

TERRANOTES

A Ground Improvement Update from TerraSystems

DYNAMIC COMPACTION IN MINE SPOIL

Mining activities throughout the coal regions in the United States have left many thousands of acres unusable in their present condition as a result of spoiling the overburden soils in valley fills. The spoils have a wide range of soil types, varying from silt and clay size particles to automobile-size boulders. The spoils are generally poorly compacted and building construction on the spoils involves considerable risk due to the likelihood of building settlement.

The choices for foundation systems for buildings are limited in mine spoil that contains boulders. The geotechnical designer has the following options:

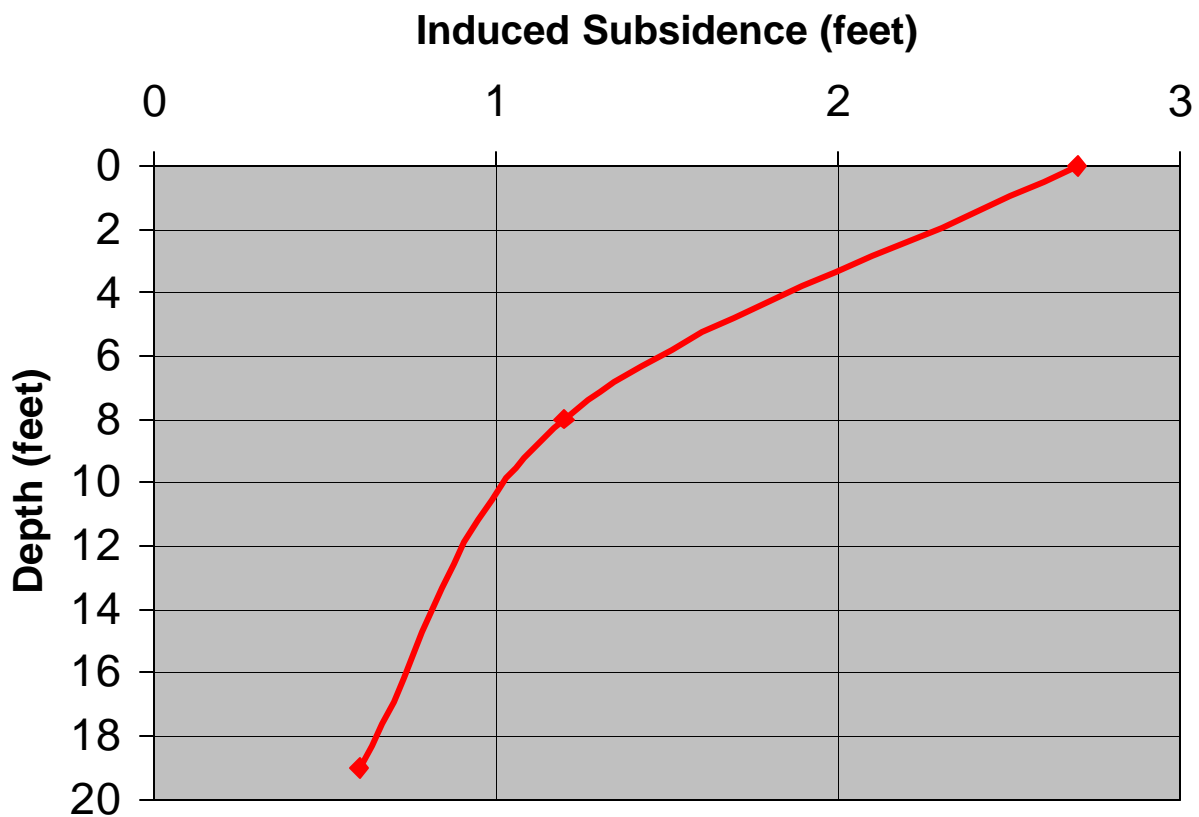
- 1) Excavate and replace the spoils
- 2) Use a deep foundation systems such as driven piles or drilled piers
- 3) Use a ground improvement technique on the spoils

Excavation and replacement of the spoils is extremely expensive. Deep foundations are often not possible because of the extreme difficulty or inability of either driving piles or drilling through boulder-size material. One of the techniques that is rapidly gaining geotechnical acceptance is the use of dynamic compaction to densify the spoils.

Dynamic compaction has been used since the early 1980's to compact mine spoil throughout the eastern and mid-western coal regions. At least 30 projects have been performed during that time period, all successfully. The range of projects has been diverse, including shopping centers, correctional facilities, mining structures, and highways. Tamper sizes have ranged from 9 to 20 tons, but primarily have been in the 15 ton range, with drop heights from 40 to 60 feet. A partial sampling of our projects is included in the following table.

Kentucky Utilities Company, 420 Site 40 feet of mine spoil	Earlington, KY	15T x 55 feet
Green River Correctional Facility 50 feet of mine spoil	Central City, KY	16T x 55 feet
Shelby High School Mine spoil in excess of 75 feet	Shelby County, KY	16T x 50 feet
Interstate 65 Mine spoil in excess of 100 feet	Birmingham, AL	20T x 60 feet
Toms Fork Coal Preparation Plant Mine spoil in excess of 70 feet	Cabin Creek, WV	15T x 50 feet
Industrial Parkway Mine spoil in excess of 40 feet	Ashland, KY	15T x 50 feet

From a geotechnical standpoint, it is sometimes difficult to evaluate the effectiveness of dynamic compaction in mine spoils. An exhaustive test program on mine spoil compacted by dynamic compaction was conducted in the early 80's in Alabama. Geotechnical testing included standard penetration tests, surface seismic surveys, cross-hole geophysical testing, downhole geophysical testing, pressuremeter testing, and deep settlement devices. In addition, deceleration measurements were obtained on the falling weight in an attempt to measure the modulus of the compacted mine spoil. The most-promising results were obtained with the cross-hole testing. All other tests, with the exception of the deep settlement devices, proved to be of limited value. The deep settlement devices indicated improvement to depths of at least 25 feet. The settlement devices in test pad 2 indicated that approximately 1.5 feet of strain occurred in the upper 8 feet, 0.6 feet occurred in the depth interval of 8 to 19 feet, and 0.6 feet took place below 19 feet. The following figure shows the settlement profile with depth.



We would welcome an opportunity to discuss the potential use of dynamic compaction on one of your projects. We also offer ground improvement services in wick drains, vibrocompaction, stone columns and TerraPiers™. If you would like information on any of these other services, or would like additional information on dynamic compaction, please contact us at 540-882-4130 or email us at jjones@terrasystems-inc.com. We welcome the opportunity to hear from you.



39565 Cottage Grove Lane
 Lovettsville, VA 20180
 540-882-4130
 FAX: 540-882-3866