Articulated Concrete Block

SHORETEC™ LLC
Preserving Our Natural Resources

The High-Water Mark of Erosion Control Systems

Waterfront areas are treasured for their beauty, diversity of wildlife and plant species, and abundance of both commercial and recreational opportunities. The downside, of course, is the potential for erosion, flooding and storm damage, which often requires man-made protection to shield fragile environments and ensure personal safety and property protection. Articulated concrete block systems (ACBs) are emerging as a vital part of this protection-providing an economical, durable, environmentally sound soil stabilization system.

ACBs are a flexible revetment system that provide effective erosion control and can also include plantings to maintain a natural appearance. Articulated concrete blocks are effective and economical for a wide range of erosion problems, and are easily installed above or below the water line, as either cabled or non-cabled systems.

Love's Park Creek

In Love's Park, Illinois, city officials and residents sought to control high water flows and sediment deposits in Love's Park Creek. The open channel drainage and storm water conveyance system sees everything from a trickle to high velocity deep flows. The highly erosive creek meanders through industrial and residential areas, threatening residential property and municipal playgrounds. Flows carry large amounts of sediment, which deposit in the creek bed and diminishes the channel's water capacity, causing flooding.

Previous solutions included periodic sediment excavation, which was hampered by the lack of hard surface floor to support the skidsters and small end loaders used to excavate. In addition, portions of the bank were stabilized using poured-in-place concrete. Although this helped the excavation, residents were unhappy with the aesthetics, and long-term performance of the concrete was compromised by slab heaving and cracking from freeze-thaw exposure and water pressure from within the banks. A new approach was required to control erosion, provide natural beauty and resist freeze-thaw damage. Articulated concrete blocks met the challenge.

For Love's Park Creek, the U.S. Army Corp of Engineers (USACE) chose a non-cabled ACB system with cores to support vegetation. According to Paul A. Kowalczyk, P.E., Assistant Chief of the Design Branch for the USACE, "Other systems considered were riprap (not very compatible with a residential area), concrete (not as aesthetically appealing), and grass lined channel (not durable enough). The riprap was not as attractive to the city because of the appearance, difficulty of maintaining it, and safety issues because of the project's location within residential areas." ACBs supply a hard stable surface to support excavation equipment, facilitating stream maintenance. ACB revetments are also resistant to freeze-thaw damage and allow release of water pressure within the stream banks.

Unfortunately, potential liability must also enter into the decision-making process for most municipalities. Public accessibility of waterfront areas demands a stable and smooth revetment. For the children of Love's Park, who inevitably play and climb along the creek banks, the ACBs offer a surface that will not shift and whose smooth surface is less likely to catch or twist small ankles.

Over 274,000 ft2 (25,455 m2) of the interlocking units were placed at installation rates up to 75 ft2 (7 m2) per man hour. Overall, choosing ACBs over other conventional systems saved the City of Love's Park thousands of dollars. Homeowners along Love's Park Creek appreciate the natural beauty and increased safety. The vegetation, which eventually covered the stream banks, visually softens the banks while also helping support the local habitat. According to Kowalczyk, "in general, our sponsor (the City of Love's Park) has been pleased with the aesthetics (green slopes), performance (high flows have not damaged the channel) and maintainability of the project."

Shoreline Protection in the Florida Keys

The Florida Keys are an environmentally sensitive area, renowned for natural beauty and pristine waters. Unfortunately, an abandoned landfill on Fleming Key, part of the Key West Naval Air Station, was subject to extensive shoreline erosion, exposing unsightly steel and concrete debris. In addition, the area was overgrown with non-native vegetation, which was choking out the native species. For remediation, the U. S. Navy required an effective shoreline repair and protection system with a minimum life of fifty years. The initial baseline for the project was a granite riprap revetment, estimated to cost approximately $2.1 million. After evaluating submitted bids, the Navy chose a cabled articulated concrete block system, installed on a newly constructed 3:1 slope along the entire 1800-foot (549-m) length of shoreline.

ACBs were chosen for performance, economy and aesthetics. Seven-and-a-half-inch-thick (191-mm) ACBs with a 12- to 18-inch-thick (30- to 46-mm) bedding layer were able to provide long-lasting erosion protection under conditions that would have required a 4.5-foot (1.4-m) depth of riprap with a minimum boulder size of 3 feet (0.9 m). Although thickness requirements are project specific, depending on embankment slope and flow conditions, a 4-inch-thick (102 mm) ACB revetment can very often replace 18 to 36 inches (0.5 to 1 m) of riprap. Part of this thickness difference is the level of engineering involved in designing the two systems. ACBs are produced under controlled conditions that provide consistent and predictable strengths and allow precise placement and interlock. Riprap stability, on the other hand, varies with stone shape, size, weight and durability, which cannot be precisely controlled.

The ACBs were placed as cabled mats, 8 feet wide and 41.3 feet long (2.4 by 12.6 m), which were assembled on-site using the concrete blocks, high strength polyester cables and aluminum sleeves. The cables facilitate placement, particularly on steep slopes or in underwater applications. The cabled mats were lifted by crane and set into place, quickly covering the slope.

The performance specification also required that the structure's appearance harmonize with the surrounding environment. ACBs provide a uniform finish on the slope, which were subsequently planted with native species. To reintroduce native vegetation, over three hundred red mangrove trees were planted along the most sheltered area of the shoreline revetment. The open cells of the ACBs provide protection for the mangrove seedlings until they mature and allow mangrove propagation via their unique "prop root and riser" root system. In addition to the mangroves, sea purslane was planted on the upper four feet (1.2 m) of the slope, also in the ACB cores. This native grass-like plant will spread to cover the slope, providing a natural appearance and help prevent the re-introduction of non-native plants.

The final cost of the ACBs, including all design, permitting, construction and replanting was $1.1 million, or approximately $11 per square foot ($119 per square meter)-almost half of the riprap protection concept. The Navy expects maintenance to be limited to removing non-native plant species, which may become re-introduced, and to addressing the flank end riprap treatment, which may migrate down slope. In short, ACBs provide a permanent, economical solution and perform as a natural looking shoreline embankment in this highly sensitive environment.

In project after project, articulated concrete block revetment systems are providing a host of benefits to waterfront communities. Whether chosen primarily for environmental benefits, economy, pedestrian safety, aesthetics or long-term durability and maintainability, ACBs are providing this entire range of benefits. Their unmatched versatility and performance make ACBs a favorable solution for shorelines, creeks, boat ramps, spillways, overflow or drainage channels, bridge abutments or levees.

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