

Asia Pacific quarry realizes a 30% improvement in annual production

At a large quarry in the Asia Pacific region, labor-intensive product changeovers requiring up to two days in traditional quarries, have been replaced with recipe-driven 'on the run' production changeovers, dramatically reducing plant downtime.

Background

A global supplier of cement and aggregates has a network of quarries operating across one country in Asia Pacific. The most recent addition to this quarry network is the company's largest quarry operation, arguably one of the most technically advanced of its kind in the region.

Producing 500,000 tons per year this quarry operation provides the domestic market with more than 24 different rock products. These range from boulders and low grade 'scalpings' for bulk filling applications, to high-grade road sealing 'chips' and premium crushed fines and sands.

The quarry's products are all accurate blends of material grades, ranging in size from boulders, 65 mm road material and 12 mm aggregate, to premium crushed fines and sands. The quarry comprises a wide range of heavy equipment, including 46 conveyors, five crushers and seven vibrating screens, plus numerous vibratory feeders, belt weighers and level indicators.

In developing the new plant, the company's overall design objective was to ensure that this quarry was the country's most technologically advanced.

"Versatility and ease of product changeovers was our absolute goal," explains the quarry's development engineer.

To simplify product changeovers, the quarry's design incorporated ingenious pre-configured product flight paths using an array of variable speed and reversing conveyors, all controlled and monitored by a PC-based control platform.

Challenge

The quarry's first two years of operation found the plant to be far



from the 'dream machine' first envisaged by its designers. The plant's original control system was built around a third-party PC-based control system and human machine interface (HMI) that was plagued with problems. The most essential problem stemmed from the PC control engine's basic inability to reliably monitor operation of the plant's heavy equipment.

Despite numerous upgrades of the PC control software throughout the commissioning and post-commissioning period, the PC software could not effectively handle the analog inputs that proved the 'run' or 'stop' status of the quarry's many large machines.

Without functional analog inputs, the important recipe-based aggregate blending process was also impossible. More importantly, an 'OFF' field isolator could render machine status monitoring incorrect and effectively disable essential operational interlocks. Daily operations became a nightmare. Conveyor stalling, rock overflows and machine jam-ups were all too regular. In a complete conveyor or crusher jam-up, the rock had to be dug out by hand, stopping the entire plant for around an hour at a time.

To overcome the machine status feedback problem, operational procedures were established using roaming operators, equipped with two-way radios. The operators had to not only determine if a machine was running, but to also visually monitor and assess its loading. Without a precise means of determining machine loading, the operators erred on the side of caution, which limited the plant's throughput.

During this post-commissioning period, it was found that on-line PC configuration changes were not possible. As a result, the entire plant was regularly stopped for an hour or two at a time, as computer program changes were made and tested.

Solution

This quarry site management team acknowledged that the PC-based control system required complete redesign, and in late 1998 the team commissioned Rockwell Automation's Information and Automation Systems group in the country.

After reviewing the existing system documentation and interviewing the quarry operational team, Rockwell Automation proposed a 'software only' changeover, resulting in a system that used the site's existing control system I/O, communications and control room PC hardware.

The tried and proven performance of two key Rockwell Automation products — the Allen-Bradley SoftLogix 5 PC-based control system and RSView32 HMI software — formed the heart of a major performance turnaround for the quarry. The Allen-Bradley SoftLogix 5 Controller is a software-based control engine that extends the functionality of the PLC-5 into the Microsoft

Windows NT environment. Aside from its advanced controller functionality, an essential benefit of the SoftLogix 5 controller is its proven integration capabilities with the other elements of the control 'picture' — I/O hardware, HMI software, communication networks, the Microsoft Windows NT operating system, and associated tools and controls.

The new PC-based controller was coupled with Rockwell Software RSView32 — a powerful 32-bit Windows-based HMI software package. RSView32 has been designed to integrate easily with Rockwell Automation products, Microsoft products and other third-party offerings. Recipe and reporting functions were developed using RSView32's Visual Basic for Applications (VBA) tools. Recipe parameters are stored in a simple Microsoft ACCESS database, drawn down as required by the VBA routine, and loaded into the appropriate SoftLogix 5 plant control parameters.

Prior to installation, the Rockwell Automation team spent some weeks researching and developing the control algorithm. The completed controller was fully function-tested and simulated at the company's local office, then client witnessed and

signed-off. The actual site software changeover took less than a day — the Rockwell Automation team visited the site in the morning, and by that afternoon the quarry was crushing rock.

Results

The control system upgrade has transformed the quarry into the quarry 'dream machine' originally envisaged by the company — and provided a rock-solid 25 to 30% improvement in the quarry's annual throughput. This operation now typically runs at 400 tons per hour, equating to an annual throughput of around 500,000 tons. These figures compare dramatically with those of the plant's first two years, where control system problems limited throughput to 300 to 320 tons per hour, or around 400,000 tons per year.

Most importantly, the plant is now "under control" and well on track to breaking further production records.

