Purpose of the Height of Earth Filling from Salt Soils on the Example of the Syrdarya Region

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***Abstract*—The article provides an analysis of regulatory documents, literature, as well as research work on the appointment of the height of embankments from salted soils common in Uzbekistan used in practice. Taking into account the level and type of soil salinity in the field, the length of public roads passing along them was determined. As a result of processing, the calculated characteristics of saline soils were determined, numerical values of the height of road embankments were recommended in accordance with the degrees of salinity**

Keywords—density coefficient, chloride, sulfate, saline soils, low salinity, salted, non-saline, moderately saline, highly saline

I. INTRODUCTION

All soils contain salts, the amount of which depends on climatic, morphological, soil and climatic factors, hydrological systems of the territory. When the amount of soluble salts (sulfates, chlorides and bicarbonates of sodium, potassium, calcium and magnesium) becomes excessive to such an extent that it adversely affects the road surface.

Salinization is a typical process in environments where there is not enough rainfall to remove salts in the soil. Usually, the phenomenon is accentuated in the presence of shallow aquifers, from which water, moving upward, carries salts to the surface.

A certain amount of salt can also accumulate in moderately humid climates, in basins with impermeable bottoms, where waters coming from adjacent territories, the soils or sediments of which contain salts [1].

One type of salinization, called secondary salinization, is common in irrigated land. This is due to various factors:

- supply of unusable irrigation water, the salts of which are concentrated in the soil due to evapotranspiration. For example, when irrigating with "fresh" water containing 0.5% salts, and taking into account the volume of 4000;. 5000 m² per year, from 2 to 2.5 tons of salts per hectare are applied to the soil. They, if not washed away by rains in the autumn-winter period, can accumulate in the soil;

- raising the level of groundwater, which can bring salts to the ground directly or by climbing capillary or prevents the leaching of excess salts [2].

The sharp increase in the type and number of vehicles moving on the roads of the country and the load on their rear axles require the solution of such tasks as the improvement of existing regulations. Therefore, it is important to rework the norms of road lifts listed in them: in particular, the height values to ensure their strength and stability [3].

II. METHOD

Classification of soils of roads passing through the saline areas of the Republic by salinity level is given in such normative documents as SHNK 2.05.02-07 [4], VSN 47-73 [5], IKN 56-10 [6] and in the literature on road construction. According to them, soils are divided into weak, medium, strong and very strong types by the sum of the amount of lightly soluble salts (in% of dry soil mass), chloride, sulfate-chloride and sulfate, chloride-sulfate by type of salt.

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In SHNK 2.05.02-07 the height values of saline soils are not given, in which clay and lyossimon soils are proposed (Tables 31 and 32 on SHNK). In particular, Table 32 states that for lyossimon soils, the rise of the coating surface above groundwater level should be increased by 20% in low and moderately saline soils.

According to VSN 47-73, the height of the pavement in places 2 and 3 (at the lowest point of the cross section) should not be less than the value given in Table 1 above the ground.

TABLE I. The height of the pavement according to VSN 47-73

Roadside soils	The height of the road surface, m, not less, in the ground		
	non-saline	slightly and moderately saline	highly saline
Medium and fine sand, light coarse supes	0,2	0,3	0,4
Dusty sand, light supes	0,3	0,4	0,5
Heavy suglinok, glina	0,4	0,5	0,6
Dusty and heavy dusty supes, light, lightly dusty and heavy dusty supes	0,4	0,6	0,7

Note. In irrigated areas, where the calculated groundwater level cannot be determined with the required probability, as well as in areas that need to be developed and irrigated during the service life between road repairs, the values given in Table 1 are 30% for level IV-V roads and 50% for level I-III roads. increased by%.

According to IQN 56-10, in order to increase the strength and stability of the hoist, as well as to reduce the height of the hoist, its upper part to a depth of 0.4 m at a low humidity (W = 0.70-0.75WOQ) to a maximum standard density (KZ = 1 , 01-1.03) condensation is proposed. In addition, it was stated that it is advisable to compact the natural base of the lift to 0.2-0.3 m. However, it is not specified what the density coefficient is.

According to V.F. Babkov [7], low and medium salinity soils can be used in standard structural elevations, as well as in the upper working layer, provided that the accepted norms for non-saline soils are followed. Strongly saline soils can be used on road sections in Round I areas under wet conditions, using measures to prevent the top layer from additional salinity. Extremely saline soils can be used by taking the necessary measures to neutralize their negative properties, which are basically accepted by laboratory studies.

It is necessary to increase the height of the coating surface from the level of ground or surface water by 20% compared to the norm in low and moderately saline soils, by 30% for loam and clays, and by 40-60% in strongly saline soils [8].

V.D. Kazarnovsky [9] The height of the coating surface, such as VF Babkov, depends on the level of ground or surface water, in low and moderate salinity soils by 20% of the norm (30% for loam and clays), in strongly saline soils 40 Proposes an increase of -60%.

S.V. Konovalov [10] proposes to increase the height of the coating surface in strongly saline soils by 20% above the norm above the ground or surface water level.

According to V.M. Sidenko and N. Ilyasov [11], the height of the footpath above the groundwater level should be determined in accordance with Table 2.

