2009 Outstanding International Project

CEMEX Bayano Plant No. 2 Line Expansion

CEMEX is one of the world's two largest cement companies, with a production capacity of approximately 86 million tons (78 million metric tonne) of cement per year. CEMEX and its subsidiaries produce, distribute, market, and sell cement, concrete, aggregates, and clinker on four continents. CEMEX has major operations in 30 countries and maintains trade relations in 60 nations. In 1994, CEMEX purchased Cemento Bayano, S.A., in Panama.

Panama's greatest source of revenue comes from the Panama Canal. In just 4 more years, the canal will have been operating for a century. Annual traffic has increased from approximately 1000 vessels during the first years to now over 14,000. People all around the world have benefitted from this truly marvelous wonder. The canal is presently handling far more traffic than had ever been envisioned by its builders. In the 1930s, it was estimated the maximum capacity would be around 80 million tons (70 million metric tonne) per year. In 2008, however, traffic through the canal consisted of over 300 million tons (270 million metric tonne).

The largest ships able to pass through today's canal are referred to as "Panamax" vessels. As world trade continues to expand, market forces demand even larger and larger ships. It's anticipated that by next year over a third of the world's container ships will be too large to pass through the present canal. Policy makers watching this trend over the years have proposed various approaches for enlarging the canal and its locks to accommodate greater numbers of ships and larger vessels. In April 2006, Panama's President proposed a course to pursue. In accordance with Panama's constitution, a national referendum was held in October of 2006, and Panama citizens overwhelmingly approved the President's proposal with 80% of the votes being in favor. The project includes new locks and water-saving basins on both the Pacific and Atlantic ends of the canal. The canal expansion project officially started on September 3, 2007. The new locks are expected to open for traffic sometime in 2015. The project is expected to cost approximately $5.25 billion USD. The completed expansion should allow for traffic through the canal to increase to nearly 510 million tons (459 million metric tonne) expected by 2025, and it will have an estimated maximum sustainable capacity of approximately 600 million tons (600 million metric tonne) per year.

Clinker storage dome, Panama

In February 2007, just a few months after Panama's national referendum, CEMEX S.A. announced it would invest $200 million USD to construct a new kiln at its Cemento Bayano, S.A. plant in Panama to help meet the anticipated demand for additional cement. Construction of the Bayano plant expansion was targeted to be completed by 2009. The plant is now producing clinker.

The expansion of the Bayano plant increased its capacity to potentially 1.6 million tons (1.45 million metric tonne) per year—up from about 450,000 tons (408,233 metric tonne) of clinker per year previously. Using CEMEX's technology, the Bayano plant has become one of the most modern, efficient, and environmentally-friendly cement production facilities in the Americas.

As part of the Bayano plant expansion, DOMTEC® International, LLC, of Idaho Falls, ID, and Construcciones FASA of Mexico City, Mexico, were contracted to construct the 77,000 ton (70,000 metric tonne) capacity clinker storage dome facility.

DOMTEC International was organized almost 15 years ago with the mission of building higher quality domes. This is accomplished by implementing strict and effective quality assurance and by conducting thorough training. DOMTEC International has become synonymous with reliability and dependability. DOMTEC International's structural engineers are some of the most experienced dome engineers in the world, and DOMTEC's dome technicians are among the most experienced.

Construcciones FASA is a 60-year-old company specializing in civil and concrete construction. Its specialty is slip-form concrete silos. The company also contracts earthwork and other types of concrete and steel construction.

Concrete Domes

Concrete domes make efficient and economical storage structures, and they have become especially popular among major cement producers. CEMEX was familiar with concrete domes, having already purchased several other concrete domes at various plants and terminals around the world. Some of their advantages include:

- Better containment and protection of stored materials;
- Efficient use of land and space;
- Strength and durability; and
- Rapid construction.

