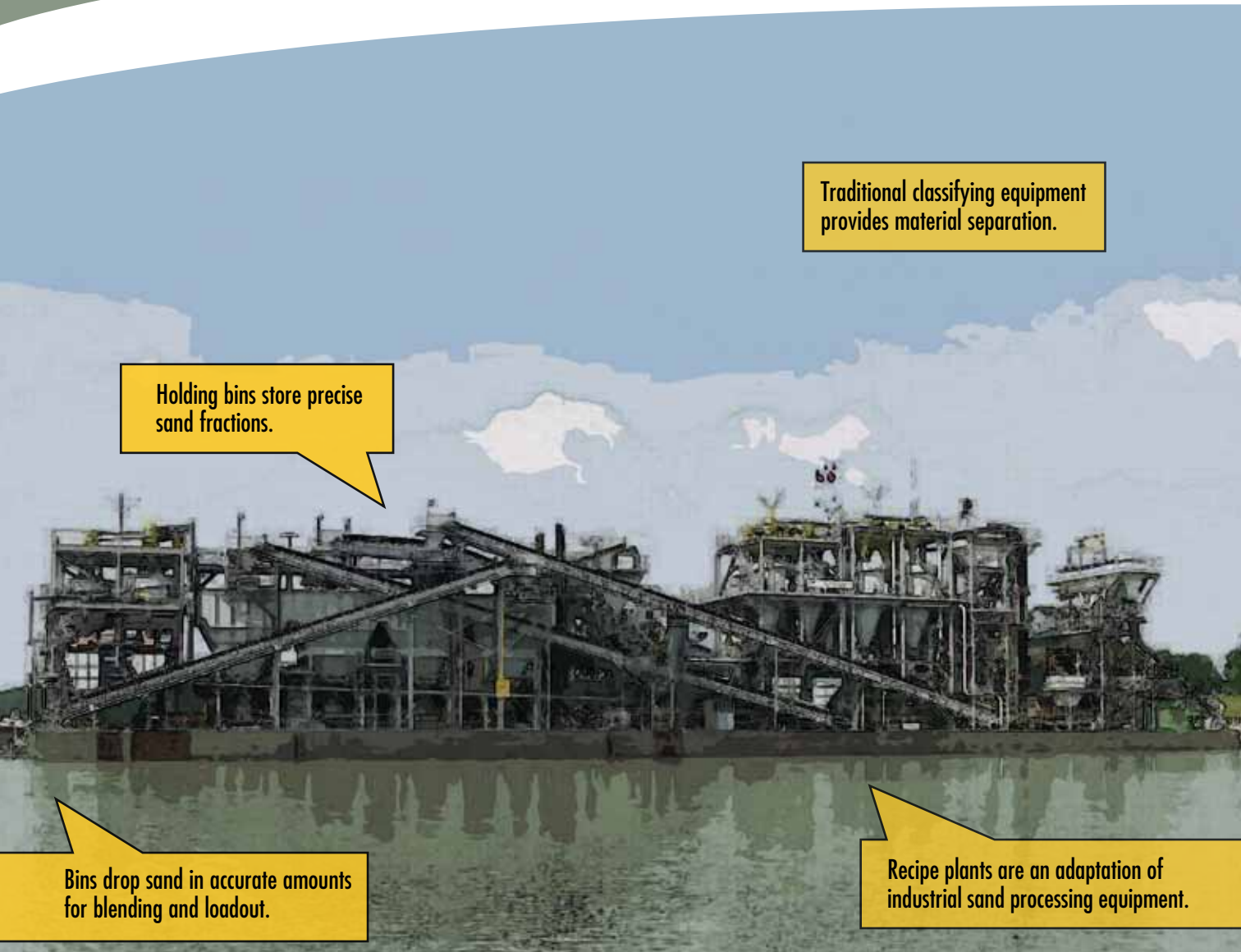
AGGREGATES MANAGER
Your guide to profitable production
PULL-OUT GUIDE
by Mary Foster, Contributing Editor

OPERATIONS ILLUSTRATED

Blend a Recipe for Success



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Create the Perfect Mix

It's true that just about any aggregate operation sizes and separates its products to blend and create specific mixes. The term "recipe plant," however, typically refers to a sand plant that can create custom material blends for tight specifications and make these blends consistently day to day, week to week, and even year to year without variation.

"Traditional classifying tanks with any number of stations do separate sand and reblend it," says Scott O'Brien, director of process engineering for McLanahan Corp. "But you can never be really sure of the variations between the stations; it's something of a guessing game." O'Brien says the good news is that ASTM C-33 concrete specifications allow for these fluctuations in mixes. Conventional sand equipment can process C-33 sand and do it well. "But when you want to take your processing to the next level, and consistently make exactly what the customer wants, a recipe plant is the way to go," he says.

