

HIGHLY FLEXIBLE PRODUCTION OF PRECAST ELEMENTS FOR HOUSING AND INDUSTRIAL APPLICATIONS

Grupo Cementos de Chihuahua (GCC), Mexico has successfully improved the quality and resistance of their manufactured concrete precast panels. Through their new, customer specific engineered concrete curing system, they are achieving a minimum of 10% higher resistance.



Company profile

Grupo Cementos de Chihuahua (GCC) is a multinational corporation with operations in North and South America. The company was founded in 1941 with the first cement manufacturing operation in the city of Chihuahua in northern Mexico. Currently, the group has three plants for the production of cement located in Mexico in addition to 3 cement plants located in the United States and an operation in Bolivia with an overall capacity of 5.5 million tons metric annually.

The principal strategy of GCC is to invest in the growth and innovation of the building materials industry. Through their active research and development department, the Center for Investigation of Technology (CIT) located in Lausanne, Switzerland, GCC tracks building materials trends throughout the world. Being proactive in the industry provides them with innovative and efficient processes and technologies to improve their products or develop new ones. The high level of operational efficiency that characterizes GCC results in high levels of performance, innovation and continuity.



Finished product storage after second stage curing

New Production Facility

In March of this year, GCC opened their new plant for the production of prefabricated concrete panels with the objective of developing their offerings of prefabricated systems in different market segments of the building materials sector. The plant has an annual capacity of 144,000 m² at one shift per day which is the equivalent to produce 1,000 economical housing units or more than 400 units of mid-sized housing.

At the moment, they are delivering on projects for public security in the principal cities of Juarez, Chihuahua, Delicias and Parral of this Northern Mexican state.

With the purpose to obtain prefabricated products of the highest quality at the lowest cost, GCC required the latest technology from Europe. These companies included the Finnish company Elematic for the battery mold system, the German company Wiggert for the batching and mixing process and "Kraft Energy" for the accelerated concrete curing system.

Comments Ing. Juan Carlos Ares, Building Systems Manager, "Since its conception and design was established using the best technology, it was necessary to have a the proper system for curing to assure the quality in terms of resistance and appearance of our prefabricated products, especially considering the extreme temperature fluctuations and conditions as the plant is located in a desert climate. A crucial objective in prefabricated concrete is to reach, in the shortest time possible, the resistance that allows you to handle and manipulate the product as well as being able to deliver to the jobsite quickly for assembly. We are always searching for ways to achieve this with the lowest cost possible. Our objective is to maneuver the panel as quickly as possible without incurring the risk of damage to the product that could occur if the strength is not sufficient"

GCC and Kraft Energy Systems developed a strong business relationship five years ago with the installation of a new Kraft Energy Vapor Curing System in GCC's block plant in Juarez. The success of this installation hinged on the reduction in energy costs compared to their traditional curing system of 35% to 40%. They also looked to have a reduction of 10% in cement usage. In addition to realizing energy and cement savings, GCC noticed a higher quality and uniformity of the block produced with this new curing system. They definitely had no doubts about using the Kraft Energy System in the new panel plant due to the relation of cost-benefit being very high. Another factor for GCC in acquiring a Kraft Energy System was their position as a worldwide leader in the design and production of curing systems with the latest technology as well as their serious engagement and service to them.



Ing. Federico Terrazas yof GCC with MArk Kraft, Director General & Lic. Primavera Landin of Kraft Energy Systems during the inauguration of 3 new facilities including the panel plant, aggregate plant & dry mix bagging operation at the Salmayuca cement factory in Chihuahua, Mexico.

Presently, the new plant is producing approximately 480 m² daily of concrete panels with maximum dimensions of 3 meters x 8 meters with thicknesses ranging from 10, 15 and 20 cm. The characteristics of the panels include fastest time possible production, rapid delivery to the job site with a perfect finish on both faces of the panel utilizing concrete specified with a resistance of more than 350 kg/cm² at 28 days.

GCC is the only company in the region of Chihuahua in Northern Mexico in the production and supply of prefabricated panels that has integrated "state of the art" technology in the form of concrete batching and mixing, molding equipment and curing. Employing such technology is a mark of a trend in the precast concrete industry in Mexico to achieve product quality; to obtain an excellent finish on both faces and for high productivity at low costs.

