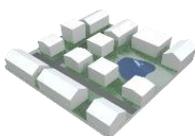


## VEGETATED CONCRETE BLOCKS



Suburban and urban

Rivers

Medium-cost

Riverbank erosion

### DESCRIPTION

<b>Measures</b>	<p>The simplest form of concrete block system for bank protection are blocks that are precast in square molds usually on or near the site. They have voids that allow vegetation to be planted once the blocks have been installed on the bank. In addition, there are Articulated Block Systems (ABS) that are manufactured and have better shear resistance but can still adapt to bank irregularities. ABS can be of several different types; interlocking and cable-tied and open cell or closed cell. The open cell blocks have voids within the individual units which allow vegetated soil to be placed while the closed cell blocks are of solid concrete but allow vegetation to grow between adjacent units and are appropriate for use below the normal waterline. A filter layer usually made of geotextile, is placed under the ABS layer to retain the soil layer while letting water pass without clogging. After installation, the voids are filled with soil for planting.</p>
<b>Location</b>	<p>Vegetated concrete blocks are an effective erosion control system and can be used to solve a wide range of bank erosion problems including on river banks, lake shorelines, drainage channels, retention basins, dykes, and levees while improving the habitat and aesthetics.</p>
<b>Design options and performance</b>	<p>The simplest form of concrete block system for bank protection are blocks that are precast in square molds usually on or near the site. They have voids that allow vegetation to be planted once the blocks have been installed on the bank. In addition, there are Articulated Block Systems (ABS) that are manufactured and have better shear resistance but can still adapt to bank irregularities. ABS can be of several different types; interlocking and cable-tied and open cell or closed cell. The open cell blocks have voids within the individual units which allow vegetated soil to be placed while the closed cell blocks are of solid concrete but allow vegetation to grow between adjacent units and are appropriate for use below the normal waterline. A filter layer usually made of geotextile, is placed under the ABS layer to retain the soil layer while letting water pass without clogging. After installation, the voids are filled with soil for planting. A third type consists of concrete blocks locked together and embedded into a high-strength geogrid. There is the spacing between the blocks that give the mat flexibility and allows for vegetation growth. This type of mat is usually packaged in rolls, making transporting and installing easier.</p>
<b>Feasibility criteria</b>	<ul style="list-style-type: none"> <li> <b>Technical design:</b> An engineering design should be prepared for block-surfaced banks based on site-specific hydrological and geotechnical conditions. They are designed to resist erosion and (if solid blocks are used) stream shear forces but not for bank support. If bank support is required gabions or riprap should be placed at the toe of the bank. The         </li> </ul>

## VEGETATED CONCRETE BLOCKS

	<p>soil of the bank should be prepared and made smooth according to the contour and slope of the bank with any holes or irregularities filled/flattened.</p> <ul style="list-style-type: none"> <li>● <b>Soil media:</b> For planting suitable soil should be placed in the holes in the blocks. Planting should take place at the start of the wet season.</li> <li>● <b>Soil slope:</b> Maximum slope where block systems should be used is 1:4.</li> <li>● <b>Surface cover:</b> Normally grass or suitable vegetation is planted in the interstices in the blocks or between the blocks. Properly selected plant species can almost completely cover the blocks providing a natural landscape.</li> <li>● <b>Materials:</b> If blocks are precast on site, materials used are concrete and steel rebar for the ABS blocks and well-graded aggregate for the filter layer. For the ABS the geotextile layer and blocks are purchased from suppliers. The blocks are usually supplied in pallets.</li> </ul>
<b>Operation and maintenance</b>	The surface of the block slope should be checked after each rainy season and any damaged or missing blocks repaired or replaced. During the summer growing season, the grass or vegetation should be cut back as required.
<b>Cost and benefits</b>	Blocks precast locally are a medium cost measure whereas ABC systems with geotextile drainage layer are high cost. The benefits of vegetated concrete block bank protection are that they reduce the area of impermeable bank surface by allowing stormwater to percolate into the ground thus reducing runoff while protecting the slope from erosion and, once the vegetation becomes established, contributes to the overall aesthetics and ecology.
<b>Design solutions</b>	In cases where river velocities are high, it may not be possible to use green measures so a combination of green and grey techniques will need to be considered. Vegetated concrete blocks are one very adaptable solution that can be applied in a wide range of situations. The linkage between the blocks is flexible but strong enough to resist significant shear forces while the vegetation growing either through voids in the blocks or spaces between the blocks helps to bind the structure to the river bank.
<b>Environmental performance</b>	Vegetated block systems contain vertical cores and spaces which allow vegetation growth. Properly selected plant species can almost completely cover the entire hard surface of the blocks, allowing them to acquire a natural look and over several years, the plant's root systems enhance the suitability of the bank. They also purify the stream water by absorbing nutrients and breaking down other pollutants. During peak storm events, the block layer beneath the vegetation will protect the soil from erosion.
<b>Sources</b>	<ul style="list-style-type: none"> <li>● Flexamat. Not dated. Pavement Erosion Control – Technical Information. Accessed via <a href="http://www.flexamat.com">www.flexamat.com</a>.</li> <li>● National Concrete Masonry Association. 2011. Articulating Concrete Block for Erosion Control.</li> </ul>