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Quarry carves out twice the production

Inside Machines: Modernization plan doubles production, minimizes costs at California quarry using automation and with universal programming software able to program all of one company's control components. Easy programming and setup saved time, meeting contract requirements.



Keith Moreland
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Faced with completing one of the largest projects in its history, Canyon Rock, a Northern California quarry, used a system integrator and universal programming software to meet deadlines, save programming time through reusability of code, simplify training, and enable diagnostics to determine failures anywhere on any device. The company knew success depended on making major changes to its operations—and making them quickly—using automation and software that could replicate success in subsequent phases of the project. It would have to double production to meet the specifications of the bid it had just won.



Recognizing that increasing capacity so significantly would require a major modernization, the company turned to its long-time automation distributor to make it happen. Canyon Rock produces aggregate and concrete. The quarry has helped build the foundation of the area, providing quality rock, concrete mixes, and sand for Sonoma County and its environs for more than 40 years. Its rock is in the surrounding roads, rail beds, and airstrips, in stores, parks, and schools.

The company is continually incorporating advancements into its operation, upgrading its facility and its equipment, striving for sustainability and to be an environmentally friendly good neighbor. It minimizes its carbon footprint by keeping its fleet performing above current emission regulation standards and planting trees in reclaimed areas of the quarry every year. The company was the first local aggregate producer to recycle concrete and asphalt starting in 1975, a practice that continues to this day.



Modernization with automation

The major job Canyon Rock had just accepted, however, presented new kinds of challenges. A change in leadership had recently occurred, the reins of the company passing from one generation to another. Prior administration had been content with traditional techniques; current management recognized the benefits of incorporating state-of-the-art technology. The benefits of expanding and automating the operations were hard to ignore.



Specifically, the company sought to minimize noise pollution by using a greater percentage of conveyors—instead of loaders—to move materials from place to place. By automating the materials handling operations with sophisticated controllers, motor starters, and variable frequency drives (VFDs), Canyon Rock could continue reducing its carbon footprint and cutting fuel costs, while significantly increasing throughput.

The company had to fulfill the obligations of the contract, which was a large, time-sensitive job. Two urgent needs emerged:

- Double the capacity of produced aggregates
- Minimize labor costs.

Meeting the demands of a modernization and the specifications of the contract would

require a collaboration of resources. To start, Canyon Rock called on an automation distributor founded in 1955 that helped with construction of the original facility some 40 years ago. When it became apparent that the quarry needed a turnkey solution, system integrator Serra, subsidiary of EandM, helped with a cost-effective, timely solution that would allow Canyon Rock to:



- Meet its contract deadlines
- Eliminate or minimize operations downtime
- Promote flexible manufacturing.

Serra used high-quality automation with an outstanding reputation, global support and service, and offered universal programming software for all components from the same automation company. This concept promoted uniform handling of all



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automation components using one system platform and tools with uniform operating interfaces. The sophisticated but easy-to-use package helped Canyon Rock achieve its goals within the prescribed deadlines, saving programming time through reusability of code, necessitating that personnel learn only one software package, and enabling diagnostics to determine failures anywhere on any device.

Meet the need for speed

With time being of the essence, Canyon Rock, its distributor, system integrator, and automation company worked together on a project that, as of this writing, totaled \$328,000. The job, expected to top half a million dollars when complete, began with the installation of a plantwide Profinet communications network and incorporated multiple product lines including programmable logic controllers (PLCs), 19-in. human-machine interfaces (HMIs) from which the entire plant is monitored and controlled, two types of motor starters with soft starting and motor management capabilities, VFDs, various input/output (I/O) devices, pilot devices, breakers, terminals, and universal programming software.

Speed was imperative. "We faced incredibly fast commissioning," explained Grant Schulz, Serra's engineering manager. "We were behind schedule from the start. We had done basic motor starter panels for the quarry, but not PLC-based automation. Simple motor starters had been sufficient to drive the operation in the past." Present management's strong belief in automation and technology gave us the opportunity to bring state-of-the-art controls and systems on board, said Schulz.