Better Storage

DOMTEC concrete domes keep products dry, despite Panama's weather, which includes heavy rains and hurricanes. Insulated DOMTEC domes also virtually eliminate condensation. They are tightly constructed, enhancing the ability to prevent fugitive dust emissions.

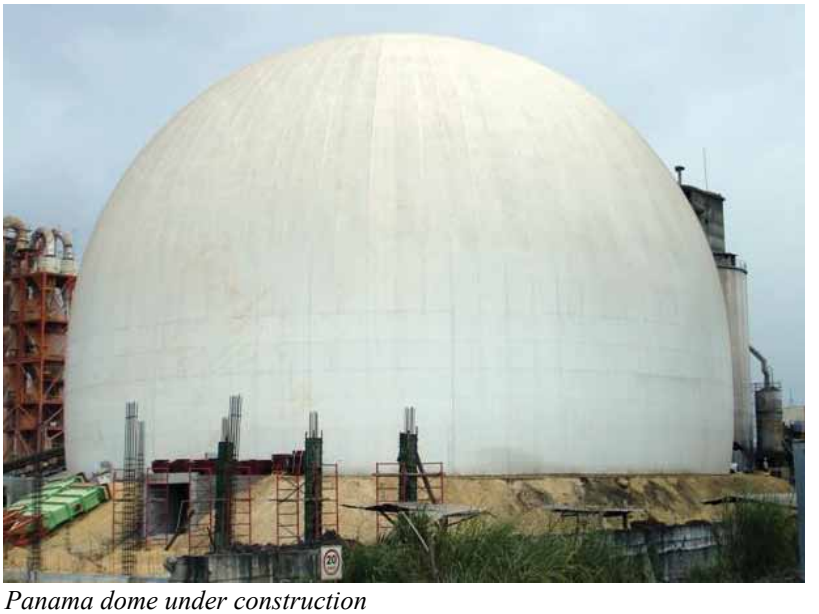
Efficiency

Large quantities of materials can be stored in a dome in a relatively small space. For example, the Bayano plant clinker dome is only 167 ft (51 m) in diameter, yet it can store up to 77,000 tons (70,000 metric tonnes) of clinker. Domes are efficiently filled by conveying to a single opening at the top. The dome's compactness also results in filling conveyors being shorter in length and simpler than those needed for silos or other types of storage warehouses.

Strength and Durability

DOMTEC concrete domes allow clinker to be piled high against the walls. They also support heavy conveyor loads. The Bayano clinker dome supports approximately 330 tons (300 metric tonnes) of conveyor equipment, head house, and dust filters. Also, concrete doesn't burn or oxidize and it isn't eaten by insects. Concrete domes are able to withstand hurricane-force winds and even earthquakes better than other structures.

Headhouse, conveying equipment installation



Panama dome under construction

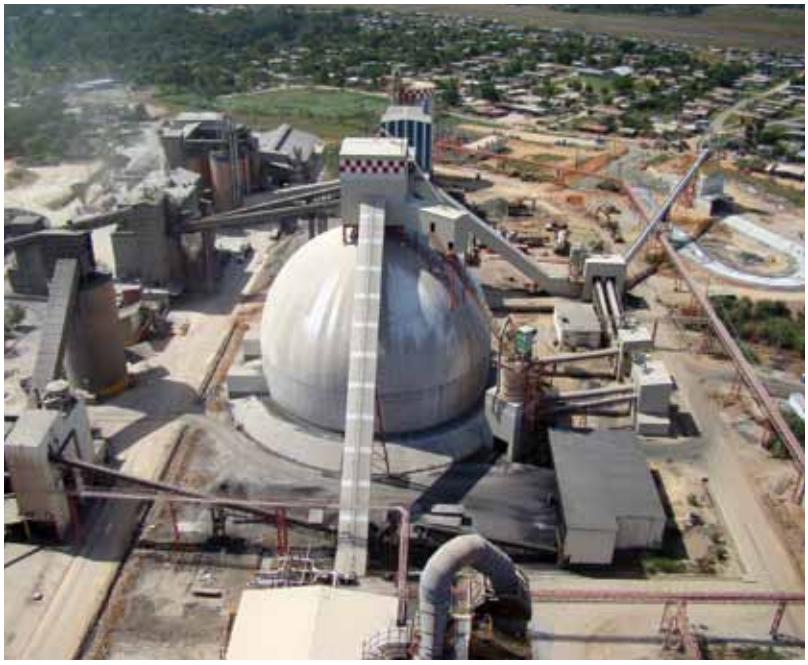
Rapid Construction (regardless of the weather)

