

# Bank Stabilization Structures of Yangtze-River

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**Bank Stabilization Structures of Yangtze-River** are ecological revetment structures that have been carried out in the Yangtze River with a focus on preventing bed-shape evolution, river-width adjustment, and lateral channel migration, which are woody planting and combined applications of planting and artificial structures. The most widely used in the middle and lower reaches of the Yangtze River are steel wire mesh gabions bank stabilization and chain-type bricks bank stabilization.

Keywords: Bank stabilization structures ; Yangtze-River ; Steel mesh gabion ; Chain-type bricks

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## 1. Definition of Bank Stabilization Structures of Yangtze-River

Schiechl and Stern (1997) defined woody planting and combined applications of planting and artificial structures used in riverbank as bank stabilization, distinguished from slope protection. Bank Stabilization Structures of Yangtze-River are ecological revetment structures that have been carried out in the Yangtze River with a focus on preventing bed-shape evolution, river-width adjustment, and lateral channel migration, which are integrated revetment system composed of woody planting and combined applications of planting and artificial structures.

## 2. Significance of Bank Stabilization Structures of Yangtze-River

The riparian zone is an important transition between the river and terrestrial ecosystems <sup>[1]</sup>. This zone has severe river erosion and frequent flow and exchange of material, energy, and information <sup>[2]</sup>. With the aim to adjust the flow and stabilize the shoreline, a series of bank stabilization structure projects have been carried out in the middle and lower reaches of the Yangtze River in recent years, with a focus on preventing bed-shape evolution, river-width adjustment, and lateral channel migration. Application and construction of bank stabilization structure not only meets the requirements of flood control and drainage and riverbank stability, but also has important practical significance for maintaining river regime stability, thus improving the river biodiversity, ecosystem productivity, and self-purification capacity <sup>[3]</sup>.

## 3. Comparison of traditional slope protection and ecological Bank Stabilization Structures

Traditional revetment structures are generally constructed with stone, steel, concrete, and other materials; the main design considerations are the mechanical factors to ensure the stability and economic benefits of traditional slope protection <sup>[4]</sup>. Blocking the exchange of material and energy between river and land ecosystems leads to the closure of the entire bank slope, which causes the riverbank to lose its ecological function and self-purification ability, destroy the diversity of the original river channel, and other adverse effects that hinder the development of traditional revetment structure <sup>[5][6]</sup>. Ecological bank stabilization can enable the natural restoration for the bank slope under the premise of satisfying the riverbank stability. Meanwhile, the bioerosion on riverbanks provides underground soil reinforcement and surface protection from erosion.

## 4. Two widely used Bank Stabilization Structures of Yangtze-River

For the Yangtze River, due to the large velocity and discharge and the great seasonal variation of water level, before the installation of the new stabilization structures construct, some unprotected river sections were seriously eroded by the river, with little vegetation coverage; the construction of ecological bank stabilization under such complex flow conditions is of great significance. So, people are constantly innovating and researching optimized structures to fully integrate the bank stabilization projects with nature and maximize its ecological benefits. At present, the most widely used in the middle and lower reaches of the Yangtze River are steel wire mesh gabions bank stabilization and chain-type bricks bank stabilization.

#### 4.1 Steel mesh gabion bank stabilization

The steel mesh gabion bank stabilization structure is composed of wire baskets filled with rocks (Figure 1). The steel wire of wire baskets under anti-corrosion treatment is with the properties of corrosion resistance, high strength, and good flexibility. This structure has a rough surface, and the sediment in the gabion is easily deposited. At the initial stage of bank stabilization, natural soil with a thickness of approximately 3–5 cm is usually laid in the steel mesh grid of bank stabilization. Grass seeds are sown to carry out the slope structure greening, using vegetation to protect the soil, reducing the probability of soil erosion in the ecological bank stabilization area [7].

#### 4.2 Chain-type bricks bank stabilization

Chain-type bricks bank stabilization is composed of slope bedding and concrete prefabricated slope bricks with a unique interlocking shape. Each brick and its adjacent six bricks form an excellent interlocking state (Figure 2). At the same time, the interstices of interlocking bricks are filled with graded crushed stone. Holes in the middle make the bricks porous, permeable, and breathable. Natural soil is paved in the holes and vegetation is planted [8].

## 5. The existing problems in Bank Stabilization research

Scientific studies on bioengineering structures along rivers mainly focus on methodological aspects, such as structural optimization and construction methods [9]. Some researchers found that succession of biocenose is found correlated with the techniques used in bank stabilization construction by biological investigation data from different structures [10][11][12]. The relationship between the distribution and diversity of plant communities and substrates are examined, but mostly concentrated on highway slopes and fluctuations of reservoir water levels [13][14][15][16]. Research remains limited on the ecological restoration and the relationship between environmental impact factors and the effect of biological restoration after the construction of different ecological structures on riverbank areas. However, the seasonal water level changes experienced by vegetation in bank stabilization areas are opposite to that in reservoir water-level fluctuations, because during the flood season, the latter is exposed while the former is submerged. For the ecological bank stabilization projects, limited professional data are available to allow tracing and comparison of the comprehensive benefits.

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