On a project of this magnitude, the commissioning of each phase would take four to six weeks, but Canyon Rock had only one week for that task to meet the terms of the contract. The company would have been subject to substantial penalties if it failed to deliver in the specified time frame. Further, the renovation had to be completed with little or no downtime of existing operations.

"We needed a way to catch up," Schulz said, adding that universal programming software helps because all the products from one automation vendor can be programmed with one software package. "A more traditional approach would have required three or four software tools and three or four diagnostic tools" to do the same. "It gave us the efficiency to roll out the systems with a speed that no other diagnostic tool could match."

All project components were programmable using that one software package, a capability Canyon Rock and Serra recognized as the major reason the goals of the project were achieved. "Everything really did turn on" having one software package, said Schulz. "We were able to commission everything in a week." As for the universal programming software, "we could not have done it that fast. We could not have met contract obligations."

Project phases, industrial Ethernet

Use of a phased approach also helped smooth the road to improvement. Following the general flow of the material as it moved from aggregate to sand, Serra divided the work into stages covering five areas:

- Scalping or removing available exposed rock and loading it into the system
- Rock crushing
- Secondary screening, which involves sorting aggregate into various sizes
- Tertiary screening, or rescreening, which separates finer-sized particles
- Wash plant.

The success of the phased approach turned largely on the implementation of Profinet, the newly applied communications architecture. "Before this project, the plant had no network," Schulz pointed out. "Once we rolled out a backbone for the entire plant, and put all components on a common network, the PLCs could talk to the HMIs which could talk to the VFDs and the motor monitoring devices."

Faced with keeping production up and running in all areas of the plant throughout the modernization, Serra personnel upgraded one area or process at a time.

"When one was done, we called it complete and moved on to the next one," said Schulz. "To date, we've completed four areas in four separate projects. That minimized the impact. Production continued as we improved the overall plant."

Schulz praised the universal programming software as he considered the benefits of the phased approach.

"Each phase required essentially the same elements," he explained. "Once the first phase was complete, the lion's share of the work was done. The standardized library of code developed for the PLCs, the VFDs, even the HMIs was all reusable" with the universal programming software, which "allowed us to collapse the design cycle and the installation cycle. We knew the functions in the second phase were going to work because they had already been tested and applied in the first." The programming software makes the operation flexible, Schulz added.

"The global library lets you reuse parts of a project and share them again and again. We're not reinventing the wheel, and we are saving a lot of programming time."

Phase 1 took 4.5 months to complete. Phase 4, which was at least 30% larger than Phase 1, took one month, including commissioning. "Speed increased with experience," said Schulz. "Programming the HMIs was faster than programming the PLCs; the VFD commissioning went faster than previous components as subsequent standardized components were reused."

Simpler design; easier startup

The modernization program, begun in February 2013, was completed early in 2015. In the fourth of five phases, Canyon Rock had doubled throughput. More than 150% of the original capacity was expected; production will have risen from 4,000 tons to 10,000 tons of aggregate a day. Other benefits include reducing the amount of wiring required in the project by incorporating Profinet across the plant. "Instead of running the traditional half dozen wires from one PLC to one VFD, we use one Profinet cable," explained Schulz.



"The network was integral to achieving the level of automation Canyon Rock wanted and needed. And the quarry can now do other things thanks to the connectivity. Right now, we are incorporating some nontraditional devices into the network to provide remote access for monitoring and controlling parts of the plant previously under manual control."

Ongoing efforts hold the promise for more progress in the future. "We started out with five major phases in the program," said Schulz. "Along the way, we picked up a half dozen to a dozen additional smaller projects that bring individual functions or smaller islands of control into the larger picture." EandM, Serra, and Canyon Rock all express satisfaction with the results of the modernization and the performance of the automation products, procedures, and systems. "If you open the door on one of the cabinets we built for Canyon Rock," other than the wire tray, wiring, and nuts and bolts, everything is from the same automation company, said Schulz. "With Profinet, I can plug in a component and it works. I don't have to troubleshoot it. I don't have to worry about it. I know it is going to work from the start."



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Key concepts

- A quarry needed to significantly increase output to fulfill a contract.
- Automation helped double production.
- Universal programming software allowed success in the first phase to significantly reduced costs in subsequent phases.

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