APPLICATION OF GEOBAGS FOR CONTROL OF SOIL EROSION IN PANCHANGANGA RIVER BASIN AREA: AN ECO FRIENDLY DEFENSE

[1]Patil R.S. [2]Patil V.N. [3]Nalawade P.M. and [4]Kamble P.N.
[1]Asst professor [2] Asst professor [3]Asso professor [4]Asso professor,
[1 2]Department of Civil Engg Textile and Engineering Institute Ichalkaranji (MH) India,
[3]Department of Environmental science KTHM College Nashik (MH) India,
[4]Department of Environmental Science Savitribai Phule Pune University Pune (MH) India.

Abstract : River bank erosion is worldwide problem and is increasing in the course of civilization due to increased human activities leading to change in channel. Prevention of bank erosion is possible through restoration with erosion control structure. Textile industry has developed products with such applications giving rise to geotextiles. One such application of geotextile is geobag. Attempt is made in present work to cater erosion of river bank in local region with geobags. Pre monsoon post monsoon assessment of erosion status was carried out with slope calculations and physical observations such as retention of vegetation. Paper discusses in detail type of geobag used with method of installation and soil retention observations of the study area.

***Index terms*- Geotextile, river, soil, erosion.**

I. Introduction :

River Panchanganga is one of major rivers in Kolhapur districts of Maharashtra India originating in western ghats. It is formed with tributaries of five rivers as Kumbhi Kasari Bhogavati Tulsi and Dhamani in hilly tahsils of western part of Kolhapur district. It flows 70 Km after it passes Kolhapur city towards eastern part of district and enters Karnataka after confluence with river Krishna. Due to encroachment for agriculture on river bank and frequent flooding problem of erosion of the river bank is becoming sever now days. This is causing severe concern in farmers in the basin. Hence there is need of implementing methods of river bank protection with immediate application and to assess its efficiency of erosion control.

Textile industry has many applications in various arenas of modern world leading to emergence of industrial textile. Invention of man-made fibers in 20th century changed industrial textile market worldwide. Every textile product applied under the soil is called as geotextile. Geosynthetic materials are today widely used in geotechnical and civil field.

भोगावती नदीकाठाची मोठी धूप

पात्र रुंदावू लागल्याने शेतकरी हबकले

कौलव : राजेंद्र दा. पाटील

भोगावती काठ हिरवागार करत वाहणाऱ्या भोगावती नदीकाठाची मोठ्या प्रमाणात धूप होऊ लागल्यामुळे जागोजागी पात्र रुंदावले असून नदीकाठच्या शेतकऱ्यांची चिंता वाढली आहे.

राजर्षी शाहू महाराजांच्या दूरदृष्टीतून राधानगरी धरण साकारले. त्यामुळे भोगावती पंचगंगा खोऱ्यात कृषी औद्योगीक क्रांती झाली. काळम्मावाडी धरणातील पंचगंगा खोऱ्याच्या वाट्याचे पाणी गैबी बोगद्यातून 'भोगावती'त सोडण्यात आले. त्यामुळे भोगावती काठावरून पाणी टंचाई हा शब्दच हद्दपार झाला. मात्र पावसाळ्यात येणारा महापूर आणि एरवी असणारा पाण्याचा वेग यामुळे भोगावती नदीच्या दोन्ही काठांची मोठ्या प्रमाणात धूप होत आहे. त्यामुळे दुतर्फा सुपिक जमीन तुटून पात्र रुंदावण्याचे प्रमाण वाढले आहे. अगदी राधानगरी धरणाच्या पायथ्यापासून बालिंग्या अनेक ठिकाणी 'भोगावती'चे पात्र कमालीचे रुंदावले आहे. अनेक जागी सुपिक जमीन तुटून गेल्याने नदीकाठच्या शेतकऱ्यांचे मोठे नुकसान झाले आहे.

