

## Study on the Physical and Index Properties of Ant Hills

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**ABSTRACT:** This research investigates the physical and index properties of anthills and their potential as sustainable construction materials. Samples were collected from an anthill located at latitude 4.97°N and longitude 6.10°E on the main campus of Niger Delta University, Bayelsa State, Nigeria. The samples were taken from three height levels: at the surface, 12 ft above the ground, and at the top. Geotechnical tests, including the Atterberg limits test, specific gravity tests, and particle size analysis, were conducted to determine the soil characteristics. The estimated specific gravity of the clay soil is 2.70, while that of clay and silty soils ranges from 2.6 to 2.9. The specific gravity of the soil solid obtained is 1.875, which falls below the typical range of 2.6 to 2.75, indicating the presence of Kurnakovite. The results infer that anthill soils possess enhanced plasticity and stability due to ant secretions, making them less susceptible to cracking compared to natural clays. The Liquid Limit (LL) is 41.6, indicating medium plasticity; the Plastic Limit (PL) is 22.45%; the Plasticity Index (PI) is 19.15, indicating medium to high plasticity; and the Liquidity Index (LI) is 0.92. These properties indicate that anthill soils have the potential to improve the quality of building materials, particularly for road construction, in developing regions.

**KEYWORDS** Anthills, Geotechnical, Building materials, Index properties, Sustainable construction

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### I. INTRODUCTION

Ant hills, also known as ant mounds, are structures built by ants as a home for their colony. They are made of soil and other materials such as plant debris, sand, and clay. The physical properties of anthills vary depending on the species of ant that builds them, as well as the environment in which they are constructed. One of the most notable physical properties of anthills is their size. Some anthills can be as small as a few centimetres in diameter, while others can be as large as several meters. This variation in size is largely due to the size of the colony that inhabits the anthill, with larger colonies producing larger anthills. Another physical property of anthills is their shape. Some anthills are conical in shape, while others are more rounded or flattened. The shape of the anthill is determined by the species of ant that builds it, as well as the materials they use to construct it.

Anthills also have a variety of internal structures, including chambers and tunnels. These structures serve a variety of purposes, including providing a place for the ants to live, store food, and raise their young. The internal structure of an anthill can be quite complex, with many different chambers and tunnels branching off from the main chamber. It is made mostly of clay materials and other fine-grained soils, and the plasticity properties have been further enhanced by the secretions from the insects while being used in building the mound (Minjinyawa et al., 2007). The clay and fine-grained soils from the mound exhibit the ability to retain a defined shape after moulding due to their plasticity. Additionally, they are less prone to cracking compared to natural clay. Materials used to build anthills are unique because they absorb water, which causes the convex to

quickly dry out when it reaches the ant's mound. The result is a hardened, huge soil mass which does not deteriorate even under very extreme weather conditions. The natural world has long served as a source of inspiration for people. We have accomplished many things that are beyond the capabilities of nature by studying and taking lessons from various creatures. Researchers are keen to understand the processes that enable various simple insects to build intricate and adaptable structures in the natural world. Scientists and engineers are hopeful that insights gained from studying these sophisticated and coordinated behaviors, ranging from how social insects build their nests to how individual insects interact within collectives, can help solve challenges faced by humans.

Social insect complexity and variety of structures resemble human architecture (Ben-Alon, 2014). However, they follow entirely different construction principles. Unlike human-made buildings, which typically consist of standardized, uniform components assembled in a precise sequence, social insect structures are composed of more irregular elements. Their construction emerges from self-organizing, decentralised processes with minimal or no direct supervision (Camazine et., 2020; Detrain & Deneubourg, 2006.). as a result, while these natural structures may lack standardization, they exhibit a remarkable ability to adapt their form in response to environmental changes (Anderson et al., 2002). The field of architecture has long been fascinated by both the similarities and differences between human-built structures and those created by social insects (Holbrook et al., 2010; Sabin & Jones, 2017). Since ancient times, architects and designers have drawn inspiration from nature. This connection between biology and architecture became particularly prominent in the 19<sup>th</sup> century, significantly influencing design thinking and shaping new architectural approaches (Martins, 2017).

