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Procedia Engineering 153 (2016) 456 – 460

Procedia Engineering

www.elsevier.com/locate/procedia

XXV Polish – Russian – Slovak Seminar “Theoretical Foundation of Civil Engineering”

The use of crusher-run aggregates of reinforced concrete frames when reconstructing hydraulic structures

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Abstract

There is a significant amount of wastes during the reconstruction and overhaul of hydraulic structures such as crushed reinforced concrete frames. The wastes must be disposed afterwards which leads to a substantial increase in costs. To use the waste products there must be appropriate comprehensive study and science technical justification. On the basis of the proposed solutions, recommended practice for the use of crusher-run aggregates of reinforced concrete frames when reconstructing hydraulic structures has been developed. To study the possibility and feasibility of using recycled rubble solutions for the reconstruction of the overflow dam have been developed. The authors proposed justification and design solutions that allow using the dismantling products in the elements of spillway structures by applying macroporous concrete.

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

Keywords: hydraulic structures, spillway structures, dismantling products, crushed reinforced concrete frames.

1. Introduction

Any structure has a certain lifetime after which it is necessary to carry out repairs or replace the operated facility to a new one. During construction works there is a large amount of various wastes. A list of recyclable wastes depends on many factors including the purpose of dismantling structure. On the territory of the Samara region there are several tens of hydraulic and environmental structures. Most of these buildings are in poor condition and require

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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.2016.08.156

urgent replacement or repair of the whole building or its part [1-9]. Dismantling and repair works that are carried out on the hydraulic structures are usually associated with the formation of a large amount of wastes such as concrete and soil wastes which are disposed in landfills. Waste management does not only require additional financial costs, but also linked to the loss of valuable secondary resources. The main objective of the research is to study the possibility and feasibility of the formed wastes usage as secondary resources while carrying out repair works on hydraulic structures

2. Research

In order to determine the application of recycled reinforced concrete wastes the authors conducted a full-scale survey of a number of hydraulic structures in the Samara and Saratov regions. One of these structures is located on the Teplovka River, 13 km upstream from the village Lomovka in the Perelyubsky District of the Saratov region. Hydraulic power system and Teplovskoye reservoir were created in 1956.

The structure refers to the objects of class IV. It occupies an area of about 2.0 hectares. The state of all the main elements of the object was carefully studied including the base, the foundation, walls, spillway, piles, floors and pavements, etc.

The characteristic elements state is shown in Fig. 1 a. As seen in the figure, the cantilever spillover has through-holes, the most of the protective concrete layer is missing. Also, there is an exposure of reinforcing bars. Washout of the foundation soil leads to the further destruction of the element.

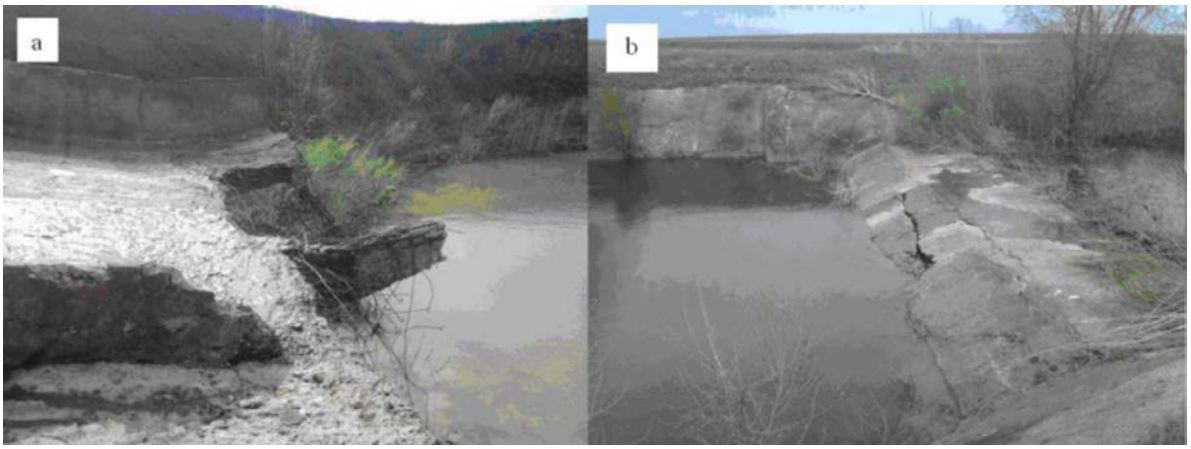

Fig. 1. A view of the structure: (a) the cantilever spillover; (b) overflow dam

The other elements of the structure are in the same emergency state. Ice protection structure is partly destroyed; the existing part of the structure is deformed. The overflow dam also has cracks and destruction of the protective concrete layer (Fig.1 b). Fixing plates forming inlet and outlet area of the approach and intermediate channel are partly destroyed. There is a significant narrowing of the channels working section due to sedimentation and retention of trees and shrubs.

According to the preliminary integrated estimates, in order to restore the structure (new chute installation, beams and grillages, fixing plates and others) would take about 360 m3 of reinforced concrete. To reduce construction costs the authors propose to use the remaining destroyed reinforced concrete of the structure as a secondary resource.

First, it is necessary to prepare reinforced concrete wastes: to sort wastes, to separate reinforcement from concrete wastes. It is also recommended to recycle the wastes using a mobile crusher to proper sizes. In the future, the resources obtained can be used as a rigid filter fill during repair works on the hydraulic structure. Besides the concrete wastes of the structure, construction concrete wastes as well as defective reinforced concrete products can