Beneficial Use Case Study

Backfilling of Basement in Converted Manufacturing Facility

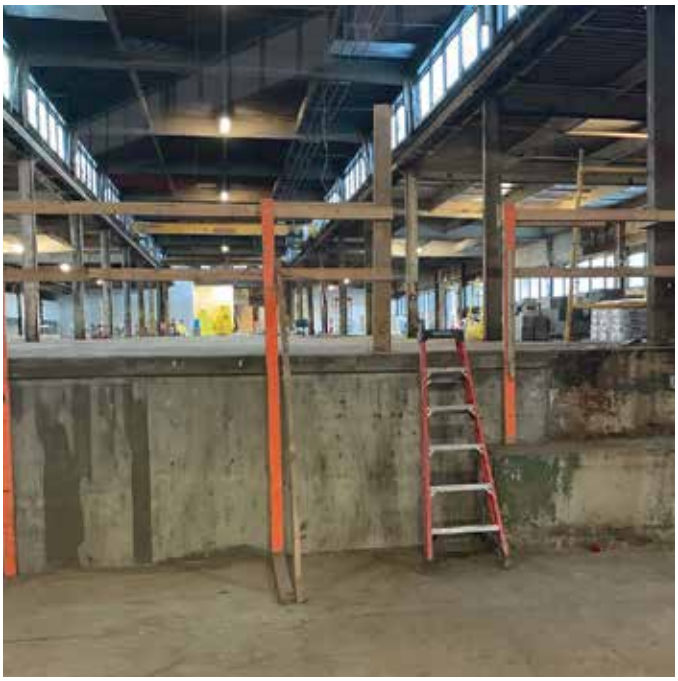
Coal Combustion Product Type
Controlled Low-Strength Material Using Class F Fly Ash

Project Location
Baltimore, Maryland

Project Participants
SEFA Group, KBK Builders LLC, Vulcan Materials

Project Completion Date
2020

Project Summary
A century-old building formerly used to manufacture airplane parts is being converted to office space with an industrial feel and decor. The building's basement, containing an old oil boiler, piping, and various obsolete pieces of equipment, was unused space and suffered from water intrusion—making it a good candidate for backfilling. Although ASTM No. 57 stone was initially considered for the job, controlled low-strength material (CLSM) using Class F fly ash was ultimately selected as the best way to completely and safely fill up the space.



SOURCE: SEFA GROUP

Project Description
The basement requiring backfilling measured approximately 11' x 20' x 40', or roughly 8800 cubic feet. A fill mixture with a ratio of 425 lbs. of fly ash, 75 lbs. of portland cement, and 60 gallons of water was selected for its flowability and to ensure that it could be easily excavated in the future if required. The flowable fill's Class F fly ash was sourced from SEFA's Keystone Generating Station, in Shelocta, Pennsylvania.

Placement was carried out in three phases, on three successive days, using the procedures outlined in ASTM D 6103, "Standard Test Method for Flow Consistency of CLSM." A 3" x 6" open cylinder was filled with slurry; the cylinder was lifted; and two diameter measurements were taken, at 90 degrees apart, to ensure their average diameter was between 8" to 12" so the mix would have the proper consistency. The contractor used the old boiler flue pipe to pour in the CLSM, thus ensuring the unit was completely filled with CLSM and helping the CLSM flow into tight spaces behind the boiler. The pump hose was then moved to the main hatchway once the contractor was satisfied the material was flowing properly.

The contractor installed several pipes through the floor for two purposes. First was to create safe observation ports to observe how the CLSM was flowing and filling the void. Second, the pipes could then be used as reservoirs for flowable fill when topping off the last few inches under the floor. Most flowable fills subside slightly as the water decants naturally upward. The reservoirs provided just enough head pressure to keep the CLSM in contact with the bottom of the slab above.

On the first day of placement, 197 cubic yards of CLSM were pumped into the basement. The following day 144 cubic yards were poured, filling the void to within 8" of the underside of the slab above. On the final day, 54 cubic yards of CLSM were poured, topping the void. It would have been possible to fill the basement in one continuous placement, but due to its overall depth, complexity, and unknown chambers, the contractor elected to use three consecutive placements.

With the CLSM at the proper consistency, no workers were needed to spread it into position, and the CLSM self-leveled. Keeping valuable employees out of dangerous confined spaces like this is a significant benefit of using CLSM, as is the reduced labor cost. The pump arrangement was simple and, as it operated at low pressure, the pump was able to operate at peak rate, offloading the mixer trucks rapidly. With two trucks at the hopper, the next truck was able to get the proper consistency and begin discharging while the previous truck was rinsing the chute directly into the pump hopper. The pump operator never had to stop the strokes unless the crew was moving the hose.