Expansion and **Modernisation**

KEN A. WILTSHIRE, CARIBBEAN CEMENT COMPANY LIMITED, JAMAICA, PROVIDES DETAILS OF THE COMPANY'S EXPANSION AND MODERNISATION PROGRAMME.

Background

The island of Jamaica is the largest English speaking island in the Caribbean and has a population of 2.7 million people. It is also the northernmost of the Caribbean islands, located south of Cuba and West of Haiti.

Caribbean Cement Company Limited (Carib Cement) was incorporated in 1947 as the sole cement manufacturer on the island of Jamaica. The idea of a cement plant was being discussed for at least two and a half decades before the company's incorporation; however, it gained impetus from the shortages suffered during World War II. While the company was incorporated in 1947, commercial production began in 1952, with an annual capacity of 100 000 t of cement. By the beginning of the 1990s, after a number of expansions, the company had a total installed clinker capacity of 600 000 t and a total installed cement capacity of 1.05 million t. As part of the last expansion, undertaken in the early 1980s, the company also installed a coal storage, handling and grinding facility to provide a cheaper form of fuel for clinker manufacturing operations.

Preheater tower foundation: concrete pour for the preheater tower foundation in progress. Overall volume was in excess of 1800 m^3 using Carib Cement Plus.

Homogenising silo: continuous slip forming of the 7000 t homogenising silo in progress for 21 days. Visible is the internal silo cone for raw meal extraction.

Concomittant with the changes in the plant, Carib Cement also underwent a number of ownership and management changes, including government ownership. With significant profitability challenges and a sizeable debt burden, the Jamaican Government eventually decided to divest the cement company. Arising out of this divestment process, the plant was sold to the TCL Group, owner of two other cement production facilities in the English speaking Caribbean, located in Trinidad and Barbados.

Early energies were directed at restructuring Carib Cement's debt and then improving the performance of the plant's operations. In 2002, the company embarked on an ABC plan to enhance the performance. The three phases of the plan were:

- Phase I (A) - Optimise the operation of the existing plant.
- Phase II (B) - Introduce a blended cement into the market.
- Phase III (C) - Expand and modernise the plant.

Phase I was successfully completed in 2003, when the company achieved a clinker production of 600 000 t for the first time in its history. In 2005, Phase II was successfully completed, when Carib Cement Plus was introduced. This is a pozzolanic cement, which now represents approximately 80% of the company's local market sales.

While these plant changes were in progress, Carib Cement also transformed itself into a customer-focused, efficiency driven organisation, manifesting its values in the treatment of its customers, employees, surrounding communities and other publics. The company invested in upgrading its management systems and successfully completed a Manufacturing Excellence Transformation process in 2004. In 2007, the company achieved ISO quality management system certification (ISO 9000), ISO environmental management system certification (ISO 14001) and the local Jamaican Bureau of Standards certification mark.

Expansion and modernisation programme

The final phase of Carib Cement's ABC plan was an expansion and modernisation programme that sought to capitalise on what was a cumulative annual market growth rate of 7%. The programme was designed to address operating efficiency by doubling cement and clinker capacities. In addition to the expanded capacity, the programme also focused on installing the most energy efficient equipment to address the high cost of energy in the Jamaican environment. The pivotal elements of the programme were:

- A doubling of the plant's clinker capacity to 1.3 million tpa by installing a new dry process, precalciner kiln system, kiln no.5. This kiln replaced the existing wet process kiln no.3 and operates in conjunction with the existing dry process preheater no. 4 kiln.
- A doubling of the cement grinding capacity to 1.8 million tpa by the installation of a new pregrinding circuit to operate in conjunction with the closed circuit, 4500 h.p. no.4 cement mill and the open circuit 2000 h.p. no.3 cement mill.
- The upgrade of the upstream and downstream ancillary plant to match the increased production capabilities of the expanded main plant areas. This also included the upgrade of the dust collection and dust abatement equipment across the plant. These efforts were targeted at improving the environmental performance of the plant to meet local and international standards.

Kiln no.5 project

The single largest component of the expansion and modernisation programme was the kiln no.5 project. This entailed the construction of a new 2800 tpd kiln, the major components of which are:

1. An FRM 38-190 vertical roller mill, rated at 235 tph.
2. A four-stage suspension preheater, with an Inline Low-NOx Calciner.
3. A 4.55 m dia. ROTAX-2, two pier kiln, with an electric friction drive.
4. An SF 3x4 Crossbar Cooler, with a hydraulic roll breaker.

5. Kiln/mill and cooler vent fabric filters.
6. Four main process fans.
7. Raw material storage bins and raw materials/raw meal transport equipment.

Employees of the mechanical erection contractor participating in their daily aerobics exercises after their morning toolbox talk and before starting work for the day.

Rotary kiln: two central kiln sections were joined and then lifted together by two cranes to connect to the tyre support sections that are already in place.

