CALCULATION METHODS OF FLUID TRANSPORT IN GROUND CHANNELS

Bozorov B.E.
Assistant
“TIIAME” NRU Bukhara Natural Resources Management
E-mail: bozorovbuston@gmail.com

Khakimov K.Z.
Assistant
“TIIAME” NRU Bukhara Natural Resources Management
E-mail: qurbon_2454@mail.ru

ABSTRACT

Currently, there are many studies conducted in our republic on the deformations of underground irrigation canals, but they cannot fully cover all the factors that affect the deformation of the irrigation canals. The task of developing the methods of calculation of non-washing velocities and liquid transport in open soil channels is revealed.

Keywords: channel, energy, water carrier, irrigation, discharge, pumping station, water source, ground, transport speed, underground discharge.

The existing calculation methods for calculating the transport of liquid in open basins are very important, the structure, geology, topography, strength of the channels, as well as the analysis of the scientific works on establishing the transport speeds of the water flow in the channels, are presented.

According to the purpose of use, canals are divided into the following types: energy, navigable, water-carrying, irrigation, reclamation, complex, and others.

If water flows from a water source to a canal under the influence of gravity, it is called a flowing canal. These channels are more common, they are cheap and easy to use. Examples of such channels are “Katta Fergana” and “Karakum”.

If water is raised from a water source with the help of pumping stations, and then flows by itself, such canals are called machine canals. These channels are built in the following situations:

- if the water source is below the place of water consumption;
- if large-scale earthworks are performed during the construction of the self-flowing channel.

Examples of these channels are the main channels "Amu-Bukhara" and "Karshi".

According to geological conditions, the channels are divided into soft and hard ground channels. In canals built on soft (sand, supes, clay, loess, clay, etc.) soils, it is necessary to make the slopes of the sides more flat and protect them from ship waves, limit water flow speeds, and in some cases, carry out anti-filtration works. Protection against the effects of ship waves is required in channels passing through hard ground. But in these channels, high water velocities can be allowed.

Channels passing through soil can be coated or uncoated. Coated channels have protective coatings that eliminate or reduce water filtration. The coating protects the channel from the effects of waves and wind and prevents damage to the side slopes. Covered channels with one cross-section along their length will have a much greater water-carrying capacity. Uncoated channels, i.e., channels that pass through ground valleys without a protective coating, are called ground channels. They are divided into solid and non-solid channels. In solid channels, the shape and size of the channel, as well as the longitudinal slope, do not change over time. In unstable channels, the opposite is true, and a lot of fine-tuning is required.

Although the problem of water flow transport speed has been dealt with since the 17th century until today, this question has not been solved to the end. At present, several empirical and semi-empirical formulas have been proposed for determining transport velocities in bound and unbound soils. These are mainly derived from different approaches to particle limit equilibrium or by introducing coefficients that take into account various factors affecting soil leaching.

Formulas for determining water flow transport speeds in unbound soils are shown in Table 1.

Table 1

Existing formulas for determining the non-washing velocities of water flow in unbound soils

The authors of the formula	formula
Dyubua	$\vartheta_0 = A_1\sqrt{\gamma_1 - 1}\sqrt{gd}$.
V.N.Goncharov va G.N.Lapshin	$\vartheta_0 = 1{,}25(1 + 0{,}014/d)^{0{,}3}\sqrt{gd}\,(h/d)^{0{,}2}$.
V.N.Goncharo	$\vartheta_0 = 0{,}95\sqrt{gd}\,\lg(8{,}8h/d_{\max})$
I.I.Levi	$\vartheta_0 = a_1\sqrt{2/\lambda}\sqrt{gd}$ where a1 is the accumulation characteristic (determined by the shape of the particle in the turbulent zone); - L coefficient of friction.
V.S. Knoroz	$\vartheta_0 = af\,(Re/d)\sqrt{\rho' gd}$, where $\rho' = (\rho_1 - \rho)/\rho$; $\rho_1 -$ particle density;r – density of water.
A.M.Latыshenkov	$\vartheta_{\max 0} = 1{,}6\sqrt{gd}\,(H/d)^{1/5}$
B.I. Studenichnikov	$\vartheta_{\max 0} = 1{,}15\sqrt{gd}\,(H/d)^{1/4}$