TABLE II. The height of the footpath

Soil	Road eyebrow height, in soils, m	
	low salinity	salted
in subsoil soils	1,1	1,3
in dusty supes	1,2	1,4
in dusty suglinoks	1,6	1,8
in dusty	1,9	2,1
The amount of water-soluble salts is from 3% in dusty and dusty-loamy soils, which are abundant	2,2-2,3	

According to E.M. Sergeev [12], the height and speed of water rising from the capillaries are affected by the chemical composition of the soil and the mineralization of porous water. An increase in the amount of salts increases the capillary rise height as a result of an increase in surface gravitational forces. The presence of various salts in the water increases the value of the capillary rise height more or less. B.B. Polinov's research shows that during capillary rise, the same salts rise higher and others lower. In particular, at the same mineralization and under other equal conditions, sodium chloride waters rise higher than sodium sulphate.

To study the subgrade, field experimental work was carried out on highways in the irrigated areas of the Syrdarya region on the roads 4R-32 and M-34 (Fig. 1).

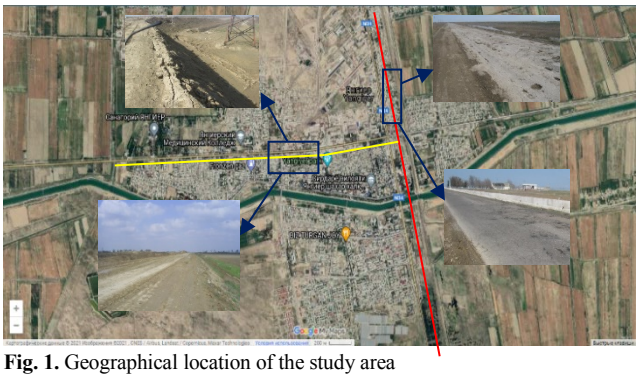

Fig. 1. Geographical location of the study area

During the research, it was revealed that during the construction of the roadbed of highways in the areas under study, the designated height of the embankment did not take into account the salinity of the soils. As a result, there was some kind of deformation of the coatings, as well as the slopes of the subgrade.

III. Results and Discussion

Analysis of the above-mentioned normative documents and literature, which increase the height of the coating surface, the level of ground or surface water, mainly in low and moderate saline soils by 20% (30% for loam and clays), in strongly saline soils by 40-60% indicates the designation. They also do not take into account the specific characteristics of saline soils, including the composition and amount of salts, the structural and mechanical properties of the uplift during construction (compaction), density norms, as well as the influence of water-salt regime on them. This leads to an increase in the cost of their use, the establishment of unreasonable side slopes.

In order to increase the strength and stability of the road lift, as well as to reduce the height of the lift, it is proposed to compact its base to a density of 0.2-0.3 m at a comfortable humidity of 1.0. It is proposed to design the structure of high-density elevation on a compacted natural foundation in road sections where the groundwater level in the spring does not exceed the height of the compacted natural foundation, and in the summer it lies at a depth of more than 1.5-2.0 m above the ground. The structure of the proposed lift is shown in Table 3.

TABLE III. Depth of pavement layer to the surface of the pavement

Depth of layer to surface, m	Layer thickness, m	Density coefficient	Density, kg / m^3
H + 0.4 each	0,40	1,03	1936
(H+0,4)÷1,0	0,60	1,00	1880
(H+1,0)÷1,5	0,50	0,98	1840
Natural foundation	0,30	1,00	1880

H -road pavement thickness

In saline soils, the height of the pavement surface above the groundwater level depends on the density, salinity and level of salinity. The height corresponding to this relationship, i.e. the distance from the surface of the coating to the groundwater level in saline soils of different densities, is given in Table 4 for heavy dusty supes and lightly dusty loamy soils.

TABLE IV. Depth of pavement layer to the surface of the pavement

Soils	Distance from the surface of the pavement to the groundwater level, m	
	chloride and sulfate-chloride salinity	sulfate and chloride-sulfate salinity
	density coefficient	

	0,96	0,98	1,00	1,02	0,96	0,98	1,00	1,02
slightly saline	1,30	1,10	0,90	0,70	1,10	0,90	0,70	0,50
moderately saline	1,43	1,21	0,99	0,77	1,21	0,99	0,77	0,55
highly saline	1,56	1,32	1,08	0,84	1,32	1,08	0,84	0,60
extremely saline	1,69	1,43	1,17	0,91	1,43	1,17	0,91	0,65

IV. RESULTS AND DISCUSSION

Based on the above, to make changes to the elevation standards based on the study of their strength and current density and to implement them in practice, the construction of saline soils in different territorial conditions of Uzbekistan, including the Republic of Karakalpakstan, Bukhara, Kashkadarya, Surkhandarya, Fergana, Khorezm and Syrdarya regions and in the diagnosis, as well as in the laboratory, a certain amount of experimental work was carried out [13].

The main factors in the formation of saline soils are mineralized groundwater and saline rocks lying close to the surface. The main condition of salinization is the impossibility of water flow in places and the fact that the evaporation process exceeds the amount of precipitation. Therefore, saline soils and soils are found in impermeable plains, deserts and steppes and hilly areas [14]. In most cases, the height of road embankments built of saline soils in these areas does not exceed 1.5-2 m.

In conclusion, in the design of elevations consisting of saline soils, the density specified in Table 3 and the height given in Table 4 can be noted that the service life is extended and the cost required after their repair is significantly reduced [13,15].

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