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DISTRIBUTION OF VELOCITIES ALONG THE SECTION OF A COHESIVE EARTHEN CHANNEL

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Abstract: *Abstract: In this article, the kinematic characteristics of water flow in connected ground channels are considered. Based on the obtained experimental data, the distribution of velocities on the channel cross-section was studied and connections were obtained.*

Key words: *soil cohesion, shear resistance, normal stress, angle of internal friction, cohesion force, tensile strength, flow velocity.*

The distribution of velocities along the section of the channel bed depends on many factors, for example, the shape of the channel, bottom undulations, depth of flow, slope of the water surface, deformation of the bed, etc. These factors affect the speed field in different ways, complicating its representation. However, it is necessary to know the speed calculations in order to solve the problems related to the study of the kinematic characteristics of the hydraulics of open waterbeds. This situation leads to finding an analytical solution to the simple problem of the distribution of velocities over the depth of a non-deforming smooth flow, i.e.

$$\bar{u} = f\left(z, \frac{h}{\Delta}\right), \qquad (1)$$

here is $\bar{u}$ - the average local speed; z – vertical ordinate; h - flow depth; Δ- the height of the bump.

There is no solution even for this simple case. As we know, it consists of a system of non-closed equations representing the velocity field of a turbulent flow. Finding a particular solution to this equation often involves a variety of physical considerations and constraints, as well as a large number of field experimental data.

We pay attention to the distribution of the values of the speed obtained during the experiments on the cross-section of the core, without going into the mathematical analysis of the speed distribution.

The universal logarithmic law of speed distribution is given by L. Prandtl-Karmanlar:

$$u = 2,5u_* \ln \frac{z}{h_0}, \tag{2}$$

here is u_* - dynamic speed.

We know that this equation takes the following form for rough surfaces:

$$u = 5,75u_* \lg \frac{30z}{k} \tag{3}$$

or

$$\frac{u}{u_*} = 5,75 \lg \frac{30z}{k}, \tag{4}$$

here is k - the proportionality coefficient, which can be taken as 0.4 according to research.

According to this equation, we express the speed of distribution of turbulent flow on a rough surface. In this case, we take the coefficient *k* equal to the average diameter of the particle.

Let's analyze the data obtained on flow kinematics in laboratory and field experiments.

The flow velocities were measured at five points along the vertical of the defined stream and their velocity curves were constructed.

Table of experimental data and graph of speeds ($m = 1,5$)

№	b m	m	h_k	Q m^3/s	*V* m/s	Y sm	h mm	Z sm	*V* m/s	$V_{o'r}$ m/s
Experiment 1										
2	0.15	1.5	0.054	0.018	1.4	55	1	19	0,57	0.569
							0.8	22	0,573	
							0.6	27.8	0,574	
							0.4	30.1	0,569	
							0.2	32.4	0,56	

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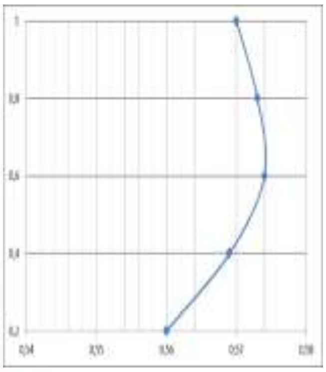

№	b m	m	h_k	Q m^3/s	*V* m/s	Y sm	h mm	Z sm	*V* m/s	$V_{o‘r}$ m/s
Experiment 1										
3	0.15	1.5	0.054	0.018	1.4	62.5	1	20	0,567	0.568
							0.8	22	0,571	
							0.6	27.8	0,574	
							0.4	30.1	0,57	
							0.2	32.4	0,558	

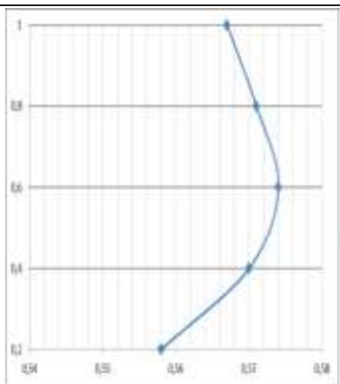

Figure 3.16. Flow velocity distribution in a channel with side slope coefficient $m = 1,5$

Table of experimental data and graph of speeds ($m = 2,0$**)**

№	b m	m	h_k	Q m^3/s	*V* m/s	Y sm	h mm	Z sm	*V* m/s	$V_{o‘r}$ m/s
Experiment 1										
2	0.15	2.0	0.047	0.009	0.9	87	1	26.8	0,412	0.408
							0.8	27.1	0,414	
							0.6	28.8	0,416	
							0.4	30.6	0,408	
							0.2	32.4	0,39	

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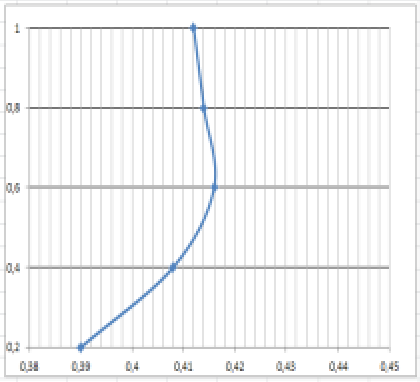

