

FROM TRASH TO CASH

A quarry operation in Hawaii comes across a unique solution for its mountain of waste coarse aggregate.

EDITED BY KEVIN YANIK

Even paradise has problems. David Gomes, general manager of Hawaiian Cement's Maui Concrete and Aggregate Division, faced growing demand for Grade A, high-density stone at the company's Puunene Quarry.

At the same time, the quarry's coarse aggregate reserves were increasingly becoming contaminated with pumice.

Selective mining only resulted in more waste rock, and crushing produced too many fines, pushing the problem into finer grades of sand without increasing the tonnage of Grade A stone. Thus, some creative thinking was required.

PHOTOS BY ANDREW SNOBY

With origins dating back to 1939 and nine locations today, **Hawaiian Cement** leases seven quarries on three of the main Hawaiian Islands.





The photo at left shows the successful stratification of a difficult material with a Snoby Separation Systems wet jig. At right, the red pumice is jigged to the top of the bed.

COMPANY/QUARRY HISTORY

Hawaiian Cement, a subsidiary of Knife River Corp., is a vertically integrated construction materials company that supplies aggregate, cement, ready-mix concrete and colored concrete in Hawaii.

With more than 200 employees, Ha-

waiian Cement is one of Hawaii's top three aggregate producers. The company provides bagged masonry cement, golf course sand, decorative stone and other landscaping products and materials, as well. Hawaiian Cement is a critical part of the residential, commercial and public

The Puunene Quarry was expanded from 28 acres to 194 in 1980.

construction projects throughout the Hawaiian Islands.

With origins dating back to 1939 and nine locations today, Hawaiian Cement leases seven quarries on three of the main Hawaiian Islands. The company's Halawa Quarry is one of the largest quarries on the island of Oahu, while the Puunene Quarry was expanded from 28 acres to 194 in 1980. In 2011, an additional 75 acres of reserves were added to the quarry's permit boundary.

Basalt is the primary rock mined at the Puunene Quarry. It is a dark-colored, fine-grained rock formed by the cooling and solidifying of molten materials flowing from volcanoes. Crushed basalt is used for road base, concrete aggregate, asphalt pavement aggregate, railroad ballast, filter stone in drain fields and a number of other purposes. Thin basalt slabs can be polished and used as floor tiles, building veneer, monuments and other stone objects.

The Puunene Quarry is located on the island of Maui, and it is an integral part of Hawaiian Cement's operations. Of course, there is limited real estate from which aggregate can be mined. So Hawaiian Cement considered developing a sustainability program, one that could convert waste rock into salable, Grade A aggregate.

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An overview of the **Puunene Quarry** plant, with a Snoby Separation Systems wet jig processing the coarse material.



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SEEKING A SOLUTION

The first concepts considered for upgrading Hawaiian Cement's contaminated stone were all dry. Crushing was tried and rejected. Size classification would have been an easy fix. Unfortunately, the contaminating pumice was found in all sizes, including the critical coarse rock (3/4 in. x 1/4 in.).

Next, dry gravity separation was tested. Improvements were noted, but consistent quality could not be sustained at economical yields. There were no electrostatic or magnetic differences between the contaminants and the base stone. Furthermore, the specific gravity of the contaminating pumice ranged from under 2.0 up to 2.4.

The base aggregate particles are 2.6 specific gravity. With such narrow density differences, the only chance to make high-quality stone would be with a wet process.

The first wet processing concepts to be considered were rising current and teeter bed separation. Again, while some improvement was noted, a consistent quality could not be achieved at economical yields. Ultimately, only one commercially viable

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option proved to be successful: wet jigging.

Hawaiian Cement sent samples of waste coarse aggregate for testing to the laboratories of Snoby Separation Systems. The samples were processed with air jigs, teeter bed separators and wet jigs. The resulting samples were collected and returned to Hawaiian Cement for their analysis.

As expected, it was discovered that only the wet jig, a wet process, provided consistently clean, Grade A stone at yields that were commercially viable. With this,

Hawaiian Cement finally found a solution to the Puunene Quarry's mountain of waste coarse aggregate.

ABOUT WET JIGGING

The wet jigging process stratifies the feed according to density and withdraws only high-density products while allowing the deleterious particles to overflow a weir and report to a reject pile.

Essentially, the jig creates an up-and-down movement of water through the controlled intake and exhaust of air. As water pulses upward, it subjects particles to differential acceleration, causing the smaller, lower-density particles to be lifted higher and faster than larger, denser particles.

At the completion of the upward stroke,

the larger, heavier particles fall faster. By repeating the upward and downward movement, multiple stratified layers are formed. A measuring device then identifies a selected stratum to be rejected, and the jig automatically controls the withdrawal of high-density, in-spec material.

By utilizing the Snoby jig, the Puunene Quarry was able to process 1 1/4 in. to 1/4 in. at a feed rate of 80 to 100 tph.

In cooperation with Snoby and Balzer Pacific Equipment Co., a longtime supplier of aggregate equipment in Hawaii, Hawaiian Cement developed a flowsheet to process up to 80 tph of 1 1/2 in. to 1/4 in. material that was previously rejected as contaminated.

The 1/4-in.-plus material fed to the Snoby jig is stratified and separated into a low-density product, including pumice, and into a high-density product, including Grade A stone. The cleaned stone is then stockpiled.

The 1/4-in.-minus material reports to a sump, and is then pumped to a two-stage cyclone system and, finally, to a dewatering screen prior to being stockpiled. The overflow from the cyclones is pumped to a thickener.

Operation of the plant, especially the jig, is simple. The jig controls can be viewed and adjusted on any apple or android phone or tablet from around the entire processing plant. Set points can be adjusted while monitoring and evaluating the product piles in real time. This also includes, trend screens and the status of all electrical components. The remote controls of the jig can be a real time saver during start up, since the control room is located 50 yards and two stories away from the jig.

Since installing the jig plant, the Puunene Quarry is enjoying expanded sales and increased production. And the previous mountain of waste material is slightly smaller today, as it is being converted each day into a valuable product. **P&Q**

Information for this article courtesy of David Gomes and Andrew Snoby.



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