Recipe sand plants closely resemble the industrial and glass sand plants upon which they originally were based. In the 1980s in Holland, B&D System's Leo Blaak realized the technology behind industrial sand processing plants could successfully be applied to aggregates. Utilizing cyclones, hydrosizers/density separators, dewatering screens, and holding bins that drop precise sand cuts for custom blending, these recipe sand plants were popular in Europe for about 15 years before they ever reached the United States.

According to Travis Wellman, Cemex vice president for Central/North Florida Aggregate Operations, the company's Davenport Sand Plant, which was upgraded to a four-fraction recipe plant in 2001, was the first fractionated recipe plant built in the United States. "Our deposit at Davenport is finer than the typical sand deposits in the area," he says. "We have a large commercial customer base in the area, and we wanted to maximize our site, utilize all of our coarse sand, and control our end products better."

Around that same time, Transit Mix Concrete Co. in Colorado Springs, Colo., experienced a similar situation. "Our pit had always been easy to mine; the top provided masonry sand, and the bottom had plaster sand," says Bud Herskind, Transit Mix aggregates consultant. "Then the pit changed, and our fine and coarse sands weren't in the same place anymore. We went to the Netherlands and looked at four recipe plants, and we realized we could put whatever we want at whatever proportions into a recipe plant and get exactly what we want out of it."

And that is the beauty of a recipe plant, says O'Brien. If a deposit changes, particles continue to be classified properly, and the plant will still provide the discrete material fractions for blending.

1 Mix it up

All aggregate plants provide material mixes, which are achieved by sorting and blending material to meet a specification. But tighter specs — from pre-cast concrete and concrete paver block customers to the Federal Aviation Administration, departments of transportation, and warranty paving projects — are causing some aggregate producers to consider taking their recipes to the next level. Customers are beginning to demand that producers make precise mixes and make them consistently.

4 Store it

With a four-fraction plant, four bins hold the dewatered sand fractions. An example of the sand cuts that are held for reblending might include 2.5 x 1.5 mm, 1.5 x 0.5 mm, 0.5 x 0.25 mm and 0.25 x 0.08 mm. A three-fraction plant will have three bins with sand fractions, typically holding coarse, medium, and fine cuts for reblending.

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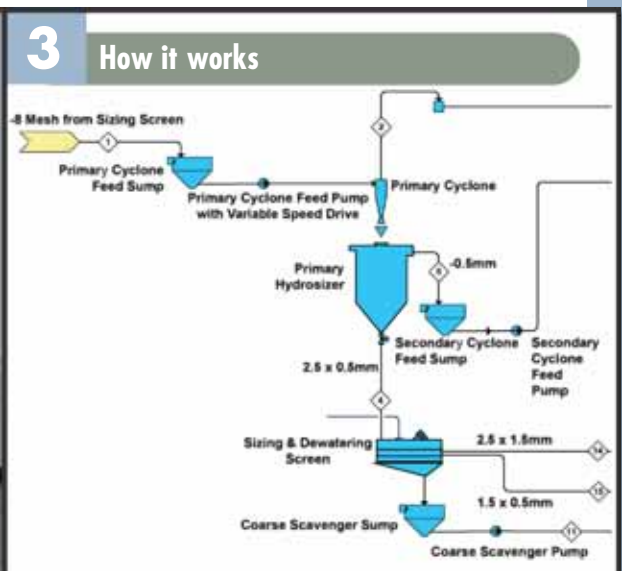
Blend a Recipe for Success

2 When consistency is key

About 25 years ago, European sand customers began to drive a need for a plant that could simultaneously produce discriminating sand cuts of distinct size fractions and then reblend the material to create custom mixes that did not deviate from batch to batch. This demand led Leo Blaak, with B&D Systems, Holland, to develop a "recipe" sand plant based on the classification systems used by industrial and glass sand producers.

3 How it works



This partial flow sheet shows how one section of a four-fraction plant works. A cyclone sits over a hydrosizer rising current classifier, which makes a precise cut of two material sizes from the slurry feed. The hydrosizer underflow material falls to a dewatering screen, which sends sized sand to holding bins for blending. Overflow goes to a secondary cyclone and hydrosizer. Ultrafines from the cyclones flow to the water treatment system.

5 Blend it

Plants blend the material to precise, consistent recipes either by volumetric means or by weight. Automation prompts sand to drop from the storage bins in discrete amounts where it lands on a blending conveyor that sends it to a stockpile for loadout. Radial stackers create recipe stockpiles according to customer needs. For a recipe product change, the stacker moves to create a new stockpile. The advantage is that the recipe is identical every time.

6 Simpler yet

Less capital-intensive inline recipe plants grew from the concept of blending from bins. The inline plant uses the same cyclones and hydrosizer classifiers to make the sand fractions. Classified materials are reblended immediately, either prior to or immediately after being processed on dewatering screens. Blending occurs "on the fly," moving straight to loadout.

OUR EXPERTS

Scott O'Brien is the director of process engineering for McLanahan Corp. He specializes in classification, solid/liquid separation, gravity separations, and thickening as they relate to the minerals and aggregate industries. He holds a bachelor's degree in geology and a master's degree in mineral processing, both from Penn State University.

