Articulated Concrete Block Performance Testing at the Colorado State University Engineering Research Center Hydraulics Lab.

Chance Bitner
Hydraulics Program, Civil Engineering Department, CSU, Fort Collins, CO 80523-1372

Abstract. As land is developed, flood protection becomes more important. This has especially become a problem for highway engineers trying to stabilize steep slopes. Additionally, protection of bed and bank conditions of river systems, earth embankment dams, and spillways has become increasingly important. As a result, a number of articulated concrete block systems have been developed to minimize embankment damage in an overtopping event. Articulated concrete blocks (ACB's) have been developed to allow placement along un-level ground where a flat concrete surface is not feasible. Understanding of system performance is necessary to construct reliable field installations. Both overtopping and channel test procedures have been developed to assess the performance of ACB's.

Through testing at Colorado State University, overtopping tests have demonstrated correlation with channelized testing on the same products. As a result, overtopping models are preferred over channelized testing due to shorter testing durations. ACB testing at Colorado State University is conducted according to standards developed by the Federal Highway Administration (FHWA) and United States Army Corp of Engineers (USACE). Standards are currently under review for the American Society for Testing and Materials (ASTM). Water for the outdoor overtopping facility is derived from Horsetooth Reservoir through an existing pipe network. Installation of the ACB's includes the construction of a soil embankment (SM soil) compacted to 90 to 95 percent of the standard proctor maximum dry density. The embankment consists of a horizontal section and a slope section with a 2H:1V slope. A Geosynthetic filter fabric is installed on the embankment under to ACB's. Edge, entrance, and exit treatments are placed to secure the system and mimic field installation and a diffuser box smoothes the transition of flow at the entrance. The ACB system is tested by introducing an overtopping flow at 1, 2, 3, and 4 foot of overtopping depth. Each overtopping flow depth runs four hours and data is collected each hour. Discharge is controlled using a valve and is displayed with a digital readout. Bed readings and water surface readings are taken every two feet along the flume. Velocity readings are recorded every four feet with a Marsh McBirney Velocity Meter. Using initial surveys, the hydraulic and energy grade lines are calculated. Cross section average velocity is computed from continuity and the shear stress calculated with the momentum equation and control volume analysis. The presentation will highlight the testing, testing standards and summarize field applications of ACBs.