G.I. Shamov	$: \vartheta_{\max 0} = 1{,}4\sqrt{gd}\,(H/d)^{1/6}$
S.Ye.Mirsxulava	$\vartheta_{adm} = \left(\lg \frac{8{,}8h}{d_m}\right)\sqrt{\frac{\gamma_c\left[g(\rho-\rho_\omega)d_m + 2C_{yn}k_c\right]}{0{,}22\rho_\omega\gamma_\vartheta}}$; $\vartheta_{\Delta adm} = 1{,}25\sqrt{\frac{\gamma_c\left[g(\rho-\rho_\omega)d_m + 2C_{yn}k_c\right]}{0{,}22\rho_\omega\gamma_\vartheta}}$,
Yu.A. Ibad – zade	$\vartheta_{\text{Д}0} = \sqrt{\frac{2\text{л}_{\Phi}F}{k_{\text{л}} + k_{\Pi}F}\frac{\rho_1-\rho}{\rho}gd}$ and $\vartheta_{\ddot{A}0} = \sqrt{2\eta\rho' gd} = a\sqrt{gd}$, here $\eta = k_{\hat{O}}F/(k_{\ddot{e}} + k_{\ddot{I}}\,F)$ - strength coefficient of the core; $k_{\hat{O}}$ - particle shape coefficient; $k_{\text{л}}$ k_{Π} coefficients of surface and lifting forces ($k_{\text{л}} = 0{,}4 \div 0{,}45$ $k_{\Pi} = 0{,}25k_{\text{л}}$); $F = 0{,}19d/(0{,}52d^{1/2} - 0{,}009)$

Analyzing the above connections, we admit that the main factors of unconnected and connected ground reflected in normative documents are the formulas of S.Ye.Mirskhulava that are fully taken into account. These depend on the depth of flow, the relative engagement between soil particles and the content of soluble salts.

One of the main requirements for the design of underground canals is to create an efficient system that can transport a given amount of water and liquid in the canal and does not require large operational costs during its entire period of use. Depending on the operating conditions of the designed canal, there is a need to solve the calculation problems of soil canals in the conditions of drainage and mixing. Some irrigation systems operate in the absence of sewage transport or despite the sufficient level of flow clarity, it is a common feature of soil canal flow. is considered to move the solid material. Forecasting the amount of groundwater in this process is one of the main issues of watershed hydraulics. Another issue related to the problem of fluid transport is that in most cases, the movement of groundwater is observed by the occurrence of riffles under the bottom of the channel. below) can be much larger than the values.

The basis of the proposed calculation methods is the capacity of channel transport, the formation of additional hydraulic resistance of the shifting bottom, and the amount of discharge into the channel.

For the calculation of all considered processes, steady-state water, and effluents are assumed.

All calculation methods are relative width $\frac{B}{h} > 10$ It is suitable for trapezoidal and parabolic channels. However, these calculation methods can also be used for channels with a relatively small width.

Setting the problem leads to the determination of the following characteristics: the width of the water level of the channel; hydraulic radius; average flow speed; underground hydraulic resistance and slope; underground, suspended, and total comparative discharges. The equation of continuity and Shezi's formulas of plane motion are used as a basis for solving the problems:

$$Q = \omega C\sqrt{Ri} \qquad (1.1)$$

$$\vartheta_{ўр} = C\sqrt{Ri} \qquad (1.2)$$

here S-Shezi koefficient.

In the following places, the analysis of accounting connections $\frac{B}{h} > 10$ we will limit ourselves to looking at large soil channels and in these $R \approx h_{cp}$. This approximation leads to some deviations in the values of hydraulic gradients and discharge transports. This error of the method is corrected by introducing the slope to be determined in the following mathematical equation.

$$\bar{i} = \left(h_{ўр} / R\right)i \qquad (1.3)$$

here i - slope corresponding to a right-angled channel.

CONCLUSIONS

1. Because many physical and mechanical factors affect the deformable stream, they cannot all be taken into account at the same time.

The discharge consumption of the flow is variable according to its physical nature, and its numerical values can be established only by conducting experimental studies. Even though the development of new hydraulic-based calculation methods for calculating the consumption of water has high performance, in many cases, the consideration of new factors is solved based on hydraulic laboratory research.

