Silt fence is one of the most widely used perimeter control devices and is considered an industry standard for use in the control of sediment transport from construction sites. Numerous research studies have been conducted on the use of silt fence as a perimeter control, including a number of studies involving controlled laboratory flume tests and outdoor tests performed in the field on construction sites with real monitored storm events. In field tests, due to the random and uncontrollable nature of real storm events and field conditions, studies have shown difficulty in evaluating silt fence performance. These field studies have shown the need for performance testing of silt fence in a more controlled environment, which can also simulate the actual use and performance in the field. This research, which is a continuation of ongoing research on silt fence fabrics at UCF Stormwater and Management Academy, was conducted in order to evaluate silt fence performance under field conditions. Presented in this thesis are evaluation of two silt fence fabrics, a woven (ARS 1400) fabric and nonwoven (BSRF) fabric. Both fabrics were installed separately on a tilted test bed filled with a clayey-sand soil and subjected to simulated rainfall.

Previous field studies on the performance of silt fence fabrics have evaluated the turbidity and sediment removal efficiencies only after the rain event, with the assumption that the efficiency values represent the true overall performance of silt fence. However, the results of this study revealed that the removal efficiencies of silt fence were significantly affected by the time of sampling. The removal efficiencies during the rain event remained less than 55 percent, however, after the rain event ended, the removal efficiencies increased over time, reaching removals upwards of 90 percent. The increase in efficiency after rainfall ended was due to the constant or decreasing ponding depth behind the silt fence, increased filtration due to fabric clogging, and sedimentation of suspended particles.

The nonwoven fabric was found to achieve higher removal efficiencies and flow through rates both during the rain event as well as after the rain event when compared with the woven fabric. It is interesting then, that over the entire test duration, the overall efficiencies of both fabrics were similar. The overall average turbidity reduction of the woven and nonwoven silt fence fabrics was 72 and 73 percent, respectively. Both fabric types also achieved comparable overall average sediment concentration reduction efficiencies of 71 and 74 percent, respectively.

This result leads to the conclusion that silt fence performance in the field is dependent on three main processes: filtration efficiency occurring during the rain event, filtration and sedimentation efficiency occurring after the rainfall event, and flow rate through the silt fence fabrics. Increases in the flow through rate lead to decreases in the overall efficiency. This thesis quantifies the different mechanisms by which these processes contribute to the overall efficiency of the silt fence system and shows how these processes are affected by different conditions such as changing embankment slope and rainfall intensity.

Major: Environmental Engineering

Educational Career:
Bachelor’s of Civil and Environmental Engineering, BS, 2012, University of Central Florida

Committee in Charge:
Manoj Chopra, Chair, Civil Environmental and Construction Engineering
Andrew Randall, Civil Environmental and Construction Engineering
Dingbao Wang, Civil Environmental and Construction Engineering
Ikiensinma Gogo-Abite, Civil Environmental and Construction Engineering

Approved for distribution by Manoj Chopra, Committee Chair, on March 11, 2014.

The public is welcome to attend.