

Anti-Erosion Work to Protect Bank of the River

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Abstract- A flood is a natural event that can have far reaching effects on people and the environment. Simply, a flood is too much water in the 'wrong' place. So, we can say a flood is an overflow of water that submerges land which is usually dry. Floods generally develop over a period of days, when there is too much rainwater to fit in the rivers and water spreads over the land next to it (the 'floodplain'). However, they can happen very quickly when lots of heavy rain falls over a short period of time. Floods disrupt normal drainage systems in cities, and sewage spills are common, which represents a serious health hazard, along with standing water and wet materials in the home. Bacteria, mould and viruses, cause disease, trigger allergic reactions, and continue to damage materials long after a flood. Water Resources Department of various states take preventive measure to control flood and certain precaution are taken up especially at the banks of river which are vulnerable to erosive action of the river. Such measures include building up of teeth bar along the banks of the river which is most vulnerable to erosive action of the river, which would otherwise cut down the bank and flood down the plain area. Such teeth bar helps in deflecting the flood causing water and hence banks are being protected from being cut down. So, such teeth bar is actually being made from Nylon Crate and Gabion which consists of EC Bags and Geobags respectively. Apron design is the key feature of this preventive measure which is done by launching NC in the river for making the base over which NC and Gabion would be placed.

Index Terms- Geobags; Gabions; Nylon Crate; Anti-Erosion Work; Teeth Bar.

1. INTRODUCTION

The Gandaki River (also known as the Narayani in southern Nepal and the Gandak in India) is one of the major rivers of Nepal and tributary of the Ganges in India. The entry point of the river at the Indo-Nepal border. The Gandak flows southeast 300 kilometers across the Gangetic plain of Bihar state through West Champaran, Gopalganj, Saran and Muzaffarpur districts. It joins the Ganges near Patna just downstream of Hajipur at Sonapur.

Bank erosion is a natural process without it, rivers would not meander and change course. In many places, whether or not the banks are unstable due to human activities, people try to keep a river in a single place. This can be done for environmental reclamation or to prevent a river from changing course into land that is being used by people. One way that this is done is by placing riprap(rock or other material use to armor shorelines) or gabions along the bank. A common natural method to reduce bank erosion is the re-introduction of native plant species in the area. The expansive root systems of these plants provide support within the soil and prevents erosion due to rain runoff.

In order to provide protection to the people, short & medium-term measures were taken up by the Water Resources Department of Bihar. Recently the flood protection works and anti-erosion works are designed using geotextile and geobags and focus to provide protection of the bed and bank from the erosive forces

of the Gandak River. Woven and nonwoven geotextiles, filters, geomembranes, geonets, geogrids, glass fibre paving mat, G.I wires, polymer rope gabions and geocomposite that are used in drainage, earthwork and erosion control applications. Launching NC is a part of bed protection. Polymer rope gabions filled with geobags bags and Nylon crate were placed at regular intervals to impart stability to the scour protection measure.

EC bags were filled with sand to the specified height to ensure that appropriate density is achieved by filling. After ensuring the bags were filled to the required height, the open ends of the bags were closed by stitching the bags at location using hand stitching machines. Stitched bags were manually transported to the site location for installation.

Flood management and bank erosion control has become a prime matter of concern due to its devastating impact in life and property. Many anti-erosion techniques are used as engineered solutions to the problems. Among them construction of revetment is the easy method for anti-erosion work. Revetments are constructed along the bank of the river and protects the bank from erosion of the flood water. It consists of the armour layer which provides protection against wave action of the flood water. Below of it consists the filter which supports the armour and prevents washing out of underlying soil. It also allows water to flow through the structure. It also consists of Toe protection which prevents displacement of

seaward edge of the revetment. Such method is very beneficial against the flood water which may otherwise erode the bank of the river and flood the floodplain area.

2. OBJECTIVE OF THE PRESENT WORK

Based on the above introduction, we now focus on the aim of the present work.

- Anti-Erosion Work to prevent the scouring and erosive action of the river against the bank of the river.
- Formation of teeth bar as shown in figure 1, for the protection of the river bank which is the projection formed towards the river which serve the purpose of deflecting flood water and protect the banks from getting eroded.
- Effective use of Geobags and EC bags to form the teeth bar which act as a deflector against the downstream floodwater.
- Precise stacking of Gabions and Nylon Crate in various sizes over each other.
- Formation of requisite number of Teeth Bars along the bank of the river to deflect heavy flash downpour in the river.
- Working and careful supervision on the launching of NC in the river.
- Estimating the amount of NC and gabions used in the AE work along with requisite number of Geobags and EC Bags.



Figure 1: Teeth bar along the Gandak River

3. MATERIALS AND METHODS

The aim of the reported work is to take preventive measures to protect the scouring and erosive action of the river against the bank of the river. Here we have used EC bags & Geobags in NC and Gabions respectively. Both, Gabion as shown in figure 2 and Nylon Crate(NC) as shown in figure 3 are important in the construction of the teeth bar at the bank of river to protect it from the erosive action of the water. The main purpose of it is to deflect the flood water which would otherwise cut the bank and could damage the levee.

