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Research Article

ENGINEERING-GEOLOGICAL ZONING OF THE FOUNDATION PROJECT ON SALINE SOILS OF KANLIKUL DISTRICT

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ABSTRACT

The article is devoted to the engineering-geological zoning of the foundation project on the saline soils of the Kanlikul district. The features of the region's geological and hydrogeological conditions, as well as the influence of soil salinity on the stability and durability of building structures, are considered. The methods of engineering-geological zoning used to assess the suitability of soils for construction are described. The article proposes solutions for designing foundations taking into account the specifics of saline soils, as well as measures to reduce the negative impact of salinization on construction sites. The work is aimed at improving design and construction practices in the region's complex geological conditions.

KEYWORDS

Engineering-geological zoning, saline soils, Kanlikul district, foundations, hydrogeological conditions, design, foundation stability, construction structures.

INTRODUCTION

Engineering-geological zoning is an important stage in the design of construction sites, especially in conditions of complex geological factors, such as soil salinity. Saline soils are characterized by a high content of soluble salts, which negatively affects the strength and durability of building structures, particularly foundations [3]. The Kanlikul district, located in the southern part of the Republic of Karakalpakstan, is one of the zones with pronounced soil salinity, which creates additional difficulties in design and construction. In this regard, studying the engineering and geological conditions of this area to ensure safe

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and durable construction is of particular importance. The purpose of this article is to conduct an engineering-geological zoning of the Kanlikul district, with an emphasis on soil salinity, and to develop recommendations for designing foundations in these conditions. To achieve this goal, the work considers the geological and hydrogeological characteristics of the area, analyzes the degree of soil salinity, and proposes solutions to minimize the negative consequences of salinization on construction sites.

The geological structure of the area is characterized by a predominance of sedimentary rocks formed through prolonged sedimentation processes. The upper layers mainly consist of loams, sands, and clayey soils, which exhibit varying degrees of density and bearing capacity. The presence of alluvial deposits formed by ancient rivers adds complexity to the region's stratigraphic structure. This diversity requires designers to closely study local conditions to select optimal foundation solutions. The main soil types in the Kanlikul District are loams, clays, and sands, which differ in their physical and mechanical properties. Loams and clays, with low permeability, are prone to retaining moisture, especially due to the close occurrence of groundwater. In contrast, sands, while highly permeable, have low bearing capacity, which poses additional challenges for designers when selecting the type of foundation. The hydrogeological conditions of the region also play a crucial role. The Kanlikul District, located in an arid climate zone, suffers from a lack of precipitation; however, the groundwater level remains relatively high. This creates a risk of capillary rise of moisture to the surface layers, leading to salt accumulation and deteriorating construction conditions. Therefore, special attention should be given to drainage systems and foundation waterproofing. A high degree of soil salinity is one of the key issues faced by designers. Saline soils reduce bearing capacity and can damage construction materials such as concrete and metal. Consequently, the selection of corrosion-resistant materials and the application of waterproofing technologies become top priorities. Although the Kanlikul District is not classified as a high seismic activity zone, it is important to consider the possibility of minor ground vibrations when designing large structures, which may be amplified by local geological conditions. This underscores the need for thorough engineering and geological surveys and monitoring of soil conditions. The climatic conditions of the region, characterized by high evaporation and a lack of precipitation, also impact soil stability. In the summer months, soils may dry out, leading to cracking, while in winter, increased groundwater levels can cause oversaturation, further compromising stability. Thus, designing foundations on saline soils in the Kanlikul District requires a comprehensive approach, including detailed studies of engineering and geological conditions, the selection of durable materials, and the implementation of specialized technologies. Timely and high-quality design will ensure the reliability and longevity of construction projects, facilitating their successful operation under the challenging conditions of the region.

Designing foundations on saline soils is a complex and responsible task that requires special attention to engineering and geological conditions. These conditions determine the durability and stability of construction structures, particularly in regions like the Kanlikul District, where soil salinity and aggressive groundwater present additional challenges. The first step in the design process is a detailed engineering and geological study, which allows for the assessment of the physical and mechanical properties of the soils, groundwater levels, and the degree of salinity. This data forms the basis for selecting the optimal type of

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foundation. In areas of high salinity, it is recommended to design shallow foundations to minimize the impact of aggressive groundwater on the structures. Several types of foundations exist, each with its advantages depending on site conditions. Strip foundations are often used for buildings with light loads and uniform soil characteristics. In the case of saline soils, insulated or waterproofed strip foundations are preferred to protect against moisture and salt penetration. For areas with highly saline upper layers, pile foundations are more effective. Piles transfer loads to deeper layers, which may have better physical and mechanical properties. Plate foundations, on the other hand, evenly distribute loads and minimize the risk of uneven settlement, making them suitable for heterogeneous soils [6].

The choice of construction materials also plays a crucial role. In saline soil conditions, it is essential to use waterproofing materials, such as bituminous membranes and polymer coatings, to protect the foundation from moisture and salt exposure. Concrete should have high density and low water absorption, and for the protection of reinforcement and other metal elements, anti-corrosion coatings are recommended. Additionally, the organization of drainage systems is a critical aspect that prevents capillary rise of moisture to the foundations. Effective solutions may include ring drainage or drainage systems utilizing geosynthetic materials. Such measures help reduce the risk of salt accumulation in the upper soil layers. Equally important are measures to protect foundations from capillary rise of moisture and frost heave. Installing geotextile under the foundation enhances drainage and prevents salt penetration, while insulating foundations in cold regions protects against destructive processes associated with frost [4].

After construction is completed, it is necessary to conduct regular monitoring of the foundation and the surrounding environment. Measuring groundwater levels, checking the condition of waterproofing, and monitoring for possible deformations allow for the timely identification and resolution of issues arising from saline soils. In conclusion, designing foundations on saline soils requires a comprehensive approach that includes careful analysis of engineering and geological conditions, selection of durable materials and structural solutions, and implementation of protective measures against the aggressive effects of salts and moisture. This approach will ensure the durability and stability of construction projects, facilitating their successful operation in the challenging conditions of the Kanlikul District.

CONCLUSION

Engineering and geological zoning and foundation design on saline soils in the Kanlikul District is a complex yet crucial task for ensuring safe and durable construction. In conditions where soils are characterized by high salt content and low bearing capacity, a meticulous approach to selecting construction technologies and protective measures is essential. The analysis of the engineering and geological conditions in the Kanlikul District has shown that soil salinity, the close occurrence of groundwater, and complex hydrogeological conditions necessitate the use of specialized foundation design methods. The implementation of pile and slab foundations, the use of high-quality waterproofing materials, the organization of effective drainage systems, and the monitoring of groundwater levels are key factors that can significantly reduce the risk of structural damage and enhance durability. A comprehensive consideration of engineering and geological conditions, along with the integration of innovative technologies in construction,

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will minimize the negative impact of soil salinity on foundations and ensure the reliable operation of structures in the Kanlikul District.

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