पिरळनजीकचा वाहतूक पूल कसबा तारळे, शिरगाव, राशिवडे बुद्रुक, हळदी येथील कोल्हापूर पद्धतीच्या बंधाऱ्याच्या दोन्ही बाजूंना जमिनी तुटून जाण्याचे प्रमाण कमालीचे वाढले आहे. ज्या ठिकाणी नदीला वळण आहे. तेथेही मोठ्या प्रमाणात जमीन तुटून गेली आहे. कुडुत्रीनजीकच्या वळणाजवळ जवळपास अर्धा एकर जमीन तुटून पात्रातील खडक उघडे पडले आहे. भोगावती काठावरील जवळपास सर्वच गावातून पात्र रुंदावण्याची समस्या निर्माण झाली आहे. जमिनीची सुपिक माती नदीत मिसळून पात्रही उथळ होऊ लागल्याने अनेक ठिकाणी असणारे खोल डोहही नामशेष होऊ लागले आहेत. त्यामुळे माशांच्या अनेक प्रजाती जलचार व पान वनस्पतीही नामशेष होऊ लागल्या आहे.

कुडुत्री : येथे भोगावती नदीच्या पाण्यामुळे धुप होऊन वाळवंटाचे स्वरूप नदीपात्राला. (छाया : सूरज पाटील)

वेळू, बच्चाची झाडे हाच उपाय

पूर्वी नदीकाठाने वेळूच्या बेटांची तसेच बच्चांच्या झाडाची रेलचेल होती. त्यामुळे नदीकाठाला गर्द झाली होती. त्यांची मुळे माती घट्ट पकडून ठेवत होती. वेळूची लागण बंदच झाली आहे. त्यामुळे जमीन तुटून पाण्याचे प्रमाण वाढले आहे. परिणामी, धूप रोखण्यासाठी वेळूची व बच्चांच्या झाडांची लागण हाच उपाय आहे.

Local news paper highlighting issue of river bank erosion and its concern in farmers in Panchanganga river basin

Considering this fact present work is undertaken to check effectiveness of geobag in erosion control on Pachganga river bank near Ichalkaranji city (Maharashtra, India).

Geotextile fabric comes in three main forms such as Non-Woven Geotextiles, Woven Geotextiles, and Coir Geotextiles. Each of these materials has its own unique properties making it perfect for the various applications in which it is used. In addition each geotextile will typically feature a different weight or strength to help meet both light weight requirements and high strength applications. The non-woven geobag is made out of technical fabric that is inhale stitched from three sides and is opened from one side. It is designed to be filled with soil and is installed while in construction of marine and hydraulic

structures. The geobags or nonwoven geotextile bags is a geosynthetic product that is made out of polyester, polypropylene or polyethylene is used for the protection of hydraulic structure and in river bank from severe erosion and scouring. Now a days, non-woven needle punched geobags are extensively used in an application of erosion control. Because erosion of soil due to flood is become a crucial problem near the embankment area of river.

According to ASTM (2005), a geosynthetic is "a planar product manufactured from polymer used with soil, rock, earth or other geotechnical engineering. Thus the term cross references "geo" (earth related) and "synthetic" (man made) (Report of FEMA 2008). These materials are now days used in restoration and prevention of degraded environment and in natural resource management. Depending on the required function, they are used in open-mesh versions, such as a woven or, rarely, warp-knitted structure, or with a closed fabric surface, such as a non-woven (Agrawal 2011).

The mode of operation of a geotextile in any application is defined by six discrete functions: separation, filtration, drainage, reinforcement, sealing and protection. Bergado and Soralump (2003) have reviewed application of geosynthetics for soil erosion control.

In addition, each geotextile will typically feature a different weight or strength to help meet both light weight requirements and high strength applications. According to Siddhartha (undated) considerable effort has gone into studying and controlling water erosion. On a problematic slope, geotextiles protect soil and seeds in the initial stages of vegetative growth.

Present study is carried to assess run off control in selected channel with installation of geo bags. Further scope is provided by this study for suitable mesh and strength for effective control of erosion over specific period of time.

