TECHNOLOGY OF APPLICATION OF FINE-GRAINED MONOLITHIC CONCRETE STRUCTURES IN HYDRAULIC CONSTRUCTION

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ABSTRACT

The scientific articles are considered to produce the production of fine-grained concrete and improving the properties of basic granular concrete on the wastes of carbonate rocks for hydraulic structures, the development of construction technology with the structure of oil-granular concrete. The fight against water supply in the channels is selected in connection with the compatibility of the hydrogeological conditions of the region, the cost of reducing costs to the length of the channel, soil filtering and related to local materials. In addition, data and conditions for technological process of concrete coatings in hydraulic structures are given. Moreover, economic efficiency of complex concreting technology for 1m^3 is 1361.6 tenge and for 1000 p.m. it shows that the channel package is 612720 tenge.

Keywords: concrete coatings, fine-grained concrete, channel, soil filtering, anti-filtering coatings, carbonate rocks, cement, monolithic structure.

INTRODUCTION

The Republic of Kazakhstan has a huge territory, in the limits of which there are a large number of localities where there is an acute lack of water for irrigation, meeting the drinking needs of the population, water cattle, etc. It is possible to resolve this situation by building special water facilities - channels, intended for transporting water to the consumer from a water source.

The problems that arise in the operation of canals are known throughout the history of hydraulic engineering. They lead to environmental consequences such as rising groundwater levels, bogging, secondary salinization of soil, acidification, alkalinization of soils, etc. The root cause of these consequences is the loss of water from the channel bed to the filtration.

There are many technically possible ways to combat filtering from channels. However, only those of them that will meet the basic requirements imposed on them at the moment, that is, a decrease in the loss of water in the channels not less than 2…3 times, the widespread use of local building materials and the complete mechanization of the entire construction process, can receive practical application only.

The most effective solution to this problem is the arrangement of a different kind of anti-filtration garments. One of such anti-filtration measures is the installation of monolithic concrete cladding. By the method of complex concreting is meant the combined use of conventional and dry concrete mixtures, at which they are alternated in layers[1, 2, 3].

From the practice of irrigation construction it is known that, due to water losses for filtration, evaporation and idle discharges to the consumer, sometimes it does not exceed 50% of the water taken in the head of the channel. This significantly increases the cost of the channel, requires an increase in its capacity, the design section at the head, which leads to additional volumes of excavation, an increase in the area of alienated land, in addition, the saturation of the soil in the immediate vicinity of the channel can lead to loss of stability of external dam slopes, and with the landing ground - to the draft of the hydraulic structures and their destruction[4,5].

Significant damage to the national economy is caused by flooding of territories adjacent to the canals. In the absence of anti-filtration coatings, significant leaks lead to a rapid rise in the water table. When the level rises, water evaporates and the soil layer becomes saline.

At present, fine-grained concrete is used more widely for manufacturing a number of structures and products in civil and industrial construction. The expediency of their application is due to the fact that some areas are not provided with a large filler of proper quality. Using instead of the imported large aggregate of local sands and stone crushing waste allows reducing the cost of concrete and reinforced concrete structures [6, 7].

In this regard, the use of various anti-filtering coatings is the most effective solution to the problem. Installation of fine-granular casting concrete packaging along the channel is one of the anti-filter activities. Here, cement costs are 20-30% higher than concrete with large fillers. However, using various technological methods, in addition to the introduction of chemical additives to small granular concrete, you can reduce the cost of cement and improve the construction and technological properties of concrete. In the production of gravel from carbonate rocks, there are many wastes that belong to the largest sand, and the main part remains in heap. They are very effective to use them as a filler to fine-granular concrete and significantly expand the raw material base.

EXPERIMENTAL PART

In order to reduce water consumption and costs, transportation by water-packed channels increase the coefficient of performance (efficiency) of irrigated systems can effectively coordinate and spend water resources.

VOL. 17, NO. 13, JULY 2022 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

There are not many evaporation costs depending on climatic conditions and the area of the water surface. The cost of evaporating water in the channel, including the length of 1 km:

$$E = 0{,}016 \cdot h \cdot J(a + 2\varphi), \quad (1)$$

here: h- Depth of water in the channel, m; J- evaporate flight, m /day; a- width of the water surface, m; φ- Length of the channel wall, m.

