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ISSUES OF CONSTRUCTION OF THE ROAD BASE FROM DIFFERENT SALINE SOILS IN THE NATURAL CONDITIONS OF UZBEKISTAN

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ANNOTATION
This article discusses the issues of taking into account the sudden decrease in strength of excess moisture above the standard compaction moisture, as a negative feature of the construction of saline soils in the construction, construction and design of roads under the saline soils in the Republic of Uzbekistan.

Keywords: automobile roads, pavement, pavement elevation, salinity, saline soils, salts, salt content, lightly soluble salts, etc.

INTRODUCTION

Due to the remoteness of the Republic of Uzbekistan from the oceans and seas, one of the major contributors to the development of the country's economy is the highway. Highways are more efficient than air and railways in transporting domestically produced and imported goods from one destination to another, bringing people closer together.

Today, the world pays great attention to the design and construction of various engineering structures, including automobile roads, in areas with saline soils.

Scientific and practical research is being carried out in foreign and CIS countries to study the effects of salts on various properties of soils, to improve methods for determining the deformation and mechanical characteristics of saline soils, to substantiate the characteristics of saline soils. As a result, all this allows to develop reliable proposals for the design, construction and operation of roads in saline soils.

46.3% of the total land area of the republic is saline soils of various degrees.

Saline soils are soils that contain more than 0.3% of different amounts and types of soluble salts. Soil salinization is the process of accumulation of water-soluble mineral salts in the soil. Saline soils are mainly distributed in the deserts and semi-deserts of the plains, in some cases in the desert regions, ie in areas with negative water balance, as well as in areas with unstable component (sulfate, halloid, etc.) hypergenesis [1].

Figure 1. Area where saline soils are scattered

Figure 2. Salt crystals in the soil

According to the water solubility of salts in saline soils, they are divided into 4 types, listed in Table 1: lightly soluble, moderately soluble, insoluble and very insoluble salts [2].

Table 1 Types of solubility of salts in saline soils

Types	Solubility level	Solubility value, g/l
1	Lightly soluble	more than 2.0
2	Medium soluble	0,1
3	Hard to dissolve	0,1-0,001
4	Very difficult to dissolve	less than 0.001

Note: 1) The composition of lightly soluble salts includes: chlorides NaCl, KCl, CaCl2, MgCl2; bicarbonates: NaNSO3, Ca (NSO3) 2, Mg (NSO3) 2; sodium carbonate Na2SO3; magnesium and sodium sulfates MgSO4, Na2SO4; 2) Moderately soluble salts include gypsum CaSO4 • 2H2O and anhydrite CaSO4.

In the natural environment of Uzbekistan there are saline soils of different quantities and quality. The most common salts involved in salinization are: NaCL, Na2SO4·10H2O, MgSO4·7H2O, MgCL2·6H2O, CaCL2·6H2O, NaHCO3, Na2CO3·10H2O, CaCO3 и CaSO4·2H2O [3].

The lightly soluble salts mentioned above have different properties and rapidly change the physical and mechanical properties of soils depending on the quantity and quality of the soil. In order to properly assess the salinity of soils, it is necessary to take into account a complex of basic natural factors that affect salt metabolism, i.e., the amount of precipitation, climatic regime, and so on. Saline soils contain large amounts of gypsum and carbonates in addition to slightly soluble salts [4].

Salts in soils, properties and engineering structures, in particular, are divided into the following groups in terms of their impact on the strength of the footpath [5]:

Group 1 - chloride salts: NaCL, CaCL2 and MgCL2. These salts have solubility properties. Soils containing chloride salts have the property of retaining a certain amount of moisture, which creates good conditions for their compaction even in the dry season of the year. Even when crystallizing in solution, the volume of the chloride salts itself does not increase.

Group 2 - sulfate and magnesium salts: Na2SO4 and MgSO4. These salts have the property of combining a certain amount of water molecules. Sodium sulfate combines 10 molecules of water. At a temperature of 32.40 C, Na2SO4·10H2O is converted to an anhydrous form. In the conditions of Uzbekistan, when the air temperature varies from 50 to 400, it creates good conditions for the periodic coagulation and the presence of crystalline waters of crystal hydrates. The latter breaks the bond between the soil particles, resulting in the formation of “fluff”.

Group 3 - sodium carbonate salts: NaHCO3 and Na2CO3. These salts are relatively rare in the soil. An aqueous solution of soda has an alkaline reaction that allows maximum dispersion of clay-colloid fractions in soils.

Group 4 - sulfate and sodium carbonate salts. They are abundant in the soil - from 2% to 60% and more.

