ErosionLab™ - Five Years of Information for the Erosion Control Industry

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ABSTRACT

Key Words: ErosionLab, BMPs, ECBs, REF, CERF, TRM

The erosion control industry has constantly pushed toward developing and supplying products that meet the needs of individuals and government agencies, while continually upgrading, adapting, and developing products. Manufacturers in the erosion control industry strive to produce products at the highest quality and performance levels. Testing of erosion control products plays a key role in acquiring acceptance by end users.

The ErosionLab™ has focused on industry-wide advancement since it opened in 1998. The lab is a large-scale erosion control testing lab. The two primary

facilities of the lab are the Rainfall Erosion Facility (REF) and the Channel Erosion Research Facility (CERF). Various Best Management Practices (BMPs) are tested according to ASTM standards in both facilities. The lab has completed blown straw hillslope testing and straw bale check testing in channels as part of a grant provided by the United States Environmental Protection Agency (US EPA). Testing under this grant provided public testing information on two popular BMPs that are used throughout the country. Other tests have been performed on erosion control blankets (ECBs), turf reinforcement mats (TRMs), and a polyacrylamide (PAM). In addition, the lab has tested products for other erosion control product manufacturers. This initial phase of testing on BMPs provides individuals and government agencies with information to make informed decisions on these products and their placement in the field.

Research and development activities at the lab have experimented with multiple trenching, overlapping, anchoring, and termination options for various BMPs. These activities strive to establish the most effective installation procedures for BMPs to help advance the industry. New products and ideas also have been evaluated and tested. In addition, a method of confidently analyzing simulated rainfall test data on a single storm basis was achieved at the lab during its first five years. The method of single storm analysis will help the entire industry comply with National Pollutant Discharge Elimination System (NPDES) Phase II guidelines.

The lab regularly hosts industry-wide field days. Representatives of various erosion control product manufacturers are invited to the lab to showcase their products in demonstrational conditions. Individuals from the private and public sectors are also invited to participate and learn about erosion control products from professionals.

This paper summarizes the activities and findings at the lab during its first five years. These findings can benefit the entire erosion control industry.

INTRODUCTION

The erosion control industry has been constantly evolving over the last five years. Many new products have been introduced to address the current wants and needs in the world of erosion control. Other products have been phased out of production due to a variety of factors. During the past five years American Excelsior Company's ErosionLab™ has been evaluating, researching, and developing erosion control BMPs in an attempt to continue to evolve the erosion control industry. During this time, the lab has played a key role in educating the general public and government agencies on changes and trends in the erosion control industry by hosting educational field days and tours. Testing for governmental agencies, such as United States Environmental Protection Agency (US EPA) and Wisconsin Department of Transportation (WisDOT), has allowed those agencies to study BMPs of their choice and evaluate specifications. Erosion control product manufacturers have benefited from the lab by testing

their products in accordance with ASTM testing standards. Tests conducted under these standards have allowed products to be accepted onto various states' acceptability lists.

BRIEF HISTORY

The lab is an outdoor erosion control research and development facility that is located near Rice Lake, Wisconsin. The lab, which began testing in the summer of 1998, has two separate facilities; the Rainfall Erosion Facility (REF) and the Channel Erosion Research Facility (CERF). REF can achieve target intensities of up to 20.3 cm/hr (8 in/hr). REF contains 12 test plots that are 12.2 m (40 ft) long by 2.4 m (8 ft) wide constructed at a 33% gradient (See Figure 1). The soil types on REF are generically classified as sand, loam, and clay. CERF contains 12 test channels of which six have a 5% gradient and six have a 10% gradient. Each gradient has two channels of the same soil classifications as REF. All channels are 24.4 m (80 ft) in length and trapezoidal in shape with a 0.6 m (2 ft) bottom and 2H:1V side slopes. The current configuration of the channels can be altered if testing requires it. Discharge has been measured at over 2.3 m^3/sec (80 ft^3/sec) in the test channels.

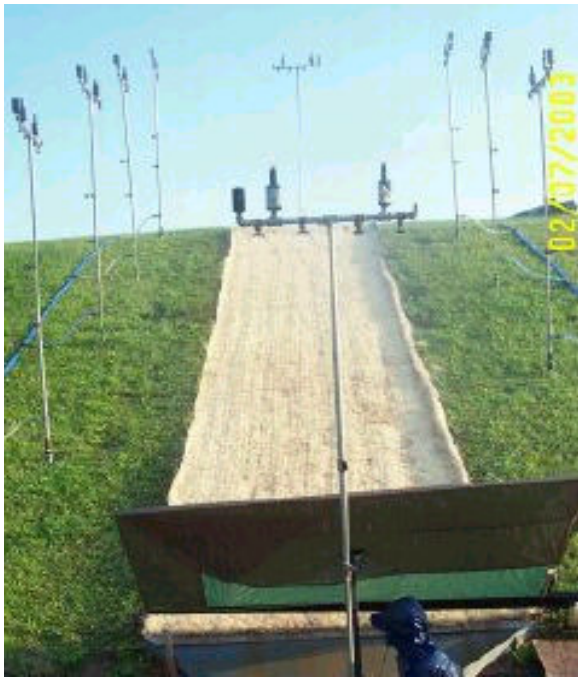

Figure 1. REF test plot during an approximate 10.2 cm/hr (4 in/hr) test.