Architects are increasingly exploring self-organizing phenomena and the emergent forms of living organisms to rethink construction and urban planning by drawing inspiration from the computational abilities of natural systems, as noted by Ireland and Garnier (2018). Among the most skilled builders in the animal kingdom, ants demonstrate remarkable architectural capabilities. Their processes of "design," "material selection," and "construction" hold intriguing secrets. After hundreds of millions of years of evolutionary adaptation, the nest of different ant species has developed efficient structural designs with excellent mechanical

properties, embodying the principle of maximizing space while minimizing material use. The intricate underground networks of ant colonies are particularly notable for their vast scale and the stability of their internal environmental conditions. These nests feature superior ventilation, optimal humidity and temperature regulation, and strategically incorporate natural elements such as grass, trees, sand, and stones near entrances and exits. Their structural integrity prevents pressure, water, heat, and moisture. Ants exhibit precise preferences for nest-building materials, selecting soil particles based on size, weight, colour, and lustre. Social insects meticulously oversee site selection, material gathering, overall nest design, construction, and long-term nest maintenance.

These biological processes have prompted architects and engineers to reconsider the fundamental characteristics of ant nest structures, particularly in load-bearing capacity, environmental stability, large-scale construction techniques, and the unique properties of ant nest soil. By studying these aspects, researchers can draw inspiration for human architecture and enhance the development of eco-friendly biomimetic construction materials. With these considerations in mind, this review sought to bridge the disciplines of civil engineering, architecture, and biology, encouraging collaboration between architects and biologists to deepen their understanding of underground ant colony nests. Such knowledge could provide valuable insights for designing sustainable human habitats suitable for long-term residence.

## II. METHODOLOGY

### 2.1 Description of Study Area

One of the many anthills that can be found on either side of the road connecting the Main campus and the Glory campus of Niger Delta University in Bayelsa State was chosen for the study and was situated at roughly latitude 4.97N and longitude 6.10E along the Main Campus. The location was selected using GPS, and samples were taken at three spot heights at the surface, 12 feet above the ground, in the middle, and at the top, based on their heights to bases. Samples were bagged and labelled for laboratory analysis. To obtain a representative sample, field samples were dried in the open sun, coned, and quartered. The upper size (clay fraction) and undersize were separated from the sample by taking one-fourth of it, weighing it to 300g, soaking it in water, and passing it through a 0.075  $\mu\text{m}$  sieve (fine fraction). Through sieving, undersize

drying, and weighing, the grain size distribution for the clay fraction was obtained. These analyses were carried out in the Civil Engineering Laboratory at Niger Delta University in Bayelsa State, Nigeria, which is part of the Civil Engineering Department.

## 2.2 Materials Needed for Sieve Analysis and Geotechnical Tests

### 1. Sample Collection

- Location:** Samples were collected from an anthill located on the main campus of Niger Delta University in Bayelsa State, Nigeria, at approximately 4.97°N latitude and 6.10°E longitude. Fig. 1 provides a graphic representation of the site and the ant hill.



**Fig.1: Location of the Anthill (Niger Delta University)**

- Sampling Points:** Fig. 2 provides insight into the collection of the data. Samples were taken at three different heights of the anthill: at the surface, 12 feet above the ground (middle height), and at the top. These points were chosen to analyze the variation in soil properties at different heights.



**Fig.2: On-site Ant Hill data collection analysis**

### 2. Sieve Analysis

Sieves: A standard set of sieves comprises a range of mesh sizes that transition from coarse to fine openings (such as 4.75 mm, 2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.125 mm, and 0.075 mm). This collection is defined by precise mathematical standards regarding opening sizes, wire diameters, and tolerances. The various compartments and experimental setups utilizing these sieves are depicted in Figs 3, 4, 5, 6, and 7.



**Fig.3: Group of Sieve with sample**



**Fig. 6: Different soil samples**

Sieve Shaker: A mechanical device to hold and shake the sieves for a specified period to ensure proper separation of soil particles. This device agitates the sample material in a stack of test sieves for particle size determinations.

- Drying Oven: To dry the soil samples before conducting the sieve analysis.

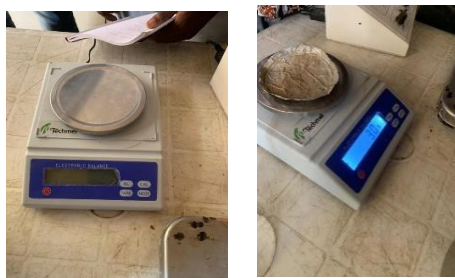


**Fig.4. Mechanically controlled shaker**



**Fig.7. Hot plate (Drying Oven)**

- Weighing Scale: A precision balance for measuring the weight of soil samples before and after sieving.



**Fig. 5. Weighing the soil samples with an electronic weighing balance**

- Sample Splitter: A device to obtain a representative soil sample for the analysis.

