

## **VA MENTAL HEALTH CLINIC - GEOTECHNICAL ENGINEERING**

The Birmingham VA Mental Health Clinic project was undertaken by developer US Federal Properties to construct a modern \$30 Million 2-story, 60,000sf outpatient clinic to meet the needs of veterans in Birmingham, AL. and regional communities beyond. The project was a redevelopment of the site which provided a boost to revitalization efforts already underway in the area.

Building & Earth Sciences joined the team as the geotechnical firm of record and worked hand in hand with other members of the team, including civil engineering partner, Birmingham-based Sain & Associates Engineers; Hayward Baker, geotechnical construction contractors who provided rammed aggregate pier ground improvement services; and Birmingham-based Hoar Construction as the General Contractor, to tackle the complex site.

Building & Earth's team developed a thorough subsurface investigation program which included standard borings, rock coring, and geophysical surveys to ascertain the specific geological nuances of the site to aid in the foundation design. The firm's involvement with other projects in the area allowed it to have a very specific knowledge of the subsurface conditions which in turn aided the team in arriving at a viable site/foundation approach which allowed the project to move forward.

## **INNOVATIVE APPLICATION OF NEW OR EXISTING TECHNIQUES**

The site selected for the VA Mental Health Facility was in an area of Birmingham which had been originally developed over 50 years ago. The site was occupied by two motels which covered a large portion of the ground surface. Conventional Standard Penetration Test (SPT) soil sampling was performed to determine the subsurface conditions in the accessible areas. The locations which could be drilled were restricted due to the existing buildings, and several of the planned boring locations were eliminated due to the presence of active utility lines and limited space to offset the borings.

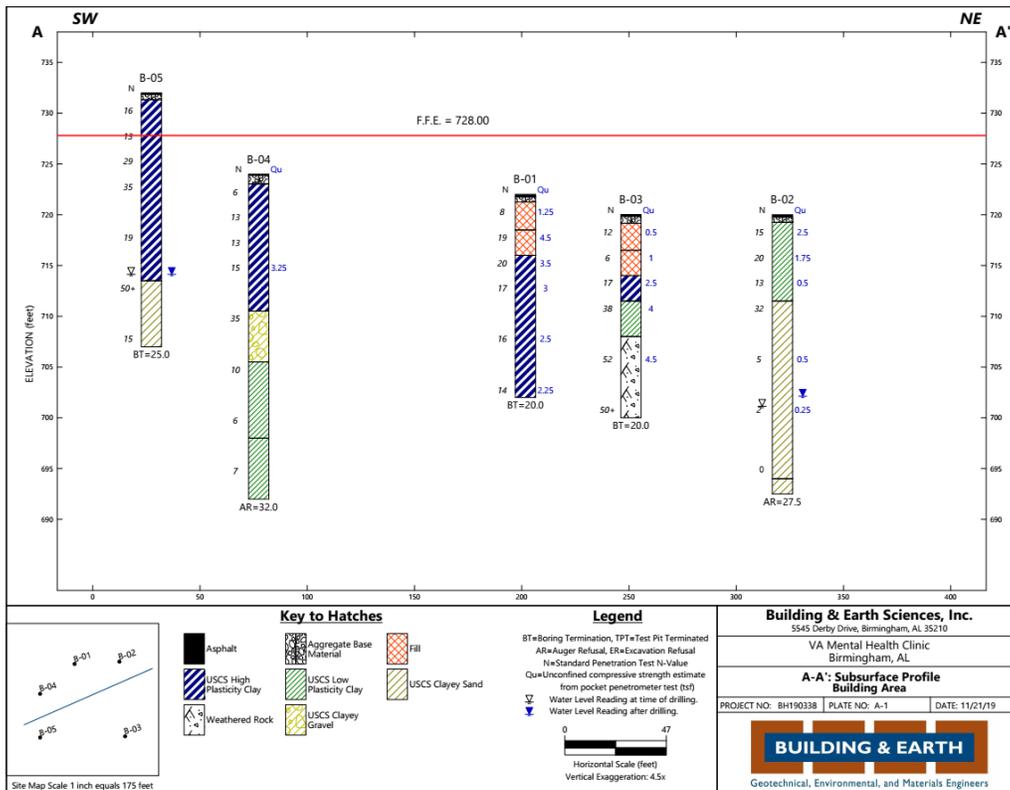
The development was in an area underlain by the Floyd Shale geologic formation, which is known to contain low strength soils. Additionally, due to the past development, existing fill material used to level the site was encountered at all but 3 of the 13 locations drilled. The fill material was highly variable in consistency and composition and gave the appearance of being poor to moderately compacted. An existing swimming pool was also present at the site.

