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Nick Farino's Individual Contribution Page

StaRS Backwash Team

Fall 2014 Semester Contributions

Semester Goals:

The StaRS Backwash team's goal for the Fall 2014 semester is to research the sand sizes and ratios for the most efficient backwash of the stacked rapid sand filters. Preliminary research will be done on gradations of sand and possible sand sizes that follow the current ideology of 1.5 ratio and 11 mm/s backwash. A experimental apparatus emulating a filter bed needs to be designed and fabricated to test theories and different sands. Once the filter apparatus is made and troubleshooted for issues, experiments can be run to collect data on backwash.

Progress:

I have done research online to try to hypothesize what filter system parameters will effect bed segregation. These unit-less parameters that are of interest are:

- The Expansion Ratio, E_R , which is the ratio of bed height during fluidization to settled bed height, $h_{\text{fluid}} / h_{\text{settled}}$
 - The backwash velocity, V_{backwash} , will also be of large importance, since it is directly related to The Expansion Ratio
- The Sieve Ratio, S_R , which is the ratio of the largest particle diameter in the sand bed to the smallest particle diameter in the sand bed
- The ratio of Pipe Diameter to Settled Sand Bed Height, $D_{\text{Pipe}} / h_{\text{settled}}$

Although our experimental filter has not been constructed yet, I have already made a system of tests that will hopefully show how Bed Segregation is related to the parameters mentioned above. The system of tests done will have some sort of order similar to:

- Tests changing only Backwash Velocity to understand its specific effect on the Expansion Ratio
- Tests with a constant Sieve Ratio and Pipe Diameter to Settled Sand Bed Height Ratio. Only changing the Expansion Ratio to understand its effect on Bed Segregation.
 - I believe that Expansion Ratio is the parameter most closely related to Bed Segregation.
- Tests holding Expansion Ratio and Sieve Ratio constant. Only changing the Pipe Diameter to Settled Sand Bed Height Ratio to understand its effect on Bed Segregation.
 - I really don't think that this will have that great of an effect after a certain boundary point. I hypothesize that as long as the Pipe Diameter to Settled Sand Bed Height Ratio is over .1, the effects on Sand Bed Segregation will be minimal.

I am really hoping to find the relationship between these unitless parameters and Bed Segregation. I am hoping that with the data I find in the lab, we will be able to form some sort of basis for questions like:

Given a Sieve Ratio, Sand Bed Height, Filter Diameter Size, what should the Backwash Velocity be in order to ensure that the Sand Bed does not segregate?