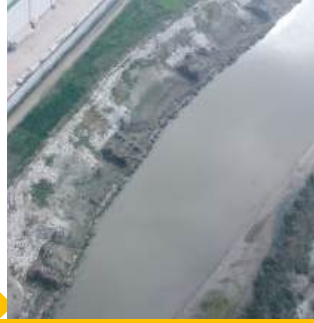




Riverbank Protection for Industrial Land Using Civil Porcupines



Executive Summary

Industrial sites near rivers offer operational advantages but also face serious risks from erosion and flooding. One of our projects had a similar problem from a nearby river: the flow pattern was changing and moving closer to the site.

Challenges:

- The construction process started- the return of land to the development authority was not possible.
- Conventional stone pitching and other embankment techniques were ineffective at the neighbouring sites.
- Monsoon flooding would cause a shutdown in the facility. Resumption of operations would take many days.
- As in all manufacturing facilities, a shutdown not only meant business losses but also the loss of opportunities.

Solutions:

There are several conventional solutions to protect the riverbank and reduce flood risks. They include stone pitching, gabion walls, and concrete retaining structures.



Solutions:



Besten Engineers delivered a **riverbank stabilisation and flood-mitigation solution** for an industrial plot subject to continuous river movement. Over time, the natural buffer reduced from **75 metres to just 12 metres**, placing the site at high risk. During the **2022 monsoon rains**, the site experienced flooding, confirming the severity of the risk.

Typically, several other conventional methods are used to control riverbank erosion and reduce flood risk. Solutions such as **stone pitching (riprap), gabion walls, and concrete retaining structures** are commonly adopted to protect the bank surface. However, these methods are often rigid and may not perform effectively in dynamic river conditions where flow patterns and velocities change over time. Other approaches, including **geotextile-based systems and vegetative stabilisation**, can provide support but are typically more suitable for low- to moderate-flow environments. The selection of an appropriate solution depends on river behaviour, soil conditions, and long-term performance requirements, with a growing preference for flexible, adaptive systems in such scenarios. All these conventional measures, such as **stone pitching, were attempted by the neighbouring sites but proved ineffective** against the changing river behaviour.



Civil porcupines, often referred to as **RCC (Reinforced Cement Concrete)** porcupine frames, are permeable, tetrahedral-shaped structures used in river engineering as a cost-effective method for flood control, riverbank protection, and sediment management. These structures allow water to flow through while reducing its velocity, encourage sediment deposition, reduce bank erosion, and protect embankments from high-velocity currents.

Key Functions in Flood Mitigation

- **Riverbank Protection:** They shield banks from scouring and erosive forces.
- **Flow Retardation (Dampening):** The structures break down the velocity of water flow and lower the boundary shear stress that causes erosion.
- **Siltation (Sediment Deposition):** By creating a slow-flow zone, they trap suspended sediments, forming a natural silt bank over time.
- **Diversion of Flow:** They can act as spurs to redirect flow away from critically eroded banks toward the centre of the river.

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Advantages

High Silt Trap Efficiency: Conventional porcupine systems achieve sediment trapping up to as high as 82%.

Cost-Effective: They are cheaper than bank-protection structures such as concrete walls or massive boulder spurs.

Adaptable: They can be arranged along or across the flow to fit specific river conditions. Field Performance: Successful projects in the Brahmaputra (Assam) and Farakka (Ganga) have demonstrated effective erosion prevention.

By implementing **civil porcupines**, the riverbank was stabilised, sediment was restored, and the site remained **protected during peak flow conditions**—making it safe for industrial use.

Components of a Porcupine

- **Structure:** A typical RCC porcupine is a tetrahedral frame made by joining six pre-cast concrete members.
- **Materials:** RCC members are joined with bars and bolts.
- **Installation:** Multiple units are linked with GI wire or wire ropes and anchored to the ground to form a screen or spur field.
- **Flexibility:** They are used alongside bamboo or geo-bags for added protection.