№	b m	m	h_k	Q m^3/s	*V* m/s	Y sm	h mm	Z sm	*V* m/s	$V_{o'r}$ m/s
Experiment 1										
5	0.15	2.0	0.042	0.012	0.7	70	1	29.1	0,42	0.418
							0.8	29.04	0,422	
							0.6	31.01	0,424	
							0.4	32.4	0,418	
							0.2	33.0	0,406	

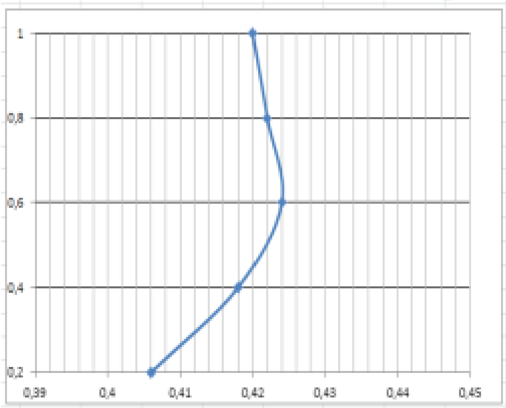

Figure 3.17. Flow velocity distribution in a channel with a side slope coefficient $m = 2,0$

Table of experimental data and graph of speeds ($m = 2,5$**)**

№	b m	m	h_k	Q m^3/s	*V* m/s	Y sm	h mm	Z sm	*V* m/s	$V_{o'r}$ m/s
Experiment 2										
1	0.15	2.5	0.039	0.021	0.9	45	1	26.4	0,412	0.41
							0.8	27.5	0,416	
							0.6	28.5	0,418	
							0.4	29.5	0,408	

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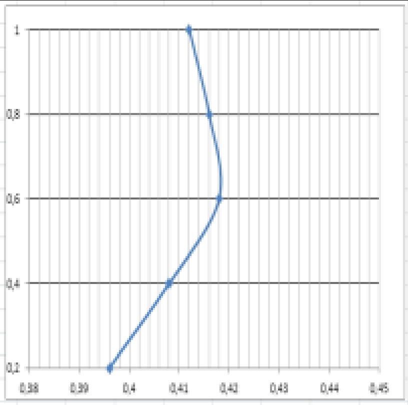
							0.2	30.5	0,396	



№	**b m**	**m**	**hk**	**Q m3/s**	**V m/s**	**Y sm**	**h mm**	**Z sm**	**V m/s**	**Vo'r m/s**
Experiment 1										
1	0.15	2.5	0.042	0.012	0.7	44	1	29.9	0,352	0.352
							0.8	29.3	0,356	
							0.6	30.1	0,359	
							0.4	31.8	0,351	
							0.2	32.1	0,342	

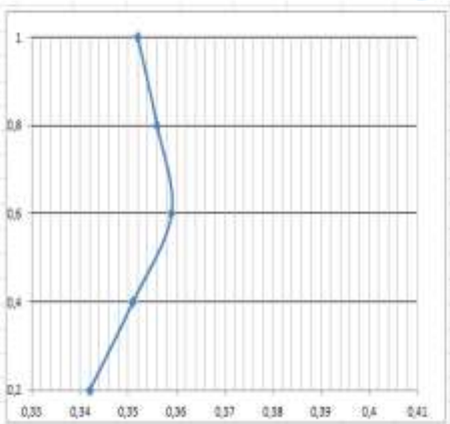


Figure 3.18. Flow velocity distribution in a channel with a side slope coefficient $m = 2,5$

Data tables and speed curves of the rest of the experiments are presented in tables and figures I.14-16 of the appendix.

The averaged local velocities at the points vary over a wide range. Under the influence of the frictional force of the flow, in all observed side slope coefficients in the channel, their velocities increase slightly from the free surface of the flow up to a depth of 0.6h, and after this depth, they decrease towards the bottom. Also, the speed decreases from the center of the channel towards the coast. It is known from researches

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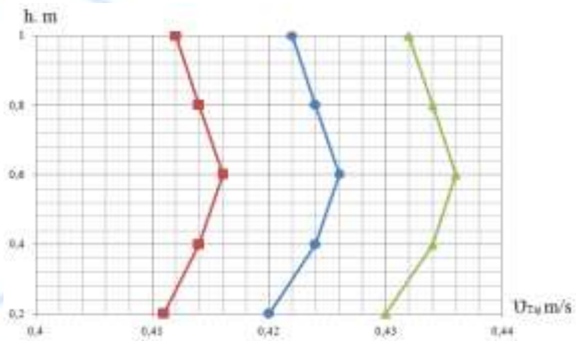
that near a solid surface, the average speed of a turbulent flow varies as the logarithm of the length from this surface. This can be seen from the given speed graphs.
From the experiments, changes are observed in relation to the speed distribution of the flow speed in different beds of the channel side slope (Fig. 3).



- m=1,5; - m=2,0; -m=2,5.

Figure 3.19. Comparison of the distribution of flow velocities in channels with different side slope coefficients

Therefore, the analysis of the experimental data was used to characterize the change in flow rates in different connected soils. Accordingly, the rates of non-washing of sandy soils are much higher than those of sandy soils.

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