UNDERGROUND STABILITY

Makes Way for Design Flexibility at New Edgewood High School

When the high-speed passenger trains roar past the 62 classrooms and three portable classrooms that comprise Edgewood High School in Harford County, Maryland, the noise can disrupt even the most studious. The train tracks — and the portables themselves — are indicative of a problem that has been plaguing the school for some time: there just isn't enough room to accommodate the multiple educational needs with the current infrastructure. That is, until next year.

The school board has embarked on an ambitious plan to build two new schools on the same site as the current high school campus, which also includes an elementary and a middle school. When they are completed in 2010, the first two structures — Edgewood High and Deerfield Elementary schools — will bear little resemblance to their 1950s-era predecessors. That's because they represent a combination of thinking on how students interact and learn along with how to incorporate helpful physical structures on a challenging site.

Mindful of the influx of residents because of the Base Realignment and Closure changes, the county needed a solution that would maximize the use of the site. This led to the decision to build anew, instead of modernizing or adding onto existing structures. Going beyond fiber-optic lines for Internet connectivity and artificial turf on athletic fields, contemporary school construction incorporates a great deal of space planning. Inside the schools, there are often partitions and divider curtains that allow use of one large space or multiple smaller spaces.

"School systems are looking for flexibility because they want spaces to be configured based on need," says Karen Burlingame of Grimm + Parker Architects, designer of the new school. "They don't want any room that is used only 5 percent of the time."

Outside Edgewood High School, space planning is particularly critical. The site is boxed in on one side with the noisy trains and on another with the nearby Chesapeake Bay and buffer zones, so creativity had to drive any expansion plans. This had to apply to the schedule, which called for an aggressive 24-month construction period, and to the sections of the site designated for the new buildings where the soil would not support conventional foundations.

Aware of the potential difficulties of having classes in session on the site of a construction project, construction manager Oak Contracting has issued and is managing 16 bid packages that seek to minimize the disturbance where possible. For example, the company took advantage of the summer recess in 2008 to perform disruptive site work, such as grading and putting in place the underground storm drains and utility lines. When students returned in September, the fence was put back up to separate the construction site from the current school building.

To address the poor foundation soils, Oak Contracting made sure geotechnical engineering firm Reuling Associates was involved in the upfront evaluation, along with design-build contractor GeoStructures, so a system could be designed that would limit excessive and differential settlement. Test borings showed that the variable coastal plain soils, which consisted of inter-bedded silts, sands and clays, had some very soft zones and a high groundwater table in areas that could not support conventional spread footings. Some sort of soil improvement would be necessary in order to use the shallow spread footings without the excessive and differential settlement that could result in cracked walls and maintenance problems.

"Most of the risk associated with site development is below the ground," said Shana Opdyke, P.E., sales engineer with Purcellville, Virginia-based GeoStructures. "Water, variations in soil and rock formations can create scheduling and cost-overrun problems, so it is important to have a sound assessment of what's down there and what will be the best solution to strengthen the ground."

Following through on the recommendation of the evaluation team, site contractor Melvin Benhoff Sons, Inc. had GeoStructures provide the necessary support through the installation of 1,437 Rammed Aggregate Pier® (RAP) elements via a lump-sum bid. The ideal choice because of their relatively fast installation and lower cost versus that of other solutions, RAP elements are created via a careful choreography of equipment. An LM30 LoDril mounted on a Caterpillar 315 excavator removes weak soil from 30-inch diameter holes, and then the dense, graded aggregate is compacted in the hole in one-foot lifts, using a specialized beveled tamper mounted on a modified hydraulic hammer. The aggregate is compacted downward and outward to create a stiff and confined pier while also improving the surrounding soils. The RAP elements work to reinforce the in-place soils and provide uniform foundation support for conventional spread footings.

"RAP elements are a cost-effective alternative to deep foundations, such as piles and drilled shafts, and also provide significant cost savings compared to removing and replacing the weaker soils with sturdier fill," Opdyke adds. "All of those systems can be very weather-dependent and have the potential for major cost overruns when differing conditions are encountered."

To prevent differential settlement and ultimately maintain the level of safety for Edgewood High School's sports fans, another 26 RAP elements will be built underneath the spot for the grandstand and its press box. Although the athletic fields don't require RAP elements for stability, plans call for use of a soil-cement mix in which 5 percent of the tilled dirt will be Portland cement in order to avoid any soft spots.

When the new Edgewood High School is completed in July 2010, the rear of the building will house the gym and auditorium, while classrooms will be in wings on the front part of the building to minimize any disruption from railroad noise. Construction is concurrently taking place on the other side of the campus on the new Deerfield Elementary School. Edgewood Middle School resides between the two projects and will remain as is, although it has received new power and utility service and will receive a canopy and reconfigured bus loop when the entire project is completed. Once the contractors are finished with the two new schools, the current schools will be torn down to make way for parking and athletic fields. The two-school project is expected to be completed in time for the 2010 school year (the third new school on the site, Deerfield Middle, will be built after that). For Project Manager Ken Credito at Melvin Benhoff, it will be a momentous occasion.

"I used to referee games here 20 years ago, and I can say these are well-thought changes. The kids will be set up for success and happy to be here."

Editor's Note: Rammed Aggregate Pier is a registered trademark of Geopier Foundation Company.