The SPT testing in the boreholes revealed that in addition to variable consistency fill material at the surface, the underlying naturally occurring soils were also variable in consistency. Very soft conditions were encountered sporadically throughout the site.

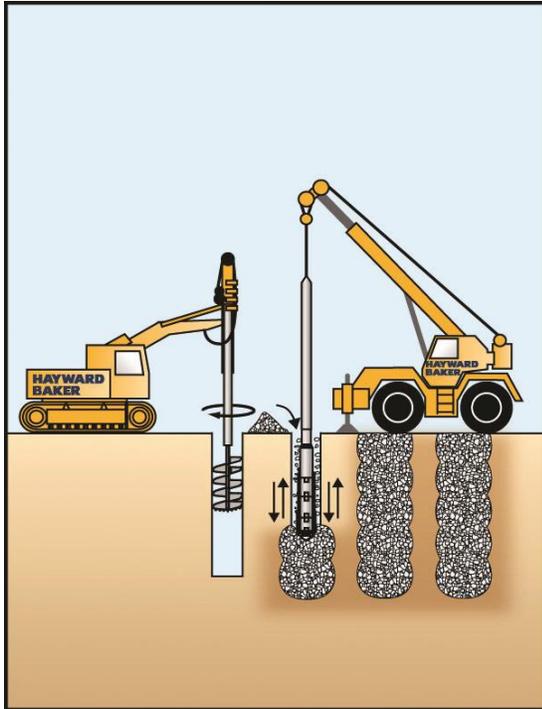
The presence of soft and variable subsurface conditions identified during our field exploration cause a concern for long-term support of the structure. Whenever such soils experience additional loading, there is a potential for settlement. If settlement is uniform, then the building is not affected, however due to the variable nature of the soils at the site there was a potential for differential settlement. The additional pressure on the underlying soils would be applied from both

the building foundations and newly placed fill required to reach the designed building subgrade. Based on our laboratory tests and analysis, it was determined that up to 2.5 inches of settlement could occur. The settlement caused by foundation and fill loads would result in future problems with the structure in the form of cracking of the walls and floor slabs and potentially doors and windows that would not open. Therefore, such structural distress would cause safety concerns.

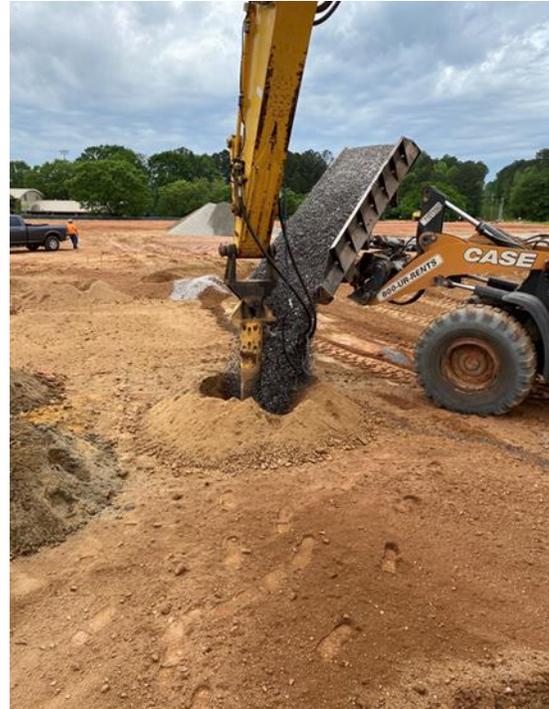
A subsurface profile showing the variable conditions is presented below:



Due to the excessive and variable settlement concerns, we evaluated several alternatives for foundation support. Undercutting to remove the soft soils was considered however due to the depth of soft material was not determined to be viable option. Drilled shafts to rock are typically the preferred method of deep foundation installation in the Birmingham area; however, due to the relatively light foundation loads, the cost of drilled shafts was not considered economical. After considering the alternatives, we recommended that the foundations be supported on an intermediate foundation system consisting of Rammed Aggregate Piers. The piers would penetrate the soft soils and derive support from the underlying rock. Typical spread footings could then be constructed over the Rammed Aggregate Piers.