Cement mill no.5: sections of the vertical roller mill equipment are being tested while process gas ducts and the mill vent baghouse are being insulated.

8. Clinker conveying equipment.

The main equipment for the kiln was supplied by FLSmidth Corporation and the ancillary equipment was individually selected from reputable industry suppliers based on well defined performance criteria. Plant construction began in July 2006 and the plant began operations in August 2008. During the construction period, over 2 million man-hours were expended on the plant erection. The nature of the construction industry in Jamaica is more geared towards commercial buildings and the hotel industry rather than industrial construction. In addition, the experience from the last plant expansion at Carib Cement was not promising for a new project. Some of the key features of the project included:

- An exemplary safety record with no serious safety incidents. This was especially significant since many of the people employed during construction were not experienced construction workers. The company, recognising that the majority of persons from the surrounding community did not possess the necessary skills, engaged the services of the national vocational training institute, HEART Trust/NTA, to conduct training in a number of construction skills and also to test and certify participants at the end of the training course. Over 250 participants graduated in three phases. More than 80% of these participants were then engaged in the construction process during the life of the project. This training was a major factor in the successful safety performance of the kiln no.5 project.
- In order to avoid some of the challenges experienced during the expansion of the 1980s, the company embarked on a formal stakeholder relationship management plan. This plan was used to build consensus amongst the project stakeholders of the need for an efficiently run project, not only to the company, but also the surrounding communities and wider national interests. In the end, the smooth progress of the project was a major demonstration of the success of this aspect of project management.
- All major foundations were poured using concrete made with Carib Cement Plus as the cement of choice. This allowed mass foundations of up to 1800 m^3 to be cast without any thermal cracking.
- The construction phase involved significant inputs from four different continents: North America, South America, Europe and Asia.

The no.5 kiln has been in operation since August 2008. In the first four months, the kiln successfully completed its performance test, achieving the guaranteed performance criteria including those for production, fuel consumption and power consumption. In March 2009, in its eighth full month of production, the kiln achieved its highest monthly production of over 80 220 t of clinker, averaging an overall equipment efficiency of 95%. The kiln has also achieved a highest daily production of 3344 t, which is equivalent to 119% of its rated capacity.

The most significant challenge to the operation of the kiln has been low raw meal inventory resulting from frequent stoppages of the roller due to high vibration levels. This has been caused by fine limestone feed as the limestone crusher

Carib Cement's General Manager, Anthony Haynes (right) and the Project Manager for the mechanical erection contractor raise a flag to celebrate the completion of 1 million safe man-hours worked on site.

was originally designed to produce a much smaller particle size for wet crushing in the ball mills that supplied the kiln no.3. There have been, however, a number of modifications to the crusher to improve the particle size distribution of the raw mill feed as well as efforts to optimise the operation of the roller mill for the smaller feed size. These initiatives have borne fruit and the uptime on the roller mill has increased significantly, resulting in much higher raw meal feed inventories. Consequently, the kiln operations have become more stable with consistently higher feed rates.

Cement mill no.5 project

The second component of the expansion and modernisation programme is the cement mill no.5 project. This consists of the construction of a new vertical roller mill for cement production. The main equipment includes:

1. A Loesche vertical cement mill LM-46 2x2 rated at 110 tph.
2. Mill feed bins and material feed metering/conveying systems.
3. Cement mill main baghouse.
4. Process fan.
5. Hot gas generator.

Preheater tower: the last section of the flue gas stack being installed. It was designed based on Environmental Air Dispersion Models.

The construction phase of the project is substantially complete and the plant is in the commissioning phase. The new mill is expected to be in operation by the time this issue has been printed. This project followed the approaches employed on the kiln no.5 project with similar results. The introduction of this cement mill will allow Carib Cement to reduce the specific power consumption for cement production as well as to produce a variety of high-fineness cements.

Summary

Over the ten year period since its majority share acquisition in Carib Cement, the TCL Group has invested over US$300 million in the restructuring, upgrade and expansion of the plant. One of the major thrusts has been the improvement of the plant's environmental performance by upgrading dust control systems, retiring inefficient sections of the plant and significantly reducing the company's carbon footprint. Extensive air dispersion modelling has meant that the new plant has been designed to achieve all the applicable emission standards.

To complement the improvements in machinery, the company has also invested heavily in upgrading the skills of the workforce. Over US$4 million has been expended on comprehensive training in cement technology, HSE systems, electrical technology, mechanical technology, process controls and management practices. This has enhanced the capacity of the experienced workforce to allow the company to maximise the benefits of the new technology that has been installed. These combined initiatives not only provide the company with the capacity to adequately supply the entire local market, but also to seek out and service export markets, thereby earning important foreign exchange not just for Carib Cement's benefit, but for the Jamaican economy as a whole.