Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 153 (2016) 77 – 82

Procedia Engineering

www.elsevier.com/locate/procedia

XXV Polish – Russian – Slovak Seminar "Theoretical Foundation of Civil Engineering"

Engineering development of bank protecting devices using concrete filling textile mats

Mikhail I. Balzannikov[a], Maxim V. Rodionov[a*], Margarita G. Litvinova[a]

[a] *Samara State University of Architecture and Civil Engineering, Molodogvardeyskaya St, 194, Samara, 443001, Russia*

Abstract

The article shows the results of the analysis of constructions of bank protection devices, in which concrete filling textile mats are used. Their advantages and disadvantages are shown. It is proved that collaboration of massive concrete elements is provided for well-known technical solutions due to fine concrete straps. Such technical solution is related to the construction disadvantage. The authors indicate that damage of fine concrete straps can lead to the destruction of the whole bank protecting device. The researchers suggest the development of the construction due to strengthening bank protecting device in the zone of fine concrete straps. It is suggested to use pliable metallic strops, located inside textile mats, as inner reinforcing elements for the realization of the project. The paper provides the technical solution, devised by the authors. The developed construction of concrete filling mats will allow upgrading its strength and durability.

Peer-review under responsibility of the organizing committee of the XXV Polish – Russian – Slovak Seminar "Theoretical Foundation of Civil Engineering".

*Keywords:*hydraulic engineering; bank protection; concrete filling textile mats.

*Corresponding author. Tel.:+7-917-109-91-72.
E-mail address: rodionov_max@mail.ru

Peer-review under responsibility of the organizing committee of the XXV Polish – Russian – Slovak Seminar "Theoretical Foundation of Civil Engineering".
doi:10.1016/j.proeng.2016.08.083

1. Introduction

Bank protecting devices are related to the sphere of hydraulic construction and are used for the protection of wind waves, ice floes and prevention from entrainment of lakes', rivers' and water basins, ground dams' slopes and channels and other hydraulic constructions [1-7].

In the period from 2012 to 2015 more than 500 thousand square meters of the impound ground slopes and banks have been protected by concrete filling mats of various construction types in our country [15, 16]. Mats in the form of "pillows" of Incomat Flex type (Figure 1) are widely spread due to their constructive peculiarities, allowing sustaining wave and ice influences [17-18].

Concrete filling textile mats like Incomat Flex consist of two high-strength woven synthetic cloths, where the space between them is filled with concrete mix at the construction site. The form of a mat represents system of concrete blocks of "pillow" type, that are connected with fine concrete straps.

Filtering elements, that provide removal of filtration pressure, are located in the straps in the angular zones of blocks. Necessary form of concrete filling mats is provided by vertical communications from the woven tapes no more than 5 mm wide, which function as cables, that interconnect canvass and prevent uncontrollable expansion of a mat during the concrete mix supply. The sizes of concrete blocks of the considered types of mats don't exceed 1,5 by 1,5 m, and width of straps is 0,1 m that allows destruction of a monolithic covering within the fine straps in case of considerable external influence or a foundation settlement to provide destruction of a monolithic covering within the fine straps, preserving integrity and reliability of the whole bank protecting design.

Fig. 1.General view of concrete filling textile mats.

Theanalysisofconstructivepeculiaritiesofconsideredtypesofconcrete filling textile mats, work conditions as well as carried out field and theoretical research [19-20] revealed their considerable disadvantage. Thus, the collaboration of massive concrete blocks of mats is provided, mainly, due to concrete straps, after the destruction of which, the sustainability of the construction is provided by woven fabric. The preservation of woven fabric during the whole time period of bank protecting constructions, according to authors, is not likely to happen, and can lead to the deformation of the rakers, soil grain entrainment of the slope and destruction of bank protecting construction.

In order to improve the safety of the existing concrete filling mats it is necessary to apply additional constructive solutions that allow normal functioning of concrete elements of textile mats and after concrete destruction in the straps.

2. Research

The identified shortcomings of the existing types of bank protecting devices using concrete filling textile mats show two ways of their construction improvement: introduction of additional elements in order to provide collaboration of concrete blocks and after the destruction of concrete in the straps; introduction of additional