**Rammed Aggregate Pier Installation Process**



**Top Loading of Aggregate During Installation**

There was also a concern that the settlement from the weight of the fill mass would affect the floor slab. We calculated that 90% of the settlement would occur within the first 60 days after fill placement. Typically, construction is delayed until the settlement is complete. Working collaboratively with the design and construction team, we identified that if the newly placed fill depth could be decreased by 2 feet, the waiting period after fill placement could be avoided.

### **FUTURE VALUE TO THE ENGINEERING PROFESSION**

Settlement analysis has long been used in the geotechnical engineering profession. In more recent years, hand calculations have been replaced with software programs. The output from the programs must be verified by monitoring the actual performance of the foundations versus the calculated settlements. On a site such as the VA Mental Health Center, it is particularly important due to the variable consistency across the site.

The actual settlement was verified during construction in order to prove out the projections. Each time this process is followed, it provides additional verification of the software output and engineering parameters of the input determined from laboratory analysis and engineering judgement. With more data, we can become more efficient with recommendations and therefore save cost to the project by avoiding overly conservative approaches to similar problems.



**Modulus Testing**

## **SOCIAL, ECONOMIC AND SUSTAINABLE DESIGN CONSIDERATIONS**

### **SOCIAL**

The last 20 years of constant war and conflict have taken a heavy toll on the men and woman who have bravely served on the fields of battle in service to our country. It is estimated that the US currently has 19 million veterans, including 2 million+ veterans who have served since the terrorist attacks of 9/11. Every soldier, sailor, marine or airman who has ever been in combat has been impacted, whether physically, emotionally, or mentally. One report says that 30% of active duty and reserve military personnel deployed in Iraq and Afghanistan have a mental health condition requiring treatment – approximately 730,000 men and women, with many experiencing post-traumatic stress disorder (PTSD) and major depression. Our country owes these brave warriors the best possible treatment for the heavy load they bear, and the new Birmingham VA Mental Health Clinic will fill an important role in meeting this need for area veterans.

### **ECONOMIC**

The site selected for the VA Mental Health Facility was in an area of Birmingham which had been originally developed over 50 years ago and the two motels which occupied the site were well past their prime and prone to crime and a general depressing of the area. The new VA facility will contribute greatly to the financial revitalization of the area. This in turn will likely spur additional investment in close proximity to the new clinic due to the increased area traffic. An added benefit is the anticipated increased boost in spending with existing area retailers, restaurants, and service industries from patients and their families which will serve to reinvigorate the economy of the area.

## **SUSTAINABILITY**

To accompany the growing need for treatment more effectively, the United States Veterans Health Administration made the decision to open the new, stand-alone mental health facility in Birmingham to reduce the amount of congestion at the current VA Hospital facility in the city center, which means less reliance on individual automobile trips, thereby assisting with pollution control/reduction efforts to the benefit of the environment of the metro Birmingham area as a whole.

## **COMPLEXITY**

The subsurface conditions identified during the subsurface exploration required additional testing and analysis to determine potential impact on the completed building. Due to the potential for differential settlement and concerns regarding the long-term performance of the completed building, it was necessary to identify an appropriate and economical approach to foundation design. In addition to the settlement considerations, the time rate of settlement had an impact on the project schedule. Working with the design and construction team, a design change was identified that could take time out of the schedule which is always an important consideration.

## **SUCCESSFUL FULLFILLMENT OF OWNER/CLIENT NEEDS**

It is important to start any new construction on appropriate foundations, and especially when the conditions are highly variable. The owner, General Contractor, and Foundation Contractor were all engaged with the geotechnical consultant to review various foundation options and design alternatives. Building & Earth was able to perform exploration and laboratory analysis to provide dependable subsurface information. Several design approaches were reviewed in order to reach the approach that was considered the most economical and cost-effective solution. The earthwork and foundation installation were accomplished as expected.

## **SUMMARY**

The Birmingham VA Mental Health Clinic represents an important investment in fulfilling the need for high quality treatment for area veterans who suffer from combat related post-traumatic stress disorder (PTSD) and major depression. Building & Earth's team, with 30+ years of experience with the complex geological conditions found in the Birmingham region, was proud to play a role in bringing the project to fruition through its innovative engineering approach to the project site.