2. At present, the available recommendations on the assessment of flow discharge are taken for the conditions of a flat flow, and the influence of the channel shape on the hydraulics of the flow is little studied. Although this issue is not important for natural wide riverbeds, it is important to study the distribution of velocity and tangential stresses on the side slopes of the riverbed for irrigation and melioration channels designed at different flow speeds.

Experimental studies have shown that in the process of increasing the water flow speed in trapezoidal channels, first the junction zone of the bottom and side slopes is washed, and then the coastal part, and this causes the washed water to lie in the central part of the channel.

3.As a result of laboratory research on flow transport in trapezoidal channels with different side slopes with granular soil, semi-empirical relationships determining the consumption of underground and suspended effluents, as well as the formula for determining the concentration of effluents were created.

Based on these obtained connections, calculation methods for determining fluid transport in trapezoidal channels with different side slopes with granular soil were proposed.

REFERENCES:

1. Arifjanov A.M., Raspredeleniye vzveshennых nanosov v stasionarnom potoke // Vodnыye resursы.- M, 2011.- №2.- s.185-187
2. Arifjanov A.M., Fatxullayev A.M., Samiyev L.N. O‘zandagi jarayonlar va daryo cho‘kindilari. Noshirlik yog‘dusi.- T, 2017. – b .100-106
3. Aripov M., Settiyev Sh. K chiyelennomu modelirovaniyu techeniya sloya jidkosti nad peyechanыm dnom. // Dokl. Akad.Nauk Resp. Uzbekistan. Tashkent: 2006, № 6, s.50-53.
4. Bazarov D.R, Nishanbayev X. A., Artыkbekova F. K., Raimova I. D., Bobokandov Sh. R., Xurazbayev M. R., Absoatov M. U. Matematicheskoye modelirovaniye upravleniye rejimom ekspluatasii Amu-Buxarskogo mashinnogokanala,INTERNATIONAL ACADEMY JOURNAL Wye bof Scholar 1(19), Vol.1, January 2018,Warsaw, Poland, 00-773 Wyebsite: https://ws-conferencye.com/ str.26-32.
5. Baymanov K.I., Kalbayev R.Z. Pereformirovaniye rusla verxnego byefa Taxiatashskogo gidrouzla. // Problemы mexaniki. 2009 № 5-6, s.44-47.
6. Baymanov K.I., Shaniyazov G.T. Gidravlicheskoye soprotivleniye legkodeformiruyemых rusel. // Problemы mexaniki. 2006. №4, s. 23-26.
7. Belolipeskiy V.M., Genova S.N. Vыchislitelnыy algoritm dlya opredeleniya dinamiki vzveщyennых i donnых nanosov v rechnom rusle. // Vыchislitelnыye texnologii t.9, №2, 2004. s.14-19.
8. Abalyans S.X. Ustoychivыye i perexodnыye rejimы v iskusstvennых ruslax. - L.: Gidrometeoizdat, 1981. – 159-166 s.
9. Altunin V.S. Meliorativnыye kanalы v zemlyanых ruslax. – M.: Kolos, 1979. – 102-113s.
10. Xojamuratova, R. T., Jumayeva, T. A., Qodirov, Z. Z., & Bozorov, B. E. (2023, February). Study of changes in soil-reclamation characteristics during collector-water

irrigation. In IOP Conference Series: Earth and Environmental Science (Vol. 1138, No. 1, p. 012038). IOP Publishing.

11. Muratov, O., Muratov, A., Yakubov, Q., Khalimbetov, A., Bozorov, B., & Khikmatov, F. (2023). Experimental estimation of the parameters of crack progression in concrete. In E3S Web of Conferences (Vol. 410, p. 02052). EDP Sciences.
12. Явов, А., Бозоров, Б., & Амонов, Д. (2021). КАНАЛЛАРДАГИ ФИЛЬТРАЦИЯГА ҚАРШИ ҚОПЛАМАЛАРНИ ДЕФОРМАЦИЯ ЧОКЛАРИ ПАРАМЕТРЛАРИНИ ХИСОБЛАШ. Матеріали конференцій МЦНД.