II. Material and Methods:

Study area : Study area selected for present work is located near to village Abdul Lat of Shirol Tahsil in Kolhapur district of Maharashtra state (India). Site selection was carried with survey and discussion with local farmers to understand severity of river bank cutting. Geographical location of the study area is 16°40'49.98" N 74°30'28.27"E

Google imageries of the study area (16°40'49.98" N 74°30'28.27" E)

Preparation of geobags : Geobags of 60cm x 90cm size were prepared with nonwoven fabric because over woven geobag it has good filtration property, pore size, high air permeability, good abrasive resistance, fabric stability is more than woven fabric, higher thickness which ensures good puncture resistance, implemented easily. Bags were filled with sand and sewed with handy sewing machine to avoid gushing out due to pressure. Also care was taken not to fill the bags with sharp or pointed rocks to avoid tearing out of threads leading to false retention.

Installation of geobags :

a Deploying the Bags: The geobag were deployed, positioned and secured in proper position without causing any damage to it.

b Completion and backfilling: Upon completion of the geobag installation, the area was backfilled and compacted to the required specification

Geobags filled with sand ready for sewing

Laying of geobags on river bank site

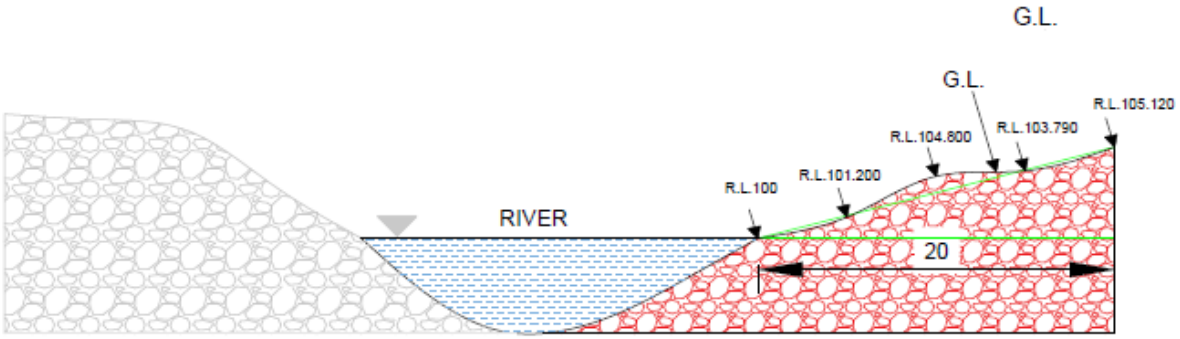
Retention of river bank due to installed geobags (post monsoon) preventing dislodging

Vegetation growth on geobag installed sites indicating natural restoration of the bank to relative stability

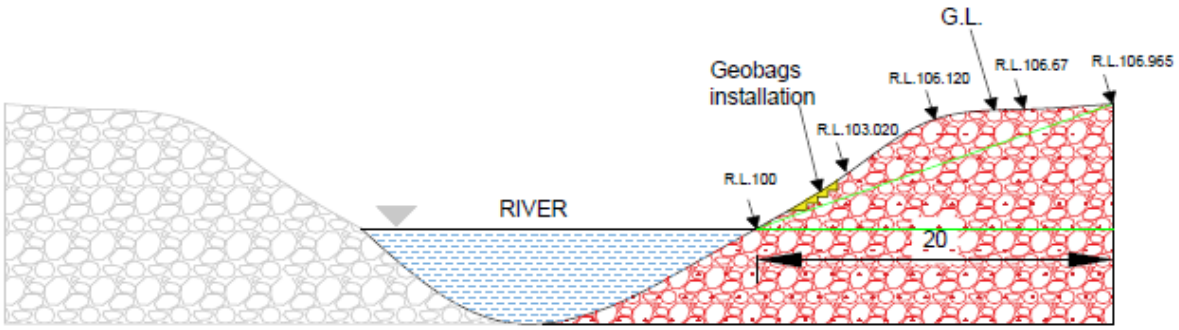
Reading bottom level of river (post monsoon)

Result and Discussion:

A comprehensive overview is taken in present paper on applications of geotextile for environmental restoration along with few civil aspects as these are many times dependent upon environmental factors.



