Case Study: Sieve Analyses Results Can Be Deceiving

Introduction

Wells are often drilled through alternating beds of clay or mixtures of clay and granular sediment. Then, once the designer or contractor decides where the well screens are to be installed, samples of the cuttings are selected and sent to the laboratory for sieve analyses. This is when the alternating sequences of clay and granular sediment can be problematic for both the laboratory and the well designer. When selecting samples that are mixtures of granular material (e.g., sand) and clay, it is important to carefully consider their lithologic character and understand how to interpret the results. This is because the laboratory could be challenged to test them and provide results that are useful and not simply misleading.

Sample Selection and Testing

Whenever samples are received by the laboratory for sieve testing, they are first removed from the sample bags and then dried. Herein begins the problem scenario when the samples are clay or clayey. When clay samples are removed from the dryer, they essentially consist of hardened "clods" which must be broken up and pulverized. (Note: It is understood by the author that one does not sieve clay, so this scenario is offered to the reader to make the point to those who have neither worked in nor observed testing in a soils laboratory.) Even the most diligent laboratory technician will find it difficult to pulverize clayey samples sufficiently so that the clay fraction will pass the #200 sieve screen and collect in the pan. The problem is that, inevitably, some the crushed clay will still be the size of sand-size clay particles (e.g., smaller than #20 sieve or larger). Then, when those particles are transferred to the sieves, some of them will be retained by screens larger than #200. In other words, they will appear on the sieve results as fine to medium sand (or even pebbles) rather than clay as they actually are. This is a recipe for confusion to some.

Interpreting Results

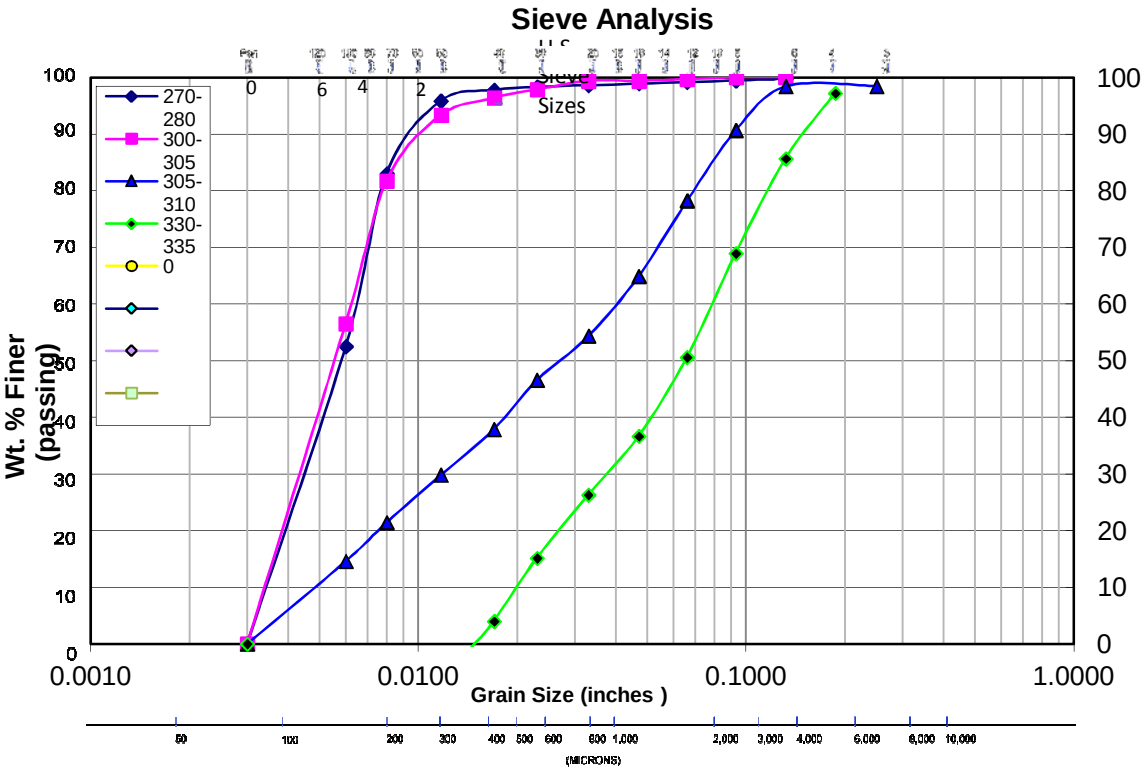
When the sieve results for samples like those described above are input to a sieve analysis spreadsheet, the results can easily be misinterpreted unless they are careful analyzed along with the actual cuttings and logs. Therefore, to properly interpret sieve results, it is recommended that one should:

1. Inspect the sample descriptions in the lithologic log or driller's log.
2. Physically inspect the samples and confirm their lithologic character as described in the log(s).
3. Interpret the electric logs (SP, resistivity, and gamma) and compare the curves to the lithologic log.
4. Confirm that that the sieve results accurately reflect the physical content of the samples.
5. Interpret the sieve results in light of all available information (#1 through #4).

Example

For those who select samples for sieve testing that were collected from boreholes drilled through beds of clay or clayey sediments, the cautionary note is to recognize how misleading laboratory results can be. For example, below are results of sieve tests performed on 4

samples from the same borehole. They appear to show that the samples from 270'-280' and 300'-305' are sandy clay, whereas the other two samples are significantly coarser and have considerable sand-size fractions. However, the results are misleading. This is because the sand-size fractions are actually sand-sized clay particles that were not completely pulverized. They were retained on the screens and did not pass the #200 sieve and collect in the pan.



Summary

For the designer, the potential for misinterpreting sieve results is a reality whenever clayey samples are sent to a laboratory. Therefore, before sending in samples for testing, one would be well served to understand that sieve testing of clay or clayey samples is inherently problematic. Knowing beforehand what the results are likely to show is important. But, equally important is to know how to analyze results before using them to select filter pack material.

About the Author

Robert Turnbull is the Chief Hydrogeologist of Roscoe Moss Company. In this capacity he provides technical support, as needed, to consultants, municipalities, and water districts to plan and design water supply wells. He can be contacted for such information or to answer inquires regarding this technical memorandum via email at rturnbull@roscoemoss.com. His website is www.blthydro.com. The corporate website for Roscoe Moss Company is www.roscoemoss.com.