

EDITORIAL

Retrofit of Support Columns Exposed to Electrolyte Cells In Copper Mine

InfoMine News To extract copper, mines insert copper anodes into an electrolyte solution that is extremely acidic - pH less than 1. Stored in electrolytic cells as a blue fluid, the acidic solution creates significant loads. These loads are supported by a series of columns in the basement below the cell house, which serves as secondary containment for the electrolyte. Over the years, these support columns degrade and become susceptible to structural failure as the electrolyte leaks through the ceiling and into the column-to-beam connections.

Corrosion of Columns

Exposure to electrolyte within the basement of the cell house causes the steel reinforcement within the concrete columns to corrode. Corrosion leads to oxidation within the columns creating an internal pressure that cracks the concrete. Corrosion of the reinforcing steel and delamination of the concrete shell causes structural degradation and failure of the Columns.

Traditional Repair Method

The existing R/C Columns were constructed with #8 rebar: 6-inch O.C in the vertical direction and 18-inch O.C. in the horizontal direction. The initial design to repair the columns required coring the columns, inserting #8 Rebar back into the column, and pouring polymer concrete 5 feet high by 8-inch thick to encapsulate the column. The client encountered difficulty coring into the existing columns causing the repair to take over 5 days to complete per column. The excess time to complete the repair increased the cost of repair significantly and caused the client to investigate alternative solutions.



Pic 1: Electrolyte Attack of Concrete Structures

HJ3 Composite Solution:

To develop a solution to replace the traditional method of repair, HJ3 Engineers wanted to create a faster system that would provide equivalent strengthening and greater chemical protection to the damaged columns. Additionally, it was necessary that HJ3 not use conductive materials given the tremendous amount of electricity used in the copper extraction process. Conductive materials in this environment would create significant dangers to installers. The system developed by HJ3 engineers included pre-cured strips of S-Glass Laminate strips in the vertical direction and 30-inch wide S-Glass Fabrics wrapped in the horizontal direction.

Installation:

First, the substrate of the R/C Columns were prepared by chipping out loose material and abrasive blasting the columns to rid the column of electrolyte. Then a polymer patching material that is tested to withstand the acidic attack from the electrolyte is used to resurface the column. Next, the pre-cured strips of S-Glass Laminate were placed against the surface of the column using the HJ3 TC-300 Tack Coat. The process took 1 day to reinforce 8 columns. To create reinforcement in the horizontal direction, the HJ3 UG30C S-Glass Fabric is wrapped around the S-Glass Laminate strips. Together the HJ3 System provides non-conductive reinforcement equivalent to the steel reinforcement specified in the traditional repair. The repair took 2 days to complete for 8 columns and created a 75% cost savings over the traditional method when considering down time costs.



Pic 8: HJ3 System Installed

Superior Advantages of HJ3 Composite Technologies

Faster...Stronger...Lighter...The HJ3 Composite System created significant advantages over the traditional method of repair including:

- Faster Repair
- Greater Chemical Resistance
- Greater Ductility and Strength
- Less Surface Area Lost (1/4-inch system thickness)
- Significant Cost Savings
- Eliminates Safety Issues associated with Conductive Reinforcing Material
- Yet The Greatest Advantage is HJ3's ability to provide a full Turn-Key Solution:
- Engineering Review
- Engineering Proposal
- Stamped Drawings & Calculations
- Custom Material Manufacturing
- Installation Manual
- Installation
- Final Client Interview

For more information on how HJ3 can design a solution for your system please contact us at 520-322-0010 or visit us on the web at www.hj3.com.