Making the Grade by Lifting a School’s Foundation with SureLift™ from Avanti

Constructed in late 2010, a new elementary school in Jalisco, Mexico welcomed students in August of 2012, but only after satisfying engineers that the building was structurally sound. Carved into the foothills of the Sierra Madres mountain region, the building site had a 20% grade which included a 16-foot retaining wall to the west of the building and natural grade to the east. Within one year, various signs of structural movement indicated settlement of the primary building and vertical cracks in the retaining wall.

Unfortunately, the retaining wall had no drainage system to relieve the hydraulic pressure and groundwater runoff from rain events. Therefore, the water trapped behind the retaining wall saturated the soils causing the building to settle and the retaining wall to crack. Soil testing indicated moisture content of soils behind the wall and below the slab at 7.2%, about four times greater than the norm.

Located just 10-12 feet from the retaining wall, the two-story building was constructed with 22 concrete columns supporting a concrete roof, concrete walls, concrete floors and concrete walkways. The estimated point load of each column is between 30,000-40,000 pounds. Initially, the scope of the project called for lifting the two columns nearest the retaining wall which had dropped 2.8 inches. Between the columns, the concrete floors had sagged as much as seven inches.

According to Chris Hamilton, president and project engineer for I-Tech Infrastructure and contracting partner of Avanti, “Before any building component could be structurally lifted, four protective and preventative steps were required.”

**Step 1:** To protect against additional erosion and groundwater drainage problems, curtain grouting with hydrophobic foam was required to the east of the building or positive side of the runoff. The chemical grout used for creating the impermeable curtain was injected as a single-component, moisture-activated, hydrophobic polyurethane resin. Set times were controlled by a catalyst and in this case equaled 5%, which allowed the resin to achieve greater permeability before expanding.

**Step 2:** The retaining wall was injected with an epoxy to mitigate further damage or deterioration, and reinforce the wall where existing vertical cracks penetrated the entire thickness of the wall.

**Step 3:** Due to gravity, weight of the soil, and hydraulic pressure behind the retaining wall, two rows of hydrophobic foam were injected 6 feet apart. The intent of this soil stabilization technique was to displace water and prevent excess moisture in the future. The contractor used a low-viscosity, single-component resin which created a dense, closed-cell, semi-rigid foam that was impermeable to water.

**Step 4:** Inside the building, it was necessary to re-stabilize the supporting soil and address the voids beneath the concrete slabs ranging from 3-14 inches. The structural foam used beneath the slab was SureLift™ a dual-component, hydrophobic resin capable of withstanding wet/dry cycles, injected at a 1:1 ratio.

AVANTI

www.AvantiGrout.com
Curtain grouting to the east of the building eliminated uncontrolled groundwater into supporting soils.

With the four corrective and preventative measures completed, stabilizing and lifting the columns became a one-time, permanent repair. Ultimately, 10 of the 22 columns were lifted. Of the desired 2.8 inches, 2.2 inches was achieved safely before the retaining wall began to show signs of stress. With the ground stabilized, voids filled, and soil moisture reduced from 7.2% to 2.1%, leveling the interior slabs to desired grade was accomplished successfully and with ease.

AV-600 SureLift™ grout was preferred over cementitious grout due to the following characteristics:
- No shrinkage
- Up to 20 times expansion
- Fully cured in minutes vs. days
- Light weight (4 lbs/cu ft vs. 140 lbs/cu ft)
- Compressive strength: 12,960 lbs/sq ft

To complete this project, I-Tech Infrastructure used multiple products from Avanti to perform curtain grouting, soil stabilization, void filling and slab lifting. As a result, I-Tech eliminated the source of the problem, saved the structural integrity of the school building, and completed the project in the allotted 10 days—all within one month of the school opening on time.