The new system boasts all the functionality required in the quarry's original design concept: recipe-driven blending and product changeovers, full plant reporting, and monitoring of load currents and tonnage throughput. "Product changeovers are recipe-driven at the PC control system," the on-site

development engineer explains. "We can readily change things basically on the run, so we minimize plant downtime." He says "The traditional quarry industry approach to product changeovers can involve a day or two of plant retooling — heavy lifting and man-handling of screen decks, meshes, crusher liners and so on."

Comparing the two PC-based systems and designers, Ashton believes the success of the new control solution came down to three key Rockwell Automation attributes: its total system design approach, the proven integration of its control components, and its genuine practical understanding of industrial processes.

"Rockwell Automation's wealth of experience comes through very clearly," the development engineer comments. "They knew their way inside and out of the software and had a practical understanding of what we were trying to achieve."

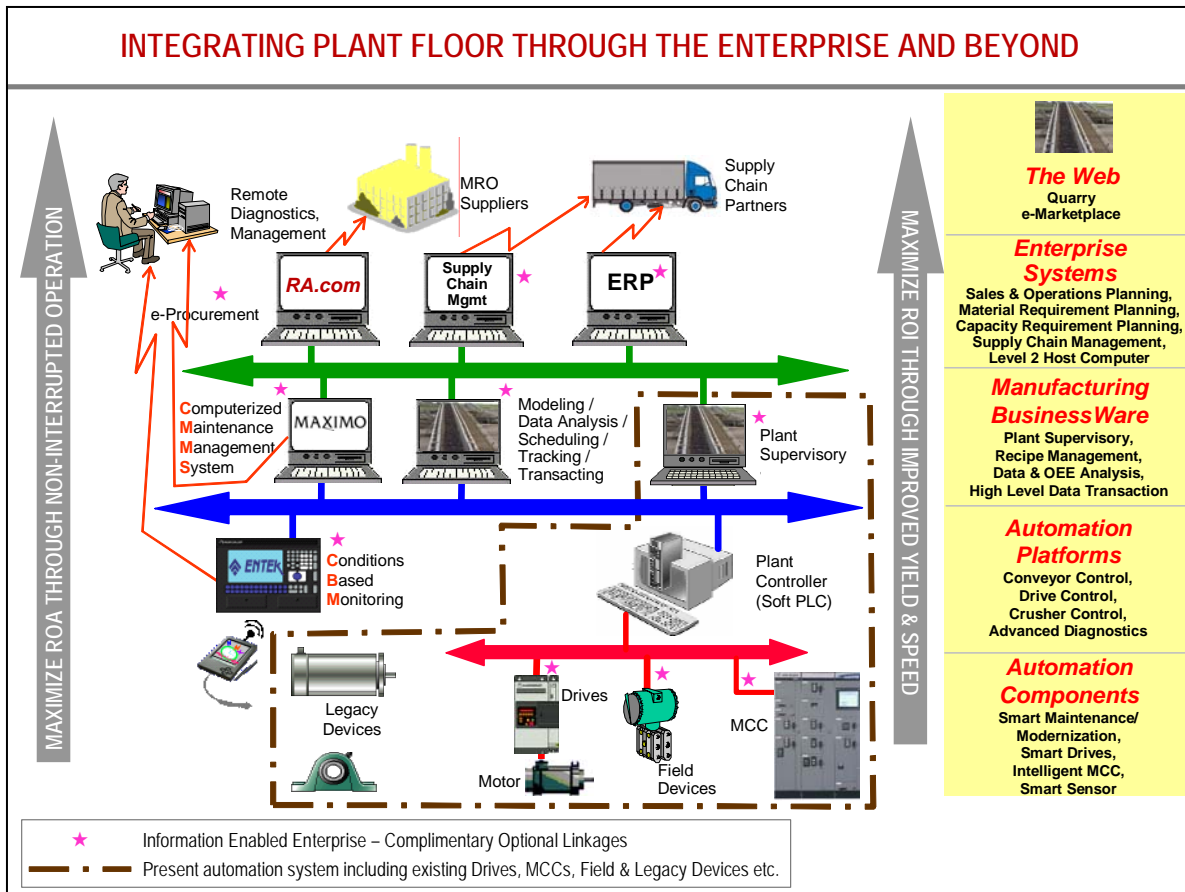
The SoftLogix 5/RSView32 system provides the quarry with the flexibility to upgrade and change the plant when required. "With the earlier system everything was a 'major' — it was all an extra hassle," the engineer adds. "With SoftLogix 5 and RSView32 we can readily change things. The Rockwell Automation

system is very much user-friendly and capable of add-on."

The SoftLogix 5 and RSView32 will continue to see the company's largest quarry through years of production success and future upgrades, backed by proven Rockwell Automation technology and engineering support.

The architecture on the following page depicts Rockwell Automation's concept of an Integrated Architecture. The area outlined with a brown dash line represents the present automation level under discussion in this document. The remaining portion illustrates a host of solutions that Rockwell Automation can provide today to integrate the plant floor to the enterprise and beyond.

Due to reasons of confidentiality, this customer prefers to remain anonymous.



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www.rockwellautomation.com

Corporate Headquarters

Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36-BP 3A/B, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products

Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433

Europe: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741

Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 351 6723, Fax: (65) 355 1733