Evaporation costs do not affect areas close to the channel as the costs of filtration.

The use of strict coatings - small and medium channels do not eliminate the problem of grass printing, but the water allows you to transport at high speeds and make it difficult for the channel and growth and growth of the plant.

Figure-1 shows the types of packaging structures [8].

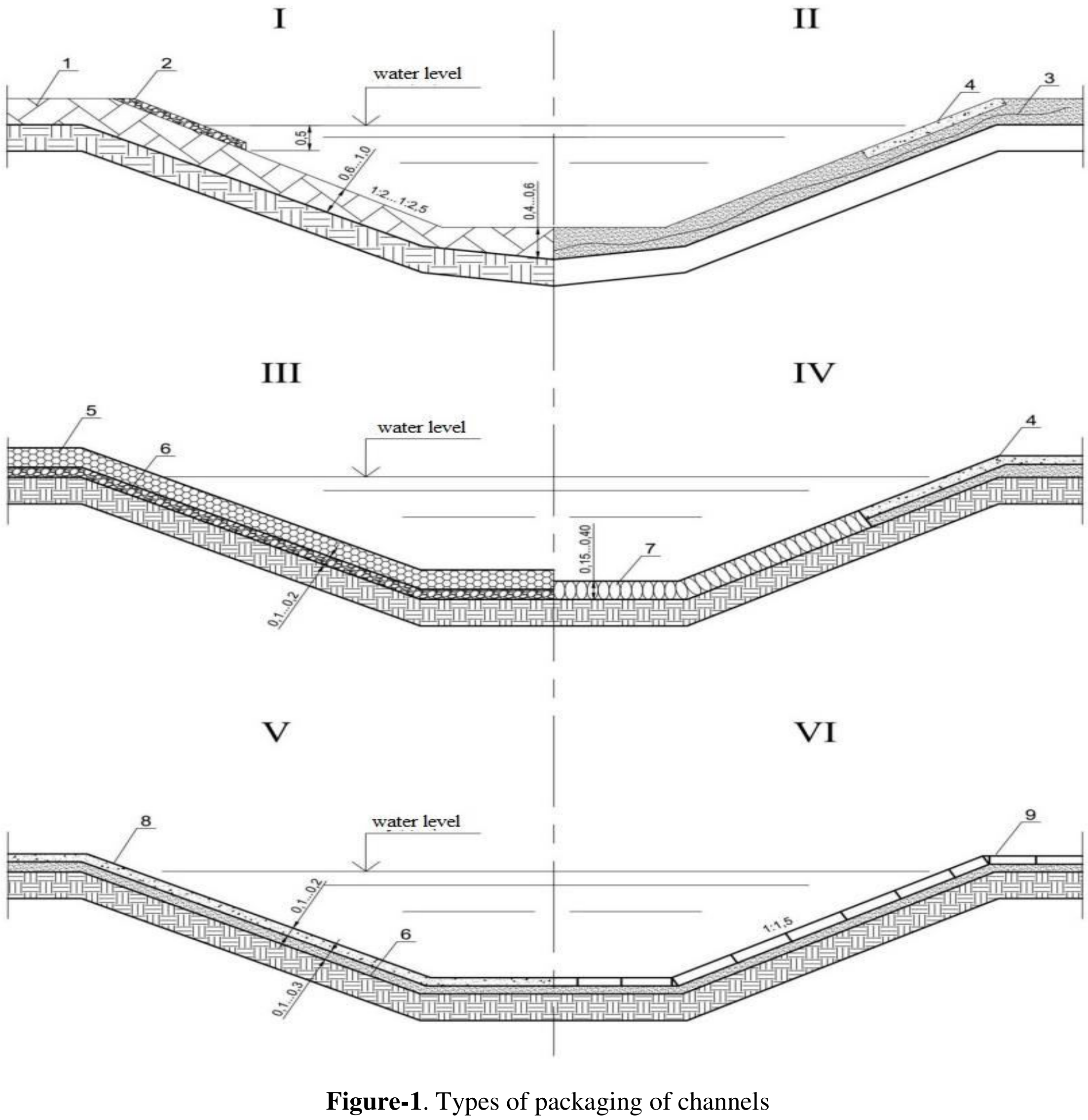

Figure-1. Types of packaging of channels
I - clay screen packaging; II - polymer membrane packaging paved with trench and perimeter scheme; III, IV - stone packaging, respectively; V, vi - casting and prefabricated concrete packaging. 1- clay shield; 2- protective cover made of gravel; 3- polymer film; 4 - protection of the protective of concrete slabs; 5 - stone dump; 6 - mala stone-sand preparation; 7- segmented lining; 8 - cast reinforced concrete coating; 9 - close of prefabricated concrete.