So, the aim of flood fighting here is to form teeth bar for the protection of the river bank which is the projection formed towards the river which serve the purpose of deflecting flood water and protect the banks from getting eroded. The minimum distance between two teeth bar is taken to be 20m. The teeth bar is generally of the dimension 9mX6m, where along its length we have 6m i.e. on land and 3m is in river.

Making of teeth bar starts with the filling of EC bags with sand of proper size. Such filling work may take place at site or in other case filled EC bag may be brought up to the site by the help of suitable means like tractor. After that they are unloaded from tractor and stacked along levee. After being filled with sand their weight should be between 50-60 kg. The general dimension of the EC bag is 450 x 625 x 145 mm. Such EC bag play various role which includes forming base over which gabions could be placed.

3.1 PROCESS OF FORMING TEETH BAR

The process of making teeth bar includes: -

- Filling and transportation of EC bags.
- Laying a base of NC onto the land and in river.
- Launching of NC into the river by suitable means.
- Filling of Geobags and its transportation at the site.
- Laying of Gabion over the NC to form the base



Figure 2: Polymer Rope Gabion



Figure 3: Nylon Crate (NC) Work

Laying of gabion over NC is done manually. These gabions contain geobags which are stacked in a particular pattern depending upon size of the gabion. In a gabion of dimension 1.8m x 1.2m, we can use 12 geobags, as shown in figure 4, but in gabion of dimension 1.8m x 1.8m, we can use 18 geobags.

In a teeth bar of dimension 6m x 9m, a total of 25 gabions could be used of size 1.8m x 1.2m and 15 gabions could be used of size 1.8m x 1.8m.

Following figure shows a well depictive layout of the stacking of the geobags.

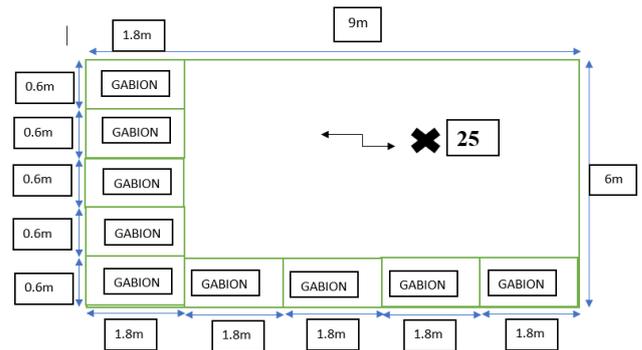


Figure 4: Layout of the Teeth Bar

Figure 4 shows the layout of the teeth bar. From the above layout we infer that for a teeth bar of size 9m x 6m, and gabion of size 1.8m x 1.2m x .5m, the total number of gabion required would be $5 \times 5 = 25$. Now, since geobag are stacked one over another so, total no. of geobag in one gabion is $4 \times 3 = 12$

4. RESULTS AND DISCUSSIONS

Anti-Erosion work is an essential and important work which must be carried out prior to the flooding period in order to reduce and minimize the adverse impact of the flood. Among the various ways to prevent the erosion, use of geobags filled with soil and empty cement bags filled with sand provides the most effective means to prevent the toe erosion of the bunds. Gabions filled with geobags applies a great amount of pressure on the Nylon Crate which is placed partially on the land and partially on the toe of the river bank to form the teeth bar which acts as a deflector against the heavy rainwater downpour and protects the banks of the river. Such preventive measure finally protects the bunds and the countryside.

Consider the gabion of size 1.8m x 1.8m x .5m, where size of geobag taken into consideration is .9m x .6m x .15m. So, hence from the above layout we infer that for a teeth bar of size 9m x 6m, and gabion of size 1.8m x 1.8m x .5m, the total number of gabion required would be $5 \times 3 = 15$. Now, since geobag are stacked one over another so, total no. of geobag in one gabion is $6 \times 3 = 18$. So height of gabion would be the summation of height of individual geobag, so height of gabion is $(0.15 + 0.15 + 0.15) \text{ m} = .45 \text{ m} \sim .5 \text{ m}$. So, total no. of geobag in one teeth bar would be $15 \times 18 = 270$ Geobags. We had a total of 22 teeth bar means $22 \times 270 = 5940$ Geobags were used in anti-erosion work.

5. CONCLUSION

Flood Fighting is essential to prevent levee failure and consequently protect the life of people who would otherwise be affected by the outrageous flood water. Certain precautionary steps are needed to be taken prior to the flood period which includes revetment design, teeth bar making etc. For making of teeth bar it requires geobags and EC bags, which is to stacked in an order.

Flood protection is a very important work of water resources development and they insure proper and efficient step is taken so, that flood causality is less. India is a country where flood is common during rainy season, but situation gets worst when dams releases too much water which increases the water level and consequently increases the chances of flood. It doesn't matter how much precaution do we take we cannot fully control the flood but could only reduce the extent of risk. Its devastating impact is not in our hands, but we could certainly reduce its impact on us.

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