Dear Colleagues,

Progress often comes hard; and living next to a construction site is never easy. This is especially true of a project with a twenty-four hour work permit. Powerful hauling and excavating equipment and large cranes punctuate our lives. Tons of earth are moved around by front-loaders and then removed from the site while tons of concrete are delivered and poured into caissons and slurry walls each week. OSHA-required back up warning “beeps” emanate from each piece of equipment as it moves backward, protecting the workers from mishaps but sometimes driving neighbors crazy. Augers dig deep below the surface of the earth while sixty-foot casing sleeves are rotated or vibrated into the ground, sometimes with such violence that the earth and the buildings surrounding them shake and frighten the inhabitants. One such temblor occurred in the middle of the night two weeks ago. Sadly, our sleeping Gewirz residents bore the brunt of it.

We have been working with BBC Construction to try to minimize some of the inevitable disruptions so that life for the Gewirz residents can be a little less difficult. BBC is no longer vibrating casings adjacent to Gewirz. They completed the remainder of the work alongside Gewirz by rotating the casings which eliminated the vibration. Indeed, all of the drilling adjacent to Gewirz is now completed. Casings on the west side of the highway and down the center line will be vibrated but the underground temblors should not be strong enough to reach Gewirz.

Although OSHA-required warning devices cannot be removed from the equipment, BBC removed most of the beeper safety alarms from their equipment with replaced them with white-noise warning devices which emit a low level growling sound rather than a beep. Some equipment, however, cannot be adapted to the white noise system so BBC has lowered the decibel level of the beep on that equipment. Unfortunately, BBC cannot control the type of warning system if the equipment is used on other projects in addition to the I-395 project. Thus, we will still hear the beep from time to time.

BBC also moved the slurry pumps that were located on 2nd Street near the alley behind Gewirz. The pumps were relocated behind the slurry processing tanks and thus, much of the sound is now blocked. BBC has also constructed a roof over the pumps so the noise is directed to the west away from Gewirz.

Slurry Wall Construction

Although the slurry pumps remain active as the caisson drilling continues, the slurry wall on the west side of the project is now complete. A diaphragm or slurry wall is a structural foundation element built underground using a mixture of bentonite clay and water to stabilize an excavation site. A trench that would otherwise collapse due to the soil and hydraulic pressure of the adjacent earth and ground water does not collapse because the slurry pumped into the trench resists these pressures.

Slurry walls serve the same purpose as caissons. They support the structures that will be built above them. On the Capitol Crossing project, a wall fifty-five to seventy-feet deep and eight hundred fifty- feet long will support the western edge of the platform. A wall rather than caissons is being used on the western edge because the project’s underground parking garage will abut the west side of the highway. The slurry wall will also serve as the foundation wall of the garage and will temporarily serve as the support of excavation when the garage is being dug out. In this respect, the wall serves a purpose similar to the soldier beams and wood lagging that I wrote about previously (See *Construction Note*, March 17, 2015 appearing at http://www.law.georgetown.edu/campus-services/facilities/construction-info/index.cfm); but it is much more rigid than the lagging system and eliminates the need to build a concrete wall after excavating for the garage.

The first full scale slurry wall was built by the Icos Company in Italy for the Milan Metro in 1950 using bentonite slurry for support. Slurry walls were introduced in the United States in the mid-1960s by various European contractors. The first application occurred in New York City in 1962 for a seven-meter diameter shaft that was twenty-four meters deep. Others were used for the Bank of California building in San Francisco in 1980, the CNA building in Chicago in 1972, and the World Trade Center in New York in 1969. The majority of slurry wall projects in the U.S. are located in six cities -- Boston, Chicago, Washington D.C., San Francisco, and New York.

In some sense, creating a slurry wall is not all that different from building a caisson. A deep and narrow trench rather than a cylindrical shaft is excavated; the trench is filled with slurry; reinforced steel is placed in the trench; and concrete is pumped into the trench via a tremie system to replace the slurry. Slurry walls are constructed in discrete sections -- in this project, a series of twenty-four foot panels. Excavators first open a three-foot wide trench that is lined with concrete curbs to serve as a guide for the deep excavation. Instead of using augers, BBC

concrete curb guide

excavator

excavated the trench using a clamshell scoop that is slightly shorter than nine-feet long. It hangs from the end of a crane and scrapes along the guide wall as it enters the trench. This ensures that the trench will remain a uniform width as it goes deep below the surface.

Clam shell scoops on the excavator

Each twenty-four foot panel is excavated in three separate units, left, right, and then center. Slurry is pumped into each unit of the panel as the excavation proceeds, providing the soil stabilization until all three units are excavated and the concrete is pumped in. After the panel is excavated but prior to pouring in the concrete, a reinforcing steel cage is lowered into the trench to provide additional strength to the concrete. The panels are not excavated one after the other because the concrete needs to cure before its adjacent panel is excavated. Thus the trench wall appears to

Reinforced steel for the slurry wall

Concrete being pumped into the slurry wall

have gaps as the excavator moves along the length of the wall. Each panel is separated by an end stop when the concrete is poured. Half-way down the edge of the end-stop is a joint shaped roughly like an arrowhead. Once the concrete is cured, the end-stop is removed. When concrete is poured into the adjacent panel, it flows into the arrowhead-joint, connecting one panel to the next and forming a single reinforced slurry wall stretching eight hundred and fifty feet long. You can watch a video of a slurry wall being excavated at

https://www.youtube.com/watch?v=e5BqHHtKR50

The caisson and slurry wall phase of the project will be completed around the beginning of December and thus, before our students' final exams. During the next few weeks, the old water pipes and the remaining section of the old retaining wall at 2nd Street and Massachusetts Avenue will be demolished. Construction of the new 2nd Street highway exit portal has already begun. If you have been watching carefully, you can now see the contours of the new exit ramp. Night work will cease between early December and February of 2016 when the steel phase of the project will begin. Once it does, the shape of the platform will start to be visible to the casual observer.

As I mentioned earlier, the remaining caissons work will continue until December. By the time caisson and slurry wall support phase of the project is completed, 1,200,000 linear feet of reinforcing steel will have been placed in the caissons and slurry wall. The weight of all that steel is 3,250,000 pounds. The wall and the caissons will contain 22,500 cubic yards of concrete. If one lined up the trucks needed to transport that amount of concrete, they would reach eleven miles. That is the total length of the Capital Crescent Bike and Hiking Trail and almost the distance between Washington and Fairfax.

As I said in my last *Construction Note*, science can make things look simple and it makes the incomprehensible real. Which of us can really comprehend the weight of a 400 million pound deck? And who or what besides Atlas, the primordial Titan, could support such weight? How will this deck stand over a highway four city blocks long? And who would have thought it was the friction of the earth pressing against a caisson that provides the essential strength to support the platform rather than the caisson itself? But science and engineering prevail -- unseen, powerful, and magical. Several years from now, as we walk across the platform or drive beneath it, our eyes will not see and our brains will not comprehend the strength of the unseen caissons and slurry walls that made it rise. Nor will we see or think about the unseen minds of generations of scientists, engineers, and construction workers, our modern magicians, who have made this platform float.

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