Currently, small granular concrete are widely used to produce reinforced concrete products in the field of hydraulic construction and to build ingots. Their effect is determined primarily by the absence of large fillers of concrete in some areas. The use of local sand or rock crushing waste instead of large filling stones imported from other sides allows you to significantly save resources. The solution to this problem is that there is cheap and local raw materials. These include the wastes of crushing production of rocks [9].

In the production of gravel from carbonate rocks, the size of the large sand particles (fractions) is a significant amount of small grain, which remains 0 ... 5 mm. These particles are considered a production balance of large warehouses and dumps, and these are polluting the environment and complicate the environmental situation. The volume of such waste is constantly growing at the enterprises of construction materials. Increasing the volume of production of small fractions of gravel and the current costs of granules grow significantly.

Thus, it is an optimized technological solution for the use of carbonate rocks based on low-yielding raw materials in the form of gravel. Its implementation should be conducted on the basis of man-made raw materials to create methods and composition of fine-grained concrete.
In the field of hydraulic construction, fine-grained concrete is widely used. Channels and hydraulic structures use natural quartz and quartz steppe sands in fine-grained concrete used to coat water accessories (sites).

In the issue of increasing the characteristics of the use of plasticized fine-grained concrete concrete for hydraulic structures, S.Alexashin was designed for other scientists [10,11]. These studies showed that the strength of fine-grained concrete, as well as frost resistance and waterproofing. The results of experimental research conducted to select the optimal rates of components are given.

A portland cement produced at the Shymkent plant was used as a connecting component. Interstate standard (GIP ST-8736-93 as fillers in accordance with the requirements of the "sand" of the Zhosaly field, quartz sands of the Zhosaly field, dolomite small granular gravel (GIP ST 8269.0-97) were used residue from the gravel deposit of the Shalkiya field [11].

Used well-known surfactants , which includes moderate to modification of models and resilience in the production of concrete and reinforced concrete products as chemical additives: C-3 supple density - 1.18g / cm^3, working concentration - 35%; - Dry Technical Lignosulfonate (LST) in accordance with the requirements of OST 13-183-83; Tuber 81-05-2-78 complying with the requirements of the soapy wooden shield (SWS).

The suitable position of cement-sand additives is determined by the requirements of the metal (vibrator) in accordance with the requirements of GS 310.4-84.

Completion of low-rolling cement-sand additives, oscillating amplitude 0.4 ... 0.5 mm, frequency - 50Hz, with a laboratory vibration platform - 0.2 ... 0.3 kPa pressure, and strict sand impurities - 0.7. ..0.8 mm ampluts, the feed-up-50Hz and 10 kPa pressure.

The long-term hardening of concrete samples was performed in a temperature of 98%, 20 + 2 ° C [11].

The viability and endurance of concrete depends on the density of cement stone and concrete structure of water supply, frost resistance, aggressive environment.

In a mixture of filtering liquid forms a directional porosity of several thin capillary cavities. This direction appears on the outer layer of chest concrete, which are focused on the outside. In our case, the structure of the structure of the channel packaging is made of dry concrete mix, the porosity is directed to the inside.

The concrete mix of capillary pores can be reduced by compaction with vibration. Vibration and compaction of the concrete mix for the second time, the integrity of the cement gel restores the highest level compared to the energy level by redistribution of fluids that arise between the actual surfaces and the volume of new formations will increase. It promotes the increase in the density of the formation and increase the energy of communication between them, due to the strength and density of concrete.

User properties of the channel cover: strength of the compression; waterproofing of packaging structures; frost tolerance; anti-corrosion tolerance; Dependence of pressure on the upper floor of water; The effect of the temperature in the water saturation was determined by laboratory work.

To increase the waterproofing of concrete, many methods are used - to add organic and hydrophobic (waterless substances), inorganic additives, condensed substances, condensed substances and thermoplastic polymers; saturation saturation with special substances after special shells, hydrophephobilization of the concrete surface; Closure with special shell-forming tools; saturation after polymerized monomer.