Besten Engineers' Approach

Assessment

- Site surveys and terrain mapping
- Study of past river movement
- Flood risk analysis

Design

- Custom-designed porcupines based on site conditions
- Use of geotextiles to support sediment build-up
- Prefabrication for better quality

Installation

- Placed in a strategic pattern along the erosion zone
- Securely anchored to handle high flow.

Monitoring

- Regular tracking of sediment formation and bank stability
- Adjustments were made where required.

Results

Stabilised Riverbank



- Sediment build-up helped restore the natural buffer and reduce erosion.

Flood Protection

- The site remained free from flooding during subsequent peak seasonal flows.

Ready for Industrial Use

The land is now suitable for:

- Heavy equipment installation
- MEP systems
- Long-term operations

Key Outcomes

- Reduced erosion significantly
- Flood risk brought under control
- Improved land usability
- Increased site reliability

Sustainability Impact

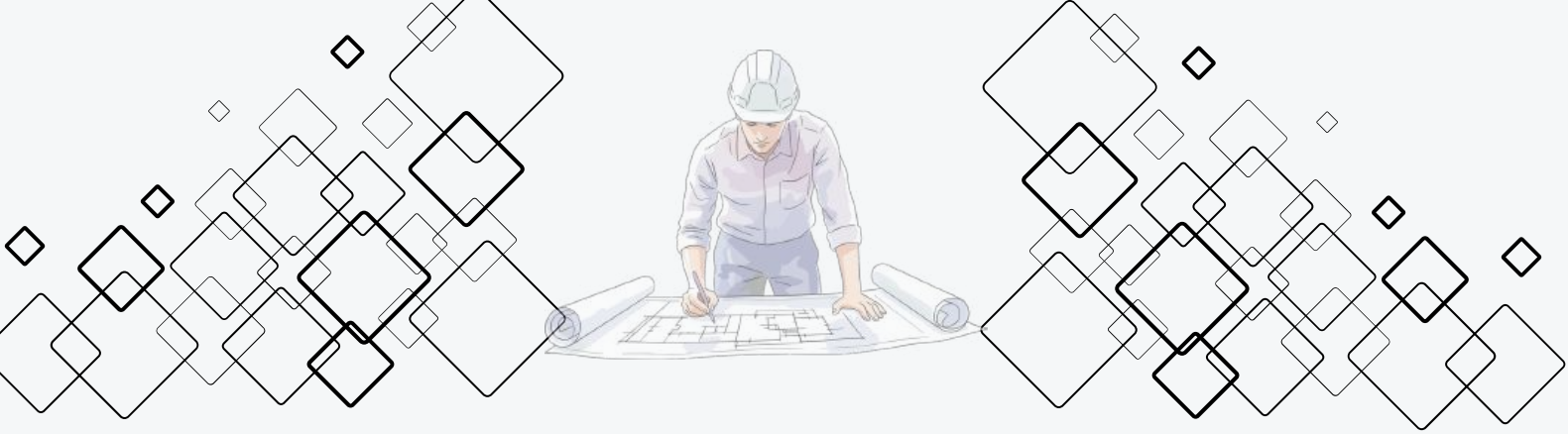
No permanent damage to the river system

Use of recyclable materials

Supports natural ecological balance

Complies with environmental standards





Why Besten Engineers?

Besten Engineers provides:

Industrial infrastructure solutions

Riverbank protection and flood mitigation

MEP and factory planning support

We focus on practical, sustainable, and reliable engineering infrastructure design solutions for industrial projects.



ABOUT BESTEN:

Besten has over **30 years of experience** in designing and consulting for industrial infrastructure projects. The design solutions are sustainable and suited for green certification-targeted factories. Besten believes in incorporating sustainable design concepts in all projects. Besten provides optimised design solutions for both **greenfield and brownfield projects** while ensuring compliance with statutory regulations and project requirements.

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