TESTING ACTIVITIES

During the summer of 1998, the lab started to slowly get its feet wet in the world of testing erosion control products. The summer focused on the calibration of REF and CERF. Following the completion of calibration tests were conducted the remainder of the testing season. Tests conducted during 1998 were performed to learn the facilities and testing procedures. Although exciting and

usable information was obtained during testing activities, the information was only used to better understand the lab facilities. Tests were performed to check the quality and repeatability of the systems. Lab staff became more comfortable with the demands of a test and also gained a better understanding of what was required during the preparation of a test plot or channel.

The lab was ready to proceed with full-scale testing at the start of the 1999 testing season. ASTM test standard D 6459,"Standard Test Method for Determination of Erosion Control Blankets (ECB) Performance in Protecting Hillslopes from Rainfall-Induced Erosion" (ASTM, 2001) and D 6460,"Standard Test Method for Determination of Erosion Control Blanket (ECB) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion" (ASTM, 2001) were adopted as industry-wide standards. The standards supply the industry with ASTM accepted testing options.

After the acceptance of the D 6459 and D 6460 ASTM test standards, the lab began the process of certifying products tested in accordance with the standards. Product certification began on the Curlex® product line. Ayres Associates, an independent third party engineering firm, was contracted to perform a Quality Assurance/Quality Control role. Ayres was hired to verify testing was being performed in accordance with D 6459 and D 6460, analyze test data, and to generate a test report for each product tested at the lab.

Through analysis of the testing already performed at the lab, it was clear that testing needed to be performed on bare soil. Although bare soil testing was performed in 1998 and 1999, more testing was needed to better evaluate tests performed on products. The 2000 testing season began with a series of nine tests conducted on REF under bare soil conditions. The bare soil tests are compared to tests with product on the plot.

While activity on REF focused on bare soil tests, activity on CERF was focused on a new product that was being developed by the company. The product was like no other on the market. Its' matrix was comprised of fibers extruded from recycled soda bottles. During the research and development process that the lab has in place the current configuration of Recyclex™ Turf Reinforcement Mat (TRM) was developed.

After bare soil testing was completed on REF and the new TRM development was completed on CERF, the testing focus switched to a grant that was awarded to the lab by the United States Environmental Protection Agency (US EPA). Under the grant, the lab was to test blown straw on REF and straw bale ditch checks in the CERF channels. Blown straw testing consisted of three plots with straw blown on the plot and one bare soil control plot. Bales were installed according to Wisconsin Department of Transportation (WisDOT) specifications. Three channels of each soil type were tested with three bale checks in each

channel along with one bare soil control channel. The bare soil tests on REF and CERF were compared to the three tests that evaluated the straw BMPs.

It became evident that a larger data base of bare soil channel information was needed after analyzing the large amount of information that was created during the 2000 test season. Testing on bare soil channels began on CERF early in the 2001 testing season. Nine bare soil channels were prepared and tested. Certification of the company's new TRM was completed in mid-summer of 2001. In addition, five other channels were installed with the TRM, soil-filled, fertilized, and seeded. These channels were allowed to vegetate and testing began on these channels when vegetation ranging from 6 to 12 inches, equivalent to SCS vegetal resistance class "C", was present (See Figure 2). ASTM test standard D 6460 testing protocol was used as a guideline for testing the vegetated TRM channels. One vegetated TRM channel was subjected to 48 hours of flow.

Figure 2. Vegetated Recyclex with approximately one foot of water in the channel.

The 2002 testing emphasis landed on REF. WisDOT contracted the lab to test a polyacrylamide and an erosion control blanket manufacturer contracted the lab to certify two of its products. Both clients requested the products be tested under ASTM D 6459. The lab certified one other product on REF in addition to the contracted testing.

Certification testing was completed in CERF on the same client's blankets that were certified on REF. An excelsior sediment log was certified in the channels in 2002 as well. Channel testing on the company's TRM continued in 2002. Lab personnel completed a 15 hour test on the same vegetated channel that endured

the 48 hour test the year before as a continued effort to study the long term stability of the company's TRM. Long term testing of the TRM continues to be performed to evaluate the product's abilities over a period of years.

Additional activity in 2002 saw the construction of six 1 m x 1 m (3.3 ft x 3.3 ft) plots on flat ground to evaluate nitrogen levels below ECBs and TRMs. The plots were fertilized with 27-3-4 fertilizer. Products were installed over some of the plots and others were left uncovered. Soil samples were removed from the plots at predetermined time intervals and analyzed for nitrogen levels. This study was done to understand nitrogen movement in soil under an ECB or a TRM or without a surface cover on the soil. In 2003, the same six plots were further reduced to 0.48 m x 0.48 m (19 in x 19 in) and used as vegetation plots (See Figure 3). The vegetation study yielded vegetation density, total biomass production, and soil moisture enhancement ability for numerous erosion control products.