Travis Wellman is Cemex USA vice president, Central/North Florida Aggregate Operations. Since joining Cemex in 2000, Wellman has held several leadership positions. Wellman holds a bachelor's degree in mining engineering from Penn State University and a master's of business administration degree from the University of Phoenix.

Bud Herskind joined Transit Mix Concrete Co. in Colorado Springs, Colo., as operations manager in 1972. In 1989, he became president of aggregates for Transit Mix. Herskind retired from the company in 2006, but continues to work with the company as a consultant. He earned a bachelor's degree in geophysics from Saint Lawrence University in New York, and also spent several years in the Marine Corps.

Voices of Experience

Travis Wellman

Florida's construction sand deposits tend to run in the central part of the state, says Travis Wellman, Cemex vice president for Central/North Florida Aggregate Operations. "It's one area where you can get coarse natural sand," he says, "and the deposit dictates what you get."

At the Davenport Sand Plant site, the deposit provides more fine sand than coarse sand. The coarse sand is ideal for commercial- and residential-grade concrete, as well as DOT specs. Until about 10 years ago, the Davenport plant used traditional sand screws and screens to process its material. "We were losing coarser product and not taking advantage of our fine grade product," Wellmann says. "We had no real control over gradation."

In 2001, Davenport commissioned a new fully fractionated recipe sand plant, which incorporates hydrocyclones, hydrosizers/density separators, and dewatering screens to create four sand fractions that feed to separate bins. When a customer needs a specific mix, each bin drops the correct amount of its sand fraction onto a blending conveyor. The sand then moves to a radial stacker, which creates a stockpile for loadout.

Hydrosizers make an initial coarse and fine split. A two-deck screen separates coarse and medium material. The fine sand runs through two secondary hydrosizers, which splits the sand into two fine products.

"The specs haven't necessarily changed for our customers," notes Wellman, "but the more consistent we can make the mixes, the better it is for them. We're also utilizing our deposit better. We're using fines in a way we couldn't before by blending more in our final products. Ultimately, we're now making multiple products with absolute control over consistency."

Scott O'Brien

The first recipe sand plants in the United States all used bins to store the fractionated material, with blending systems that created the custom mixes for stockpiling. "While the plants have a low operating cost, they initially require more capital than a traditional sand plant," notes Scott O'Brien, McLanahan Corp. director of process engineering. He says the concept has since evolved, however, to include less capital-intensive plants.

"We now have installed a number of inline blending plants," O'Brien says. "These use the same precise hydrosizer classifiers to make the same precise cuts, but the blending is done on the fly." The hydrosizer products are re-blended either prior to or immediately after dewatering screens. A chute splits one cut from the screen and conveys it for loadout as product "A," and another cut for loadout as product "B."

The hydrosizer makes a cut and overflow fines fall by gravity through a dewatering cyclone, which discharges into a small slurry bin. The coarser underflow drops directly onto a dewatering screen. Because the hydrosizer is being controlled to maintain a proper cut (by monitoring the density of the slurry in the sizer and adjusting the underflow valve), the producer uses the position of the underflow valve to instruct a certain amount of fine material to be blended onto the screen at the same time. The ratio of fines to coarse can be adjusted to produce the desired product.

"The question is, do we put it into a bin and blend out in a controlled fashion, or do we go with an inline plant and blend from the classifier straight to the product?" says O'Brien, adding that an inline plant is ideal for a producer that only makes a couple of products each day.

Bud Herskind

Transit Mix Concrete Co. provides sand blends from three fractions at its recipe plant in Colorado Springs, with a fourth bin collecting rejected oversize and undersize material to sell for frac sand. Bud Herskind, aggregates consultant for Transit Mix, says the company decided to upgrade its equipment with a recipe plant in 2002 to increase production and make a better product. "With the recipe plant, what goes to the bins is extremely uniform," he says. "Of course, the true magic is how we put it back together."

Herskind says that a recipe plant's accurate blending capabilities can instill confidence that the plant's aggregate mixes will yield quality concrete and notes that the Transit Mix plant's blending system is unique among recipe plants.

"With most recipe plants, when they take the material out of the bin, it goes to a constant-feed belt that combines the material volumetrically," Herskind says. "But if there are variances in moisture, which can reach 10 to 20 percent, it can make a difference." He explains that Transit Mix looked to the moisture control technology used in concrete block plants when it installed its automated blending system. "We use belt scales with moisture control during the blending stage, which looks at moisture content and adjusts the sand combining process to within 1 percent accuracy," he says. "It's amazingly accurate. I'm convinced our plant is the best in the world."

In addition to precision blends, Herskind says the plant's better production and reduced manpower requirements have also improved Transit Mix's bottom line.

"The recipe plant is a marvelous thing," he says. "It gives you the same sand that you dialed in all day long, wet or dry. And I feel it's not exploited here the way it should be."