The Design for an Efficient Curing System

In order to be able to finish a design for the curing system, a work group was established with members from both GCC project coordinators and personnel from Kraft Energy Systems. Several meetings were held by this group that were used to define and understand the needs and goals of the curing system for the new plant. The excellent lines communication established between members of this group and the two companies allowed for an efficient planning process of a customer specific engineered curing system.

Thus, after an analysis of the production requirements such as raw materials available in the area, type of cements, curing temperatures, humidity and time, and mix design for the product including possible use of colors, Kraft Energy developed and designed a system focused on the needs of GCC with a unique curing system that involves two stages for accelerated curing: a ThermalCure System and a Quadrix System.

The production of the panels consists of two stages of curing;

The first curing stage utilizes the ThermalCure system. The production process starts with a series of molds, or battery molds. There are two sub-processes before the battery molds are filled. The first process is the preparation of the reinforcing steel, placement of blockouts, lifts and anchors as well as the placement of water, electrical and sanitary fixtures according to the individual design of each panel.

Once the inner molds are placed inside the battery mold, the concrete is batched and dosed per the project or product specifications. The battery mold is then heated using the ThermalCure System. Installed inside the mold is a radiant heat piping network. Through a pump system and temperature control, hot water (90°C) is re-circulated through the mold to heat the concrete to 50°C which in turn accelerates the set and hydration of the cement so that it can be de-molded and moved in six hours without the use of chemical admixtures. The ThermalCure System utilizes a 90% efficient water heater with low NO_x emission values from Kraft Energy Systems.



Battery Molds showing ThermalCure Circulation System to heat the molds to 55 C



ThermalCure & AutoCure Control System

The second curing stage uses a Quadrix Curing System. The production process at this stage begins with the panel being de-molded from the battery mold, it is then moved via overhead crane to the secondary curing area which consists of racks to hold the panels upright with the face side exposed. To enclose the panels, Kraft Energy designed a movable curing enclosure consisting of insulated steel panels and retractable curtains – a matchbox design. The curing enclosure moves on a rail with powered wheels. Once the panels are placed, the curing enclosure is moved into position and the secondary curing process begins.



Quadrix System with Matchbox style movable curing chambers

The Quadrix Curing System allows for four component curing – heat, moisture, circulation and carbon dioxide. Air is constantly re-circulated throughout the enclosure via a high-efficiency radial ventilator and insulated duct system to provide uniform distribution. Temperature and relative humidity are monitored and controlled independently in the Quadrix system. The required curing temperature is achieved through the addition of hot air via a gas-fired heat exchanger while the required humidity level is provided by vapor from a 98% efficient direct-fired Micro Vapor Generator which also contains carbon dioxide. The addition of carbon dioxide allows for the accelerated carbonation of the surface of the concrete reducing the occurrence of efflorescence.

The panels are kept in an environment of 55°C and a relative humidity of 90% for 6 to 8 hours after which they have achieved a resistance of 150 to 180 kg/cm² and are then moved to the storage area to be shipped to the jobsite.

Both systems are controlled by an Auto-Cure control system that monitors temperatures, humidity and time of the curing process automatically and without supervision. This ensures consistent product treatment and quality.



Transport of finished product to storage area.

Benefits:

- An increase in the resistance of the product between 10% to 15% in less time and while using less cement. Due to the Quadrix System, cement hydration is optimized allowing for less cement usage.
- The curing process is rapid and efficient allowing for quick de-molding and handling and meets the strength requirements set by GCC engineers.
- The energy usage is efficient and provides savings over other systems
- Best product quality
- Reduced damage of corners and edges as well as less breakage
- Since using the system GCC has not discovered any cases of efflorescence.

Working with the Kraft Energy curing system, GCC has achieved the specifications and goals for curing established at the beginning of the project which were high early strengths, less use of cement, quick production and delivery of the product to the jobsite and lowest cost energy usage. As to the functioning of the equipment, it is simple to use for the operator and other personnel.

According to Ing. Juan Carloes Ares all of the equipment in the plant has worked well since the start up with good results and this has allowed them to acquire the position as the most competitive in the market. "We are definitely satisfied with the selection of Kraft Energy as they have provided the best support and excellent technology.



Storage area of the panels ready for delivery

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