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PROBLEMS OF RELIABILITY OF FOUNDATIONS AND FOUNDATIONS ON SALINE SOILS

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Abstract
The influence of aggressiveness and variability of the properties of saline soil on the work of foundations and bases is studied. Materials with non-corrosive properties are presented, including electrokinetic stabilization that reduces the salt content in soils and increases its bearing capacity.

Keywords: Saline soils, suffusion, concrete corrosion, fiber polymers, electrokinetic stabilization, protective coatings.

Introduction

Ensuring the reliability of foundations and substructures beyond the design life of buildings takes center stage when faced with the unique challenges posed by saline soils that have aggressive properties towards the materials of underground structures. Saline soils, characterized by high concentrations of salts, present a number of challenges for both engineers and designers. In this article, we delve into the intricacies of designing foundations that can withstand the corrosive nature of saline soils, exploring innovative approaches and technologies that redefine traditional notions of structural stability. Saline soils are common in many regions of the world, including vast swathes of Central Asia. These soils are often rich in dissolved salts, including sodium chloride, which can have detrimental effects on the structural integrity of foundations. The corrosive nature of saline soils can compromise the stability of traditional foundation materials such as concrete and steel, requiring a re-evaluation of design principles[1,5,7,9].

The corrosive effects of salts on foundation materials are multifaceted. In the case of concrete, moisture containing salts can penetrate the material, causing internal expansion and possible cracking. Reinforcing steel within the concrete is also susceptible to corrosion in the presence of salt, resulting in a reduction in the strength of the structure. Such deterioration poses a significant risk to the long-term stability of structures in regions with saline soils[1,8]. One of the key points in the design of foundations on saline soils is the careful selection of materials. Therefore, alternative building materials that provide increased resistance to salt corrosion are currently being increasingly studied. Fiber-reinforced polymers (FRP) are gaining popularity due to their non-corrosive properties, providing a viable replacement for traditional steel reinforcement in concrete[2,3,4,6]. In addition, the use of corrosion-resistant alloys and specially designed concrete mixtures can mitigate the effects of saline soils on foundation materials. The goal is to create a foundation that will not only withstand a corrosive environment, but will also maintain its structural integrity over a long period of time.

Applying protective coatings to foundation materials is a preventative strategy to combat the corrosive effects of saline soils. Various coatings, such as epoxy or zinc, act as a barrier, preventing salts from penetrating the material and deteriorating. These coatings are particularly effective in extending the service life of steel foundation components by ensuring their durability in harsh soil conditions. Designing foundations for saline soils requires a thorough understanding of the specific site conditions. On-site investigations should include soil testing to assess salt concentrations, soil texture, and moisture content. This data provides an indication of the severity of saline conditions, allowing them to tailor the foundation design accordingly. In some cases, it may be necessary to apply soil improvement techniques, such as leaching or soil replacement, to reduce the salt content in the foundation area. Site-specific design takes into account the challenges associated with saline soils, providing a customized approach to foundation construction.

The growing field of foundation engineering has seen the emergence of innovative technologies designed specifically for saline soil conditions. Electrokinetic stabilization, for example, involves applying an electric field to the soil, reducing its salt content and increasing its load-bearing capacity[3]. This technology offers a sustainable and effective solution for stabilizing foundations in saline soil regions. Additionally, advances in geosynthetics have paved the way for the development of salt-resistant membranes, which act as a barrier between the foundation and the surrounding soil. These membranes prevent salts from entering the foundation, maintaining its structural integrity. In the quest for sustainable construction methods, holistic design approaches are being explored that go beyond mitigating the immediate problems associated with saline soils. Green infrastructure, such as vegetative cover and permeable pavements, can play a role in managing salinization by facilitating natural salt removal processes. Integrating sustainable drainage systems into foundation designs helps maintain a balance between soil health and environmental protection.

Thus, the design of foundations in saline soils requires an interdisciplinary approach combining geotechnical engineering, materials science and innovative technologies.

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