After the foundation is completed, depending on the dome's size, most domes are usually completed within 2 to 5 months. Dome construction takes place primarily on the inside of the inflated form. Working on the inside has several inherent advantages. For example, temperatures stay within a comfortable range and higher quality work can be achieved even during inclement weather.

Dome Construction

The dome construction process begins with a ring beam footing, or in Bayano's case, a ring "pile cap." A fabric form is attached to the base ring beam and inflated. This inflatable form is made of durable single-ply roofing material. (Dome construction takes place on the inside of the

Shotcrete application by experienced nozzlemen



CEMEX Cemento Bayano Plant

The Outstanding International Project

Project Name
CEMEX Bayano Plant No. 2 Line Expansion

Project Location
Bayano, Panama

Shotcrete Contractor
DOMTEC International, LLC*

General Contractor
Cemex S.A.

Architect/Engineer
ZZ Consulting P.A.

Material Supplier/Manufacturer
Cemex Bayano Plant and
The Farley Group

Project Owner
Cemex S.A.

*Corporate Member of the
American Shotcrete Association

inflated form, thus upon completion of the dome, the inflatable form remains in place and functions as the dome's finished roof membrane.) Once inflated, polyurethane foam is applied against the dome's interior surface to a thickness of approximately 2 in. (50.8 mm). Initial reinforcement steel is attached using special fasteners that have been embedded in the foam. Depth gauges and hanger wires are also installed, and the first layers of shotcrete are sprayed, providing enough stiffness and strength to support the next mat of heavier structural reinforcing bars. The initial shotcrete is sprayed in thin layers. As the overall shell thickness increases, the quantity of shotcrete that can be applied per pass can also be increased, depending on where in the dome the shotcreting is taking place. Overhead shotcreting is done in thinner layers than horizontal spraying. All nozzling is performed by experienced DOMTEC nozzlemen to ensure proper reinforcing bar embedment and the designed thickness.

Building CEMEX's Bayano Plant Clinker Dome

DOMTEC International designed the storage dome and supervised its construction, including doing all the shotcrete nozzling. FASA built the dome's base ring beam foundation and two subfloor reclaim tunnels and supported DOMTEC International during dome construction.

DOMTEC's specialty equipment and the air form were shipped to Panama via ocean containers. CEMEX supplied the reinforcing bar and shotcrete locally in accordance with DOMTEC's specifications. The overall plant expansion justified an on-site batch plant, which mixed and supplied the shotcrete in typical concrete trucks. DOMTEC's crew of six experienced supervisors and technicians oversaw the complete dome construction process and personally performed all the shotcrete nozzling. Local labor was hired to install most of the reinforcing bar installation, under DOMTEC's supervision, and to help with dome shotcreting.

Approximately 897,000 lb (407,727 kg) of reinforcing steel were installed in the CEMEX Bayano clinker storage dome. This consisted primarily of reinforcing bar sizes ranging from No. 3 to No. 10. By far, the majority of the bars, both by weight and numbers of bars, were No.10, 8, and 6. The reinforcing steel was enveloped with 2515 yd^3 (1920 m^3) of shotcrete sprayed using a pump. Shotcreting was applied at an average of about 90 yd^3 (69 m^3) per day. Dome construction took about 4 months and was completed on time and on budget.

CEMEX is now in the position to help meet the growing demand for cement as the Panama Canal Expansion Project continues.