Figure 3. Vegetation study plots.

Other efforts in 2003 included two product certifications on REF and two product certifications on CERF.

Various trenching, overlaps, and anchoring patterns of Rolled Erosion Control Products (RECPs) have been installed and tested. Over five years, lab staff have discovered that various practices used in the erosion control industry that are more effective than others. Numerous anchoring patterns have been tested and retested. Trenching options have also been tested and altered accordingly along with proper overlap distances between two blankets. Lab findings are shared with the industry through technical papers, presentations, and other medias of communication.

NON-TESTING/EDUCATIONAL ACTIVITIES

The lab regularly hosts educational workshops. Over 30 educational workshops have been conducted in the lab's first five years. The Minnesota Erosion Control Association (MECA) has held an annual educational workshop at the lab since

2000. The day consists of a morning of classroom presentations and an afternoon of field observation at the lab. Some of the topics that have been covered are industry trends and new product innovation, National Pollution Discharge Elimination System (NPDES) Phase II, computer models for erosion control planning, and installation and explanation of ECBs, TRMs, silt fence, triangular silt dike, polyacrylamides, chitosan, rock checks, and straw, excelsior, flocculating, and compost logs.

The International Seminar on Watershed Management, representing seventeen countries, visited the lab for a tour and educational meeting in 2003 (See Figure 4). These individuals were very interested in erosion control techniques that are used in the United States and shared the approaches to solving erosion control issues in their respective countries.

Figure 4. International Seminar on Watershed Management group observes a channel demonstration.

In 2003 the lab also hosted a training session for National Resource Conservation Service (NRCS) and County Land Conservation employees of northern Wisconsin. Another training session soon followed for employees of the Land Conservation Department of Trempealeau County. Basic installation techniques of ECBs, selection and application of erosion and sediment control products, and designing an erosion and sediment control plan were covered during the training sessions.

More than 607,027 ha (1.5 million acres) of land are developed each year in the United States (Kassulke, 2003) With the large amount of land developed each year the need for testing erosion control products has increased. Knowledge of how the product performs is becoming more important information. NPDES Phase II litigations require greater knowledge of the products that are used to control erosion. When land is disturbed for construction, road building, mining, logging, landscaping, or other activities, the soil erosion rate increases from 2-40000 times (Goldman et. al., 1986). The lab has helped the industry fill this knowledge void with its ability to test erosion control products in simulated

situations and evaluate their ability to retain soil. The testing that has been conducted in the past has allowed engineers and lab staff to develop a method to predict sediment runoff from a construction site. The method allows engineers to design an erosion control plan, while knowing the estimated amount of soil that is expected to runoff the construction site during any segment of a rain storm. If the predicted amount of runoff exceeds the "acceptable" limits for the site, the engineer can redesign the erosion control plan until it meets "acceptable" limits. Costly fines as well as time and money spent reinstalling erosion control products can be avoided by following the framework of single storm analysis.

Test information has been incorporated into an online software program, ErosionWorks® Online, that allows engineers to evaluate rainfall and channel erosion. The performance levels of various erosion control products are provided after the user inputs the parameters of the slope or channel to be protected. With more and more emphasis placed on erosion control government employees, contractors, and the private sector are looking for more information on this topic.

DISCUSSION

Allowing access to the lab and providing individuals with knowledge better educates them about the industry. Individuals will discover solutions to erosion control problems that expand beyond conventional BMPs with an increased erosion control knowledge base. Educating government employees, contractors, and the private sector plays a key role in advancing the industry past the level it currently holds. With increasing knowledge more sound and informed decisions will be made. Better decisions can translate to consumers getting the results that are desired.

Throughout the erosion control industry the claim has been made that the majority of erosion control product failure is the result of improper product installation. Erosion control installation training sessions are a key to eliminating this problem. Although the lab's training sessions have been helpful in slowing the problem the problem is not getting smaller. As more and more erosion control products are introduced and more and more erosion control products are installed, the problem is growing. Individuals informed about the industry is a vital part to the continued growth of the erosion control industry.

During its first five years of testing the lab has pushed to produce solid data. Solid data is the framework for informed decisions. Receiving poor information results in poor decisions. Solid information is a basis for solid decisions. Data produced at the lab is a foundation for engineers to make educated decisions when developing erosion control plans. The erosion control design engineer has more tools available to him since the lab opened in 1998. More tools are being developed daily and those tools are essential to industry growth. With this being

said, the lab continues its pledge to be an educator of the erosion control industry.

WORKS CITED

American Society of Testing and Materials (ASTM). 2001. "ASTM Annual Book ASTM Standards -2001: Section Four, Construction". Vol. 04.09. ASTM, West Conshohocken, PA.

Goldman, S. J., K. Jackson and T. A. Bursztynsky. 1986. Erosion and Sediment Control Handbook. McGraw-Hill, Inc., New York.

Kassulke, Natasha. 2003. "Where the Law Meets the Land". Wisconsin Natural Resources. 27:2.