### 2.3 Materials and Methods

A sieve analysis is a method utilized to determine the particle size distribution of granular materials with macroscopic granular sizes. This technique involves using multiple layers of sieves with varying grades of sieve openings. It is a mandatory test method for various analytical and industrial processes specified in national and international standards. A search for the keyword "sieve" on the ASTM website yields over 150 standard results and over 130 results on the ISO website. These results provide information on the required sieve sizes for specific materials. Each standard offers detailed instructions on how to perform the particle size test, including sample size, test duration, expected results, and acceptance criteria.

Most of these standards stipulate that the sieves employed must adhere to certain technical specifications outlined in the relevant sieve standards. The kind of material being sieved determines the different criteria for sieves. Ensuring that the sieves utilized meet the required parameters is crucial in

ensuring the attainment of the intended outcomes.

## 2.4 Sieve Test

The sizes of sieve openings were initially established in ASTM standards using imperial units, specifically inches, apertures measuring ¼ inch (6.3 mm) or larger. For finer sieve cloth, mesh numbers were determined by counting the openings per linear inch. For instance, a No. 4 sieve contains four openings per inch. In contrast, ISO standards describe millimetres (mm) or micrometres (µm) sieve openings. The terminology used in sieving can often be unclear, as some terms are industry-specific while others are used interchangeably. For example, “aperture size” and “mesh opening” are frequently used as synonyms. In geotechnical engineering, soil gradation testing used sieves follows ASTM D6913, which applies to soil particles are fine as 75 µm, corresponding to a No. 200 sieve.

$$G_s = \frac{w_2 - w_1}{50 - (w_3 - w_2)} \quad (1.0)$$

The **uniformity coefficient (Cu)** measures the range of particle sizes in a soil sample. It is calculated as the ratio of the diameter of the soil particles at 60% finer (D<sub>60</sub>) to the diameter at 10% finer (D<sub>10</sub>). A higher Cu value indicates a well-graded soil with a wide range of particle sizes, while a lower Cu value suggests a uniformly graded soil with particles of similar size.

$$C_u = \frac{D_{60}}{D_{10}} \quad (2.0)$$

The **coefficient of gradation (Cc)**, also known as the coefficient of curvature, assesses the soil's particle size distribution shape. A well-graded soil typically has a Cc value between 1 and 3. Values outside this range may indicate poorly graded soil, which could affect its compaction, permeability, and strength properties. It is calculated using the following formula.

$$C_c = \frac{D_{30}^2}{D_{60} \times D_{10}} \quad (3.0)$$

For soil to effectively support structures, pavements, or other loads, geotechnical engineers must assess its behaviour under applied forces and changing moisture conditions. In geotechnical laboratories, soil mechanics tests determine particle size distribution, shear strength, moisture content, and the expansion or shrinkage potential of cohesive soils. The Atterberg limit tests identify the moisture levels at which fine-grained clay and silt soils transition between solid, semi-solid, plastic, and liquid states. Atterberg soil indexes compare the test values

mathematically to express different plasticity and consistency characteristics.

## 2.5 Atterberg limit Test

As moisture content increases, clay and silt soil transition through four distinct consistency states: solid, semi-solid, plastic, and liquid. Notable differences in strength, consistency, and behaviour characterize each phase. The Atterberg limit tests precisely determine the moisture content thresholds that mark the transitions between these states. As shown in the Fig. 8 graph. Test results and their indices are crucial to the design of foundations and the prediction of soil behaviour in infills, embankments, and pavements. The values obtained from these tests are used to evaluate the strength of soils, estimate their permeability, predict settlement, and identify those that are prone to expansion.

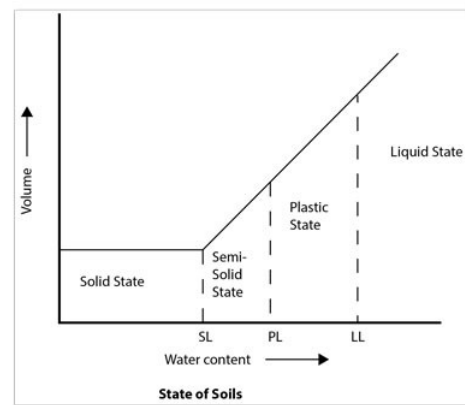


Fig. 8. Atterberg Limit Graph Profile.

In soil engineering and geotechnical testing, the Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI), and Liquidity Index (LI) are critical parameters used to characterize the properties of fine-grained soils, particularly clays. These values provide insights into the soil's behaviour under different conditions, which is crucial for construction and engineering projects.

