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SOIL LIQUEFACTION AND STABILIZATION SYSTEMS: ONE STUDY IS LOOKING AT PLASTIC AS A STABILIZER IN SOIL

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Introduction

Soil liquefaction is a geotechnical phenomenon that occurs when saturated soil loses its strength and stiffness due to an increase in pore water pressure, resulting in the soil behaves like a liquid. Soil liquefaction poses a significant threat to critical infrastructure, including buildings, bridges, and roads, and can cause devastating damage during earthquakes or other forms of ground vibration. In response, various soil stabilization techniques have been developed to mitigate soil liquefaction and prevent infrastructure damage. However, conventional soil stabilizers such as cement, lime, and fly ash are not always environmentally friendly and can have negative impacts on soil properties (Hazirbaba and Gullu, 2010). The use of these stabilizers can also be expensive and may require significant resources for transportation and handling. As a result, researchers have been exploring sustainable and cost-effective alternatives to conventional soil stabilizers, including the use of plastic waste. The objective of this study is to investigate the feasibility of using plastic waste as a sustainable and cost-effective alternative to conventional soil stabilizers for mitigating soil liquefaction. The use of plastic waste as a soil stabilizer has several potential advantages, including reducing plastic waste in the environment, providing an alternative source of construction materials, and potentially improving soil properties. Through this study, we aim to determine the effectiveness of plastic waste as a soil stabilizer and assess its potential impact on the environment and soil properties. By exploring this novel approach to soil stabilization, we hope to contribute to the development of sustainable and cost-effective soil stabilization techniques.

Review of Literature

Several studies have been conducted to investigate the use of plastic as a stabilizer in soil. The results of these studies have been mixed, with some suggesting that plastic can improve the strength and stiffness of soil, while others have found little to no improvement. One study conducted by Kurakalva *et al.* (2021) found that the addition of plastic to soil increased its shear strength and reduced its compressibility. Another study by Goh *et al.* (2020) investigated the use of plastic waste as a stabilizer in sandy soil and found that it significantly improved the soil's mechanical properties.

Problem Statement

The occurrence of soil liquefaction can result in significant damage to infrastructure, loss of life, and financial loss. Therefore, the development of sustainable and environmentally friendly soil stabilization techniques is essential to mitigate the adverse impacts of soil liquefaction (Castiglia *et al.* 2017). The use of plastic waste as a soil stabilizer has the potential to address the limitations of conventional soil stabilizers while also promoting sustainable waste management practices.

Need for Research

The use of plastic waste as a soil stabilizer is a relatively new concept that has not been extensively studied. Therefore, there is a need for research to investigate the effectiveness of plastic waste as a soil stabilizer for mitigating soil liquefaction (Hazirbaba and Gullu, 2010). This research will provide valuable insights into the use of plastic waste for sustainable soil stabilization and waste management practices.

Objectives

The objectives of this research are to:

1. “Investigate the effectiveness of plastic waste as a soil stabilizer for mitigating soil liquefaction”.

2. "Evaluate the physical and chemical properties of plastic-stabilized soil".
3. "Assess the environmental impact of plastic waste as a soil stabilizer".
4. "Develop recommendations for the use of plastic waste as a sustainable and cost-effective alternative to conventional soil stabilizers".

Research Methodology

To investigate the feasibility of using plastic waste as a sustainable and cost-effective alternative to conventional soil stabilizers, this study will employ a Secondary qualitative thematic analysis approach. The approach aims to understand the experiences, opinions, and values related to plastic waste as a soil stabilizer. The physical and chemical properties of plastic-stabilized soil will be evaluated using laboratory tests such as the standard proctor compaction test, unconfined compression test, and California Bearing Ratio test. These tests will help determine the strength and stiffness of the plastic-stabilized soil and compare it with conventional soil stabilizers (Hamza *et al.* 2023). Moreover, the environmental impact of plastic waste as a soil stabilizer will be assessed by conducting a life cycle assessment. The life cycle assessment will assess the environmental impact of the entire life cycle of plastic waste as a soil stabilizer, including the extraction, manufacturing, transportation, use, and disposal of plastic waste. The life cycle assessment will help evaluate the sustainability of plastic waste as a soil stabilizer and its overall impact on the environment.

Sources of Data

The primary sources of data for this study will be laboratory experiments and life cycle assessments. The laboratory experiments will involve testing the physical and chemical properties of plastic-stabilized soil. These tests will generate quantitative data that will be analyzed to conclude (Hazirbaba and Gullu, 2010). The life cycle assessment will also provide quantitative data on the environmental impact of plastic waste as a soil stabilizer. In addition to the primary sources of data, secondary sources of data will be utilized. These sources will include relevant research articles, books, and reports. These sources will help provide context and background information on soil liquefaction, conventional soil stabilizers, plastic waste, and sustainable development. They will also help to identify any gaps in the literature that the study can address.

Sampling

The study will use a purposive sampling technique to select soil samples and plastic waste samples for laboratory experiments. For the life cycle assessment, a systematic random sampling technique will be used to select plastic waste samples.

Expected Outcome of the Study

The study is expected to demonstrate the effectiveness of plastic waste as a sustainable and cost-effective alternative to conventional soil stabilizers for mitigating soil liquefaction. It will provide valuable insights into the physical and chemical properties of plastic-stabilized soil and assess the environmental impact of plastic waste as a soil stabilizer (Hazirbaba and Gullu, 2010). The study will develop recommendations for the use of plastic waste as a sustainable and environmentally friendly soil stabilizer.

References

1. Castiglia, M., Morgante, S., Napolitano, A. and de Magistris, F.S., 2017. Mitigation measures for the stability of pipelines in liquefiable soils. Journal of Pipeline Engineering, 16(3).
2. Hamza, M., Nie, Z., Aziz, M., Ijaz, N., Akram, O., Fang, C., Ghani, M.U., Ijaz, Z., Noshin, S. and Madni, M.F., 2023. Geotechnical behaviour of high-plastic clays treated with biopolymer: macro–micro-study. Environmental Earth Sciences, 82(3), p.91.
3. Hazirbaba, K. and Gullu, H., 2010. California Bearing Ratio improvement and freeze–thaw performance of fine-grained soils treated with geofiber and synthetic fluid. Cold regions science and technology, 63(1-2), pp.50-60.
4. Kitazume, M. and Terashi, M., 2013. The deep mixing method. CRC press.

5. Kurakalva, R.M., Kuna, G., Vaiphei, S.P. and Guddeti, S.S., 2021. Evaluation of hydrogeochemical profile, potential health risk and groundwater quality in rapidly growing urban region of Hyderabad, South India. Environmental Earth Sciences, 80(10), p.383.

6. Goh, C.S., Chong, H.Y., Jack, L. and Faris, A.F.M., 2020. Revisiting triple bottom line within the context of sustainable construction: A systematic review. Journal of cleaner production, 252, p.119884.