Determination of waterproofing of the packaging structure is carried out according to the accelerated method in accordance with the requirements of GIP ST 12730.5-84.

Analyzing of the obtained results, the composition of the mixture and secondary reduction with a vibrator reacts to the conductivity of the concrete, conclude that it reduces waterproofing.

One of the most tolerant of concrete is its frost resistance. Frost tolerance is the ability to resist the concrete to freeze and fight many times in a saturation of the water[12]. During freezing, the volume of water increases by 9%. An extreme skeleton of concrete interferes with water increases, which can occur very high voltage. Return of freezing and dissolution leads to reducing the strength of concrete structure and its destruction. When the freezing temperature decreases, the concrete is damaged quickly when freezing in water or salt solutions.

Determination of frost resistance of concrete is carried out in accordance with the requirements of GOST 10060.1-95.

Because the structures of channel packaging work under water and in water, in case of freezing and thawing, they are given minimum requirements for frost resistance, which corresponds to the F150 stamp. Therefore, it is necessary to check how new technologies of complex concreting are in line with these requirements.

Depending on the component of the mixture, the number of the structure (repeated part) is 75 ... 100. It fits F75 and F100 stamps.

According to the test results, there is a positive impact on high frost resistance of concrete. This is due to the possibility of capillary pores to be removed by vibration.

ARPN Journal of Engineering and Applied Sciences

When using concrete structures, it may be exposed to aggressive environments that lead to their damage. In this case, the concrete is caused by low resistance.

The development of hydraulic structures in the area with aggressive groundwater requires issues that ensure long-term confrontation.

The geological condition of Kyzylorda region is characterized by high sulfate aggressions of groundwater, which reduces long-lasting hydraulic and reclamation structures in the region.

One of the ways to increase the anti-sulfate resistance of hydraulic concrete is the use of carbonate sands as a fine filler. To solve this problem, it is necessary to study the anti-corrosion stability of carbonate filler concrete in a sulfat aggressive environment. The presence of an aggressive environment depends on the level of impact on temperature, liquid and speed, concrete structures of liquid medium. Construction standards for corrosion protection of construction structures (GIP ST 2.03.11-85) determine the level of their aggressive effects.

The aggressive effects of soluble salts and other reagents meet small porous concrete, high-porous concrete.

An important condition for obtaining quality coating of the channel is the technological connection of the main technological processes. These include: isothermal heating temperature, length of thermoactive form, length of heat-insulating coating, the second vibration effect. All these processes are directly related to the speed of the concrete placement.

Conflicts of conversion depending on isothermal heating time and length of the form can be determined by the following formula [13]:

$$V_{form} = \frac{L}{t}, \text{ m/hour;} \quad (2)$$

here: V_{form}- the speed of the form; L- the length of the form, m; t- time of strength collection depending on isothermal heating temperature, hour.
If t=3;4;5 hour, then:

$$V_{form} = \frac{10}{(3;4;5)} = 3{,}3;2{,}5;2 \text{ m/hour} \quad (3)$$

The speed of thermoet-shaped moving is 2 ... 3.3 m / hour.

For this purpose, special technological equipment in the form of a vibrator has been installed. Its location is determined by the speed of the facial movement:

$$l_{br} = V_{form} \cdot t_1 = (2...3{,}3) \cdot 0{,}75 = (1{,}5...2{,}5) \text{ m} \quad (4)$$

here: t_1- 0,75 hour - the third vibrator is calculated from the end of the operation of the shaft, the start time of the second vibration compaction.

If the entire temperature interval that affects heat is covered by 20 ... 80 ° C, it is necessary to set it so that it can move on the required interval through qualified volatile special regulators that compact the second time.

This factors can be determined the length of heat-moisture insulating coating, taking into account these factors and speed (V_{form});

$$L_{co} = V_{form} \cdot t_{ent} = (2...3{,}3) \cdot 3 = 6...10 \text{ м} \quad (5)$$

The power capacity of the concrete placement machine (P_{max}, kWt) is determined by the cost of the hourly performance of the concrete placement machine (P, m^3 / hour) and 1m heating:

$$P_{max} = P \cdot W, \text{ kWt} \quad (6)$$

here: P- hourly productivity of concrete spreader, m^3/hour:

$$P = V_{form} \cdot F \text{ kWt m}^3\text{/hour} \quad (7)$$

here: F- area of the cross-section of the packaging (m), F=0,450m^2.