### Particle Size Distribution – Coarse Analysis

**Theory:** For a coarse-grained material, the distribution of various-sized particles in the soil may be determined by sieving

### Procedures

The particle size distribution for coarse-grained materials is determined through sieving. This method involves weighing an oven-dried soil sample before passing it through a series with decreasing sizes, typically 4.76mm, 2.36mm, 1.18mm, 0.15 µm, 0.30mm and 0.075 µm. The material retained on each

size is then weighed to assess the distribution of particle size within the sample.

### Specific gravity test

Theory: Specific gravity  $G_s$  is defined as the ratio of the weight of a given volume of soil to the weight of an equal volume of water, as shown in Equation 1.0. Specific gravity is an important parameter in soil mechanics as it helps in identifying and classifying soil types.

Procedure: (A) Density Bottle: The density bottle method begins with weighing the empty bottle ( $W_1$ ). A small quantity of oven-dried soil is then placed in the bottle ( $W_2$ ), and its weight is recorded. Distilled water is added to cover the soil and fill the bottle ( $W_3$ ), after which the total weight is measured again. To minimize errors arising from temperature variations, the bottle is immersed in a constant temperature bath maintained at 20°C for at least an hour before each weighing. This procedure is repeated for multiple samples to ensure accuracy.

Procedure: (B) Pycnometer: In the pycnometer method, the pycnometer is first weighed empty ( $W_1$ ) and then filled with distilled water ( $W_2$ ) to record its weight. The pycnometer is then emptied and dried before introducing the oven-dried soil sample, which is weighed once more ( $W_3$ ). Distilled water is added to the soil within the pycnometer, and the mixture is carefully stirred to eliminate trapped air. The pycnometer is topped up with additional water if necessary and weighed again ( $W_4$ ) with its contents. This procedure is repeated for several samples to obtain reliable results.

### Consistency limits – Liquid Limits

The liquid limit of soil is defined as the minimum moisture content at which it begins to flow under its weight. A soil sample is considered to have reached its liquid limit when a groove, made using a grooving tool in the Casagrande liquid limit device, closes after 25 blows or drops. To determine the liquid limit, a dried soil sample is mixed thoroughly with distilled water using a spatula to form a stiff consistency. A portion of this mixture is then placed in the circular brass dish of the liquid limit device and levelled to ensure an even surface parallel to the base. A groove is cut through the centre of the soil portion using a grooving tool, after which the dish is raised and allowed to drop onto the rubber base at two revolutions per second. This process continues until the bottom of the groove closes, and the number of blows required for closure is recorded. Additional water is added to the sample, which is repeated to

obtain further measurements.

### Consistency Limits – Plastic Limits

The plastic limit of soil is defined as the minimum moisture content at which the soil can be rolled into a thread of 3mm in diameter without breaking apart. Approximately 20 grams (20gm) of dried soil is mixed with distilled water and moulded into a ball to determine the plastic limit. The soil is then rolled between the palm and a glass plate to form a thread. The rolling process continues until the thread reaches a diameter of 3mm; at this point, the soil is kneaded together and rolled out again. The process is repeated until the thread crumbles and a portion of the soil is taken for moisture content determination. This sequence is repeated twice to ensure accuracy in the results.

## 2.6 Data Collection & Representation

The ant hill, located at Niger Delta University, Amassoma, Nigeria (Latitude: 4.9771282 °N, Longitude: 6.1038301 °E), has been analyzed in a three-dimensional (3D) space with coordinates  $x = 12ft$ ,  $y = 13ft$ . The heights recorded at various points across the structure include 3.4 ft, 3.5 ft, 3.4 ft, 3.35 ft, 3.55 ft, and 3.6 ft, reflecting minor variations likely due to the natural formation of the mound and the uneven terrain on which it is located. The environmental conditions were recorded during the analysis, providing insights into the surrounding atmosphere at the measurement time. The compass direction was determined to be 134.0 °SE, with a humidity level of 66%. Wind speed measured 8.95 miles per hour (m/h), and atmospheric pressure stood at 1009 hPa. The temperature was observed at 31°C, with the data time stamped at 06:49:06 PM, ensuring accuracy in referencing the conditions under which the study was conducted.

