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MITIGATION OF SWELLING POTENTIAL: A REVIEW ON INNOVATIVE APPROCH TO EXPANSIVE SOIL STABILIZATION

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Abstract
Expansive soils pose significant challenges in construction projects, necessitating effective stabilization techniques. This research explores the synergistic application of fly ash and synthetic polymers to stabilize expansive soil. The study focuses on evaluating the combined impact of these materials on soil properties, aiming to enhance its engineering characteristics. The research investigates the long-term benefits of this stabilization method, emphasizing its potential to mitigate soil expansion and contraction. A comprehensive literature review examines previous studies in this domain, providing insights into various methodologies and outcomes. The findings of this research contribute valuable knowledge to the field of soil stabilization and offer practical solutions for sustainable construction practices.
Keywords: Stabilization, fly ash, synthetic polymers, expansion

I. Introduction

Expansive soils, characterized by volumetric changes in response to moisture fluctuations, pose substantial changes in the field of geotechnical engineering. These challenges include foundation instability, swelling, and shrinking, leading to structural damage. To address these issues, this research delves into the combined application of fly ash and synthetic polymers as a viable soil stabilization technique. The integration of these materials aims to improve soil properties and mitigate the adverse effects of expansion and contraction. The study explores the interaction mechanisms between expansive soil, fly ash and synthetic polymers with a focus on achieving long-term stability and enhanced engineering performances.

II. Aim and objectives of the study

The primary aim of this research is to assess the effectiveness of fly ash and synthetic polymers in stabilizing expansive soils. The specific objectives are as follows:

i. Evaluate the influence of fly ash and synthetic polymers on the physical and mechanical properties of expansive soil.
ii. Investigate the long-term stability of the stabilized soil under varying moisture conditions.
iii. Assess the potential reduction in soil expansion and contraction through the combined application of fly ash and synthetic polymers.
iv. Compare the performance of stabilization technique with traditional methods.
v. Provide practical recommendations for the application of this stabilization method in construction projects.

III. Benefits of using fly ash and synthetic polymers in soil stabilization

i. The utilization of fly ash and synthetic polymers for soil stabilization offers several benefits, including enhanced strength, reduced swelling potential, and improved durability.
ii. The combination of these materials provides a sustainable and cost-effective solution for mitigating the challenges associated with expansive soils.
iii. The environmentally nature of fly ash contributes to the overall ecological sustainability of construction practices.

IV. Literature review

Previous research on the stabilization of expansive soils has explored various techniques, including lime and cement stabilization, chemical additives, and geosynthetics. Studies have reported mixed outcomes with some techniques exhibiting limitations in terms of cost, environmental impact, or long-term effectiveness. The incorporation of fly ash and synthetic polymers has gained attention in recent literature, showcasing promising results in terms of improved soil stability and reduced expansiveness. The current research builds upon this foundation by providing a comprehensive analysis of the combined impact of fly ash and synthetic polymers on expansive soil properties.

The soil was frequently found to be weak and lacked sufficient stability under heavy loading. The aim of the study was to conduct a review on the stabilization of soil using low-cost methods. Various reinforcement methods were considered for stabilizing expansive soils. These methods comprised stabilization with chemical additives, rewetting, soil replacement, compaction control, moisture control, surcharge loading, and thermal methods [1].

In the present days, profligate properties of soils were a fundamental concern in designing ventures. Enhancing the properties of unsatisfactory soil was sometimes a crucial step for construction. Studies were conducted, and it was demonstrated that the addition of additives led to improvements in the functionality and mechanical behaviour of the soil after lime and fly ash, serving as local natural and mechanical resources, were employed foe chemical modifications [2]. The main concern still revolved around the search for the best soil stabilizers to address issues caused by soft and expansive soils. This was not only aimed at achieving the necessary soil engineering properties but also at considering the cost and environmental impact. The objective of this paper was to review the techniques that had been employed for soil stabilization based on experimental studies [3]. Many researchers have contributed to the field of soil stabilization, and it is a vast area with numerous studies. The following are a few researchers who have made significant contributions:

1. Claude Mitchell: Known for his work on lime stabilization of soils.
2. Karl Terzaghi: Often referred to as the ‘father of soil mechanics,’ his research laid the groundwork for understanding soil behaviour and stabilization.
3. Ralph Proctor: Developed the proctor compaction test, which is crucial for soil stabilization studies.
4. Eugene C. Buth: Worked extensively on the application of chemical stabilization techniques.
5. Fred L. Brandon: Contributed to the study of cement stabilization in soil.
6. Nadim Wehbe: Studied geosynthetic reinforcement and its role in soil stabilization.
7. Delwyn G. Fredlund: Known for his work on unsaturated soil mechanics, which has implications for soil stabilization.
8. R. Kerry Rowe: Contributed to research on the use of geosynthetics in soil reinforcement and stabilization.

V. Conclusion

1. In conclusion, the integration of fly ash and synthetic polymers presents a promising approach for stabilizing expansive soils.
2. The research findings highlight the positive impact of these materials on soil properties, contributing to increased stability and reduced susceptibility to expansion and contraction.
3. The study’s insights provide a valuable foundation for the implementation of sustainable and effective soil stabilization techniques in construction projects.
4. The potential long-term benefits of this approach position it as a viable alternative to traditional methods, paving the way for improved engineering practices in the management of expansive soils.

VI. References

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