Then, P=(2..3,3).0,450=1,0..1,6m^3/hour.

Electricity's own consumption depends on the heat capacity of the newly-placed concrete and the amount of temperature increase in the heating process.

$$W = \frac{C \cdot \gamma}{864} \Delta t, \frac{kWt}{kg \cdot \circ C} \quad (8)$$

here- W-1m electricity consumption spent on the heating of concrete, kWt/kg ^{0}C;
C- Heat capacity of concrete, kJ/kgºC, C=0,131kJ/kg· ºC;
γ- average density of the newly-placed concrete, kg/m^3, γ= 2400 kg/m^3;
Δt- the difference between the average values of the last heating temperature of the concrete heating temperature and the initial temperature of concrete, ºC, Δt= 60 ºC;
864- electrical equivalent of heat, kJ/kWt·hr.

$$W = \frac{0{,}131 \cdot 2400}{864} \cdot 60 = 21{,}8 \frac{kWt}{kg \cdot \circ C}$$

Then, the maximum performance of the concrete placement machine and is the largest of isothermal heating temperature:
P_{max} =1,6.21,80=34,88 kWt- болады.

Further, the calculated estimated power is determined by the type of maximum power used for heat treatment of concrete, and the following condition is deposited:
$P_{cal} \geq P_{max}$

ARPN Journal of Engineering and Applied Sciences

For these preconditions, a 35 kW diesel power plant will be required.

The economic efficiency of the production of fine-grained concrete products consists of reducing the cost of production of flowing channel production and increasing their long-term consumption [10].

RESULTS AND DISCUSSIONS

Compared versions are: The main version - installation of single-storey casting concrete coatings of channels based on traditional construction technology; The recommended version is to create multi-storey channels on complex concreting technology.

Table-1. The comparative calculation of the cost of concrete 1m^3.

No	Materials	Unit of measure	Price of unit of measurement, tenge	Cost rate		Cost, tenge	
				For heavy concrete	For fine-grained concrete	For heavy concrete	For fine-grained concrete
1	Portland cement m400	t	20000	0,49	0,4	9800	8000
2	Gravel	t	6000	1,15	-	6900	-
3	Sand	m^3	1200	0,55	-	660	-
4	Dolomite sand	t	5000	-	1,6	-	8000
5	Water	t	80	0,19	0,17	15,2	13,6
6	C-3	kg	140	-	2,0	-	
7	LST	kg	62,5	-	0,6	-	
Total						17375,2	16013,6

In order to identify the options, the structure of the frost-resistance is based on the design of 400 cycles. Conditions obtained to calculate economic efficiency:

- is carried out to 1000 pogon meters of the external channel design;

- The size of the necessary concrete for 1000 pogon meters of the data plan is 450 m^3,

Calculation of the cost of creation of 1m^3 concrete and 1000 channel designs was performed according to Table-2.

Table-2. Cost of channel design

Indicators	Unit of measurement	The main version	The recommended version
1 m^3 Concrete price	tenge	17375,2	16013,6
1000 p.m. of channel packaging cost	tenge	7818840,0	7206120,0

Economic efficiency that can only use complex concretion technology of three-layer monolithic structure:

-1m^3 for concrete mix Э=17375,2-16013,6=1361,6 tenge.

-1000 p.m. for canal packaging Э=7818840,0-7206120,0=612720tenge.

Undoubtedly, these indicators are achieved through the economic efficiency that can be used by the use of complex concreting technology, in the same way through the savings of cement.

CONCLUSIONS

Based on the analysis of the experience of construction and use of monolithic concrete structures of irrigated system channels, it can be concluded that it is necessary to improve the design of irrigated system channels and methods of their construction. Scientific analysis of the study of the state of construction of monolithic structure of channels identified the main purpose and research objectives of the work.

Thus, based on the analysis of the received indicators, the basic technological processes of irrigated systems, which allow to obtain high-quality structures of water channels of irrigated systems.

The economic efficiency of application of complex concrete structures of channels and the use of fine grained concrete is 1361.6 tenge per 1 m^3 and for 1000 p.m. concrete mix - this shows that the channel package is 612720 tenge.

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