According to the road classification, salinities include soils with chloride, sulfur and carbonic salts of lightly soluble sodium, calcium and magnesium in the upper one-meter layer by more than 0.3% by mass [6].

Since lightly soluble salts have different and complex effects on the soil, the allowable criterion for the amount of salt in the soil, as well as the numerical limit of salinity is obtained as a summary of indicators that determine the characteristics and level of salinity in the soil property. Such an indicator is the characteristic moisture of the soil, its resistance to loading (shear, compression, compression) at constant absolute and relative humidity, maximum density at standard compaction, water resistance, as well as the ability to leach in the soil when wet with water-insoluble salts, water and atmospheric precipitation. If the amount of salt later exceeds the accepted

criterion, it is better not to use the given soil in the construction of the footpath, as its strength and water resistance will quickly decrease.

Today it is proposed to leave the principle of characterization of saline soils, taking into account their quality in terms of salinity. In this case, the salinity of the soil is characterized by the average sum of the amount of lightly soluble salts in the soil layer, which is pushed to the surface, and is expressed as a percentage of the absolute dry weight of the soil. Qualitative characterization of salinity is determined by the ratio of CL^1 ion in soil to $SO^{11}{}_4$ ion, determined in milliequivalents per 100 g of dry soil. Given the ratio of ions in the salinity of saline soils and the nature of their use at the base of the road, there are five types, as shown in Table 2 [7].

Table 2 Type of saline soils

Salinity	The ratio of ions in the composition	
	$\frac{Cl^-}{SO_4^{2-}}$	$\frac{HCO_3^- + CO_3^{2-}}{Cl^- + SO_4^{2-}}$
Chloride	>2,5	0,33
Sulfate-chloride	2,5-1,5	-
Chloride-sulphate	1,5-1,0	-
Sulfate	<1,0	-
Sodali	-	>0,33

In pavement soils, the allowable amount of salts is determined by the amount of water that can be dissolved in them, filling the pores of the compacted soil at a comfortable humidity, and is characterized by the salinity of the saline soils and their suitability for use in pavement [8].

Currently, research on saline soils has been carried out to differentiate the slightly soluble salts contained in the soil in terms of favorable moisture content and maximum density.

Table 3 The effect of salts on the favorable humidity and maximum density of soils

Salt type	The amount of salt, %	Optimal humidity, %	Maximum density, kg/m^3
1	2	3	4
Unsalted lightly powdered suglinok	-	15,0	1790
NaCL	1	15,1	1780
	2	15,2	1780
	3	14,6	1800
	4	14,0	1810
	5	13,4	1830
	8	13,2	1850
	10	12,9	1850
	13	12,8	1830
$Na_2SO_4 \cdot 10H_2O$	1	15,1	1790
	2	15,1	1790
	3	15,4	1790
	4	15,7	1790
	5	16,1	1780
	8	19,2	1680
	10	22,2	1620
	13	26,0	1520
1	2	3	4
$MgSO_4 \cdot 7H_2O$	5	13,4	1900
	8	14,9	1850
	10	16,5	1780
	13	19,5	1720
$CaSO_4 \cdot 2H_2O$ small crystals	10	15,3	1830
	30	19,1	1760
	40	20,7	1690

	50	21,5	1700
$CaSO_4 \cdot 2H_2O$ large crystal	10	15,5	1820
	30	16,9	1810
	40	17,3	1800
	50	17,6	1780
The mixture is salted			
1,6 NaC L + 6,4 $Na_2SO_4 \cdot 10H_2O$		17,6	1730
3,0 NaC L + 5,0 $Na_2SO_4 \cdot 10H_2O$		16,2	1780
3,6 NaC L + 4,4 $Na_2SO_4 \cdot 10H_2O$		16,9	1800
4,0 NaC L + 4,0 $Na_2SO_4 \cdot 10H_2O$		15,6	1830
4,5 NaC L + 3,5 $Na_2SO_4 \cdot 10H_2O$		14,3	1840
5,5 NaC L + 2,5 $Na_2SO_4 \cdot 10H_2O$		14,3	1850
7,0 NaC L + 1,0 $Na_2SO_4 \cdot 10H_2O$		13,2	1850

In the process of designing and constructing the pavement of highways, it should be taken into account that the negative properties in the construction of saline soils are a sudden decrease in strength in excess of favorable humidity at standard compaction. Such soils may lose their bond when dry and their density decreases as a result of the formation of crystal hydrates. Therefore, measures are taken to ensure high strength of the pavement, especially at the top of the lift (at a depth of not less than 50 cm below the pavement), which limits the seasonal fluctuations of soil moisture and density.

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