PROJECT SHEET

The Panama Canal

1995

ABOUT THIS PROJECT:

Market Segment:
Marine Structures,
Water Holding Structures,
Dams and Irrigation,
Water Treatment Plants,
Tunnels

Contractor:
Panama Canal Commission
Maintenance Division

Products Used:
Xypex Admix C-2000
Xypex Concentrate
Xypex Modified
Xypex Gamma Cure

Location:
Panama

Owner:
Panama Canal Commission

Chief Engineer:
George Berman

The Panama Canal, spanning approximately 80 km (49.7 miles) between the Atlantic and Pacific Oceans, is one of the most significant engineering achievements in history. It features a complex system of locks that elevate ships from sea level to Gatun Lake, 26 m (85.3 ft) above sea level, allowing them to navigate through the Continental Divide.

The lock chambers are 33.53 m (110 ft) wide and 304.8 m (1,000 ft) long. Annually, over 10,000 vessels pass through the canal, carrying nearly 600 million tonnes (600 million tons) of cargo, making it a vital route for global trade.

At the beginning of the 1990s, as part of the preparations for the canal's transition from the U.S.A. to Panamanian control in 1999, significant investments were made to revitalize and modernize its infrastructure.

An extensive audit revealed that the aggressive marine environment had degraded the concrete structures since the canal's construction in 1914.

To address this challenge, the engineering team had extensive technical discussions and decided to abandon the traditional waterproofing methods previously used in favor of the unique Xypex Crystalline Technology, a superior waterproofing solution with a proven track record. Since 1995, Xypex products have been key in maintaining and refurbishing the canal's concrete, which has endured decades of continuous use.

One of the major challenges during the project was addressing the culverts' walls at the Gatun Locks, Pedro Miguel Locks, and Miraflores Locks.

After over 80 years of continuous use, the concrete had become rough, with exposed aggregate causing turbulence, slowing the fill-and-dump cycles, and resulting in water loss through exfiltration. The original plan called for applying Xypex Concentrate, followed by shotcrete.

However, using Xypex Admix C-2000 simplified the concrete waterproofing and protection process with reduced labor and time, resulting in substantial cost savings as Xypex Admix C-Series' products are mixed with the concrete during batching, eliminating the need to install membranes or additional coatings after curing.

The culverts' rehabilitation process included cleaning the walls by water blasting to remove loose materials and prepare the surface. A shotcrete application using 17,237 kPa (2,500 psi) mortar with 3% Xypex Admix C-2000 per bag of cement was then applied, covering an area of 60,000 m^2 (645,834.63 ft2). The thickness of the mortar cover varied between 1.25 cm and 3.85 cm (1/2 in to 1 in). In total, over 54,400 kg (120,000 lbs) of Xypex Admix C-2000 were used.

Finally, a film of Xypex Gamma Cure was applied to ensure optimal curing and superior performance. Smoothing out the surface of the concrete with the Xypex treated shotcrete coating stopped the water loss and resulted in a seven-minute faster fill-and--dump cycle, permitting the passage of more ship traffic through the canal system.

Due to the success of the culvert rehabilitation, Xypex products were used in various other parts of the canal infrastructure. For the repair of concrete walls at the Gatun Locks, Pedro Miguel Locks, and Miraflores Locks, over 815 kg (1,800 lbs) of Xypex Concentrate were used to address cracks and aged substrates over approximately 900 m^2 (9,687.52 ft^2).

The Miraflores Visitors Center's exterior west wall received a preventive waterproofing treatment using over 815 kg (1,800 lbs) of Xypex Concentrate over an area of 900 m2 (9,687.52 ft^2). During an inspection of the Gatun Locks, it was found that the concrete walls were deteriorated and approximately 500 m^2 (5,381 ft^2) needed resurfacing, which was addressed using over 450 kg (1,000 lbs) of Xypex Concentrate.

For the Gatun Locks and Miraflores Locks firefighters' building, Xypex Concentrate was specified in the concrete flat roof slabs to waterproof over an area of 800 m^2 (8,611.13 ft^2), using 1,600 lbs.

To waterproof the walls of the tanks of the Water Treatment Plant at the Gatun Locks, over 725 kg (1,600 lbs) of Xypex Concentrate and 635 kg (1,400 lbs) of Xypex Modified were used over an area of 800 m^2 (8,611.13 ft^2).

For the electrical distribution tunnels of the Gatun Locks and Miraflores Locks, waterproofing and resurfacing the walls over an area of 1,400 m^2 (15,069.47 ft^2) was achieved using 1,270 kg (2,800 lbs) of Xypex Concentrate.

Finally, the substrate of the concrete walls in the tunnels of Madden Dam required resurfacing over an area of 500 m2 (5,381.96 ft2), which was completed using over 498 kg (1,100 lbs) of Xypex Concentrate.

The use of Xypex products was crucial for this project. Xypex reacts with by-products of cement hydration to produce non-soluble crystalline formations within the concrete's pores and capillaries. These crystalline formations render the concrete permanently waterproof and significantly enhance the resistance against saltwater, oils, and other aggressive chemicals, thus greatly extending the concrete service life.

The Panama Canal project highlights the effectiveness of Xypex waterproofing solutions in providing reliable and long-lasting solutions for concrete waterproofing and protection. By integrating Xypex's advanced crystalline technology, the Panama Canal Commission ensured the canal's infrastructure remains resistant to harsh environmental conditions, securing its role as a crucial global shipping route for the decades to come.