Riverbank erosion before installation of geo bags



Riverbank retention using geobags

Area Calculation:

SPLINE Layer: "0"
Space: Model space
Color: 0,0,0 Linetype: "BYLAYER"
Handle = ec1
Length: 21.8101
Order: 4
Properties: Planar, Non-Rational, Non-Periodic
Parametric Range: Start 0.0000
End 21.7631

Number of control points: 7
Control Points: X = 2026.6414, Y = 1411.9951, Z = 0.0000
X = 2028.3326, Y = 1412.9360, Z = 0.0000
X = 2031.7271, Y = 1414.8247, Z = 0.0000
X = 2036.1539, Y = 1418.6586, Z = 0.0000
X = 2041.6766, Y = 1418.5934, Z = 0.0000
X = 2044.9888, Y = 1418.8381, Z = 0.0000
X = 2046.6414, Y = 1418.9601, Z = 0.0000
Number of fit points: 5
User Data: Fit Points
X = 2026.6414, Y = 1411.9951, Z = 0.0000
Press ENTER to continue:
X = 2031.6414, Y = 1415.0151, Z = 0.0000
X = 2036.6414, Y = 1418.1151, Z = 0.0000
X = 2041.6414, Y = 1418.6651, Z = 0.0000
X = 2046.6414, Y = 1418.9601, Z = 0.0000
Fit point tolerance: 1.0000E-10
SPLINE Layer: "0"
Space: Model space
Color: 0,0,0 Linetype: "BYLAYER"
Handle = a8f
Length: 20.8714
Order: 4
Properties: Planar, Non-Rational, Non-Periodic
Parametric Range: Start 0.0000
End **20.8226 Sq. m. cross sectional area protected**
Number of control points: 7

Control Points: X = 2026.6414, Y = 1411.9951, Z = 0.0000
X = 2028.3480, Y = 1412.2639, Z = 0.0000
X = 2031.8787, Y = 1412.8202, Z = 0.0000
X = 2036.3180, Y = 1416.1154, Z = 0.0000
X = 2041.7763, Y = 1415.3802, Z = 0.0000
X = 2045.0022, Y = 1416.5314, Z = 0.0000

According to Bhattacharya *et al* (2008) Geotextiles create a stable, non-eroding environment and, if constructed using indigenous materials, they could be effective, affordable and compatible with sustainable land management.

Present study is carried out to determine efficacy of synthetic Geotextile bags with control and experimental plots. According to Artieres, John Lostumbo (2010) traditional embankment solutions have short lifetime, are too expensive or do not comply with secret environmental regulations. An environmentally friendly embankment solution in arctic conditions, with geosynthetics bags and tubes filled with local soil, was developed and tested alone a 100 meter coastline in their study. Further they have stated that these are environment friendly solutions as compared to transport of traditional armor block.

Maurya (2013) *et al* has studied about use of geosynthetics in restoration and bank protection in case of Brahmputra river. Their study highlights the source, flow regime, complex and unique soil erosion characteristics of the Brahmaputra River and describes the case study where Geosynthetics are used as erosion control.

Tewari (1992) has described about the case study of geotextile in earthen dams. Erosion control of water retaining embankment e.g. earthen dams is one of the many problems faced by the civil engineers. Within the advent of synthetic geotextile, efforts have been put to use geotextiles as a filter layer in place of traditional granular filters.

Conclusion :

Research work in this field made it possible to arrive at certain norms regard selection of geotextile as a filter layers for effective erosion control. The use of needle punched non-woven geotextile fabric for erosion control of river basin. Slope retention prevented dislodging of river bank protecting cross sectional area during historical flood of 2019. Effectiveness of geobag in erosion control is found to be good. 350 GSM needle punched non-woven fabric is found effective for river bank retention as per floodplain conditions of the study area. Non woven geobag is found to be good because of filtration property and air permeability over woven material used in previous studies. The geotextile produced exhibited required properties for river bank retention with good performance. This work provides further scope for wide application and resistance analysis of geobag material. Vegetation restoration on area is found to be indicator of erosion control which promotes natural restoration of the area .

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