IDENTIFYING POTENTIAL GEO-HAZARDS IN HINGURAKGODA AREA LINKED TO DAMAGED HOUSES

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Expansive soils pose significant challenges for construction projects worldwide due to their dynamic response to changes in moisture levels. This study focuses on identifying and categorizing expansive soils in the Hingurakgoda region, using data from the National Building Research Organization (NBRO) alongside advanced analytical techniques. By examining key soil parameters such as Atterberg limits, clay content, moisture content, and swell pressure, the research aims to understand the underlying causes of structural issues affecting buildings in the area. Spatial analysis tools like ArcGIS and Google Earth Pro were utilized to develop effective methods for recognizing expansive soils and understanding their geological relationship with marble layer cavities. The presence of minerals like smectite, montmorillonite , and illite in expansive soils significantly influences their swelling and shrinking behaviors. The study thoroughly investigates the geotechnical aspects of the soil, revealing complex underground conditions such as alluvial deposits and karstic formations, which exacerbate the challenges posed by expansive soils. The research emphasizes the importance of accurately identifying and categorizing these soils to predict soil movement and potential structural damage effectively. By combining insights from extensive data analysis and geotechnical studies, the study offers valuable recommendations for minimizing risks associated with expansive soils, thereby enhancing the security and durability of structures in the Hingurakgoda region.

In this study, six different methods were utilized to assess the swelling potential of expansive soils: Seed et al. (1960, 1962a), Ladd et al. (1961), Ranganatham and Satyanarayana (1965), Carter and Bentley (1991), Chen (1988), and Vander Merwe (1964). Among these methods, the Vander Merwe (1964) method demonstrated the highest level of similarity in predicting soil swelling potential. The method's consistent performance across various test results suggests that it is the most appropriate approach for classifying expansive soils in the Hingurakgoda area. The accuracy and reliability of the Vander Merwe (1964) method make it a valuable tool for evaluating soil expansiveness and managing associated risks, providing a strong foundation for construction and mitigation strategies in regions prone to soil swelling.

To further build on these findings, future research should prioritize increasing the number of soil sampling locations in Hingurakgoda. Expanding the sampling distribution would lead to more comprehensive data, allowing for more accurate spatial mapping and improved predictions of swelling potential. This approach would enable a more precise identification of high-risk areas, contributing to better-targeted risk mitigation strategies. By adopting an enhanced sampling strategy, future studies can significantly improve the reliability of soil classification and provide more effective guidelines for construction practices in regions affected by expansive soils.

In conclusion, the study's findings underscore the critical role of accurate soil classification methods, particularly the Vander Merwe (1964) method, in mitigating the risks associated with expansive soils and ensuring the long-term stability of structures in the Hingurakgoda region

Keywords: Expansive soil, Hingurakgoda, Swelling potential, Soil Shrinkage

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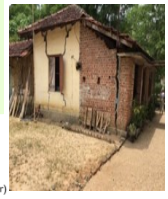
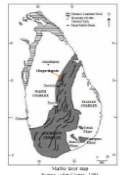
1.Background

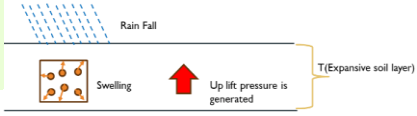
Hingurakgoda, situated in Polonnaruwa, Sri Lanka, is experiencing a concerning issue of house damage

AIM: To understand the causes of structural cracking and other damage in the Hingurakgoda region. By examining soil expansiveness, geological factors, and the relationship with marble layer cavities, the goal is to identify effective methods to **detect expansive soil** and propose strategies to mitigate related building risks.





The presence of minerals like smectite, montmorillonite , and illite in expansive soils significantly influences their swelling and shrinking behaviors

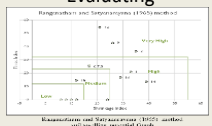


2. Methodology

Data

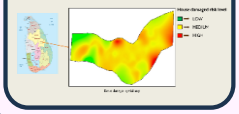
Data Collection
- Structural damage severity
- Soil Properties
  - Atterberg limits
  - Clay content
  - Free swell index
  - Shrinkage limit

Evaluating



Analysis

Spatial Analysis



Classification of soil sample

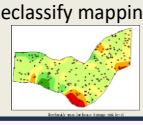
Swelling potential	Ranganatham and Satyanarayana (1965)		Seed et al. (1960, 1962a)		Ladd et al. (1961)		After Chen (1988)		Carter Benly (1991)
	PI	SI	S%	PI	PI	LL	LL	Clay%	PI
Low	<12	<15	0-1.5	0-10	<12	20-35	30	<30	0-15
Medium	12-23	15-30	1.5-5	10-20	12-23	35-50	30-40	30-60	10-30
High	23<	30<	5<	20<	23<	50<	40<	60<	30<

Comparison

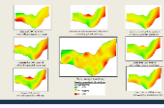
Comparison weightage system

Methods / House damage	Low		Medium		High	
	1	2	3	4	5	6
Low	1	1	0.8	0.5	0.4	0.2	0.1
	2	0.8	1	0.6	0.5	0.3	0.2
Medium	3	0.5	0.6	1	0.8	0.4	0.3
	4	0.4	0.5	0.8	1	0.6	0.4
High	5	0.2	0.3	0.5	0.6	1	0.8
	6	0.1	0.2	0.3	0.4	0.8	1

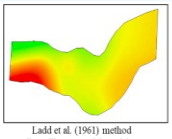
Reclassify mapping

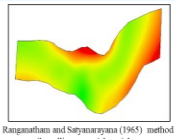


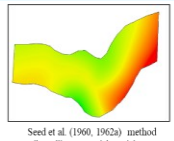
Methods and house damage map

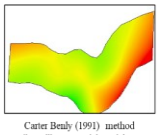


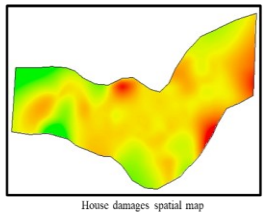
3. Result


Ladd et al. (1961) method soil swelling potential spatial map

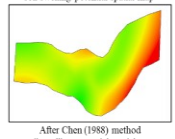

Ranganatham and Satyanarayana (1965) method soil swelling potential spatial map

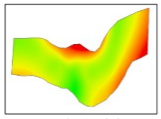

Seed et al. (1960, 1962a) method soil swelling potential spatial map

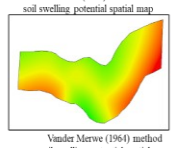

Carter Benly (1991) method soil swelling potential spatial map



House damages spatial map


After Chen (1988) method soil swelling potential spatial map


Ramani(1967) method soil swelling potential spatial map


Vander Merwe (1961) method soil swelling potential spatial map

	Ranganatham and Satyanarayana (1965)	Seed et al. (1960, 1962a)	Ladd et al. (1961)	After Chen (1988)	Carter Benly (1991)	Vander Merwe (1964
Similarity Percentage	59.5%	54.92%	58.6 %	52.12 %	59.47%	63.23%

ArcGIS mapping techniques were crucial for identifying high-risk areas and visualizing soil swelling potential, while the **Vander Merwe (1964) method** showed a high level of similarity when comparing soil expansiveness with house risk levels.