

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fulfill a customer's rush order.

In addition to using information from the ultrasonic gauges, the software interfaces with programmable logic controller (PLC) hardware from companies such as Allen-Bradley, Westinghouse, and Cutler-Hammer to provide both safety features and process control capabilities. For example, the operations manager can graphically "cap" a silo so that no product will flow into the vessel. This might be done if someone is working inside the bin or on a gauge atop the vessel.

Also, nine transfer and shuttle conveyors are equipped with "zero speed switches," which detect potential problems such as excess slack in a conveyor belt. Too much slack in a conveyor creates a heat build-up—sometimes enough for the conveyor to catch fire. The switches detect this problem and interface with the control software to immediately stop the conveyor.

Automatic alarms also detect product pile-ups at the end or beginning of a conveyor belt. Stalled conveyors or plugged gates can cause such pile-ups. If left unnoticed, a material pile can grow quickly (at 500-tons/hr.), which not only shuts down production but requires extra labor to remove. Alarms also are used to detect variations outside of the prescribed "flow time." In other words, operators are told if material flow is too slow or too fast along a given conveyor. This can happen if the sand or gravel is too wet and sticky, causing it to flow improperly.

In addition to the auto shut-off features, the system has an alarm that sounds to let operators know when the auto flow path is about to change. While this may seem like a rather mundane feature, it provides a warning for someone working in the vicinity of the transfer conveyor near the materials pile or in the area of the shuttle conveyor near the about-to-be-filled silo. □

***Dale Surdyk** is operations manager at Associated Sand & Gravel's Everett, Wash., facility. The company is owned by CSR America, Atlanta, one of the leading aggregate suppliers in the United States.*