### Design Assumptions

In approaching the analysis of the ant hill, several design assumptions were made to facilitate the computation of spatial parameters. The base of the ant hill was presumed to be rectangular, simplifying the representation of its foundation. Its overall shape was approximated as a rectangular-based pyramid, which provided a structured approach to estimating its volume and spatial characteristics. Due to inherent measurement constraints, area calculations were conducted within defined limitations, ensuring reasonable accuracy without advanced surveying tools. Furthermore, height measurements were taken from different reference points due to the sloping nature of the ground, which introduced slight variations in the recorded values. These assumptions and conditions collectively

contributed to a comprehensive understanding of the ant hill's structural and environmental context.

**Calculations**

**1. Base Area:**

The base area of the ant hill was determined using the standard formula for the area of a rectangle, given by the product of its length and breadth. With a length of 12 ft and a breadth of 13 ft, the base area was calculated as follows:

$$Base\ Area = Length \times Breadth \tag{4.0}$$

$$= 12ft \times 13ft \tag{5.0}$$

$$(12 \times 13)(ft)^2 \tag{6.0}$$

$$= 156\ ft^2 \tag{7.0}$$

The calculation establishes the ant hill's foundational surface area, which is crucial for further volumetric assessments and spatial representations.

**Converting to square meters:**

The base area of the ant hill was originally calculated in square feet, and converting this to square meters involves using the conversion factor that 1 ft equals 0.3048 m. Thus, the conversion for area is performed using the factor  $(0.3048)^2$ . This can be expressed as

$$1ft = 0.3048m \tag{8.0}$$

$$Base\ Area = 156\ ft^2 \times (0.3048)^2 \tag{9.0}$$

Which yields approximately

$$\approx 14.4928m^2 \tag{10.0}$$

**2. Mean Height:**

The mean height of the ant hill was computed by averaging the recorded heights, resulting in

$$\frac{3.4+3.5+3.4+3.35+3.55+3.6}{6}ft = \frac{20.8}{6}ft \approx 3.467ft \tag{11.0}$$

Converting to meters:

Converting this mean height to meters is done by multiplying by

$$Mean\ Height = 3.467ft (0.3048) \tag{12.0}$$

$$= 1.0567m \tag{13.0}$$

**3. Height-to-Base Area Ratio:**

Finally, the height-to-base-area ratio is determined by dividing the mean height in meters by the base area in square meters:

$$Base\ Area = 1.0567m : 14.4928m^2 \tag{14.0}$$

$$Base\ Area = \frac{1.0567}{14.4928} = 0.0729 \tag{15.0}$$

Thus, the ratio of height to base area for the ant hill is approximately 0.073.

$$Approx. \approx 0.073 \tag{16.0}$$

**III. RESULTS AND DISCUSSION**

The sieve analysis of a fine clay sample was conducted with a dry weight of 300 grams (0.30 kg) and a basin weight of 0.14 kg. The sample was shaken for 5 minutes to ensure proper separation of particle sizes. The resulting data was used to compute the distribution of particle sizes in the clay sample. Using an Excel graph, the Particle Size Distribution curve was achieved. The finer percentage % was plotted against the sieve size. Figs 9, 10, 11, and 12 present the results, which will be discussed in graphical format.

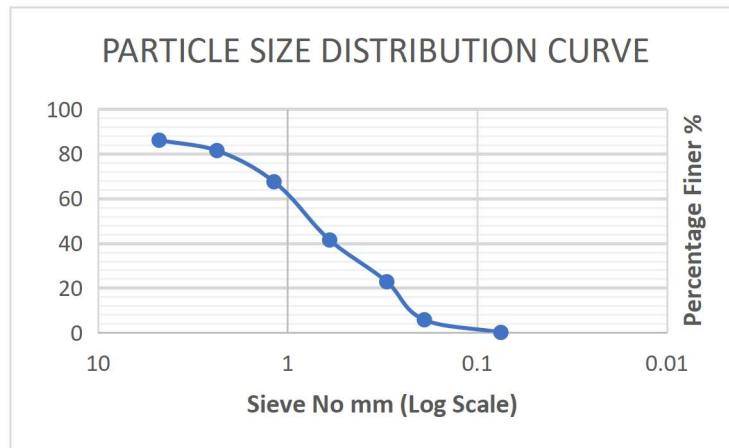


Fig. 9. Particle Size Distribution Curve

The Particle Size Distribution (PSD) curve, as shown in Fig. 9 above, illustrates the proportions of different particle sizes within the sample. This analysis is essential for understanding the soil's behaviour, particularly its permeability, compaction potential, and suitability for construction purposes. A well-graded soil typically has a mix of particle sizes, which improves its load-bearing capacity, while poorly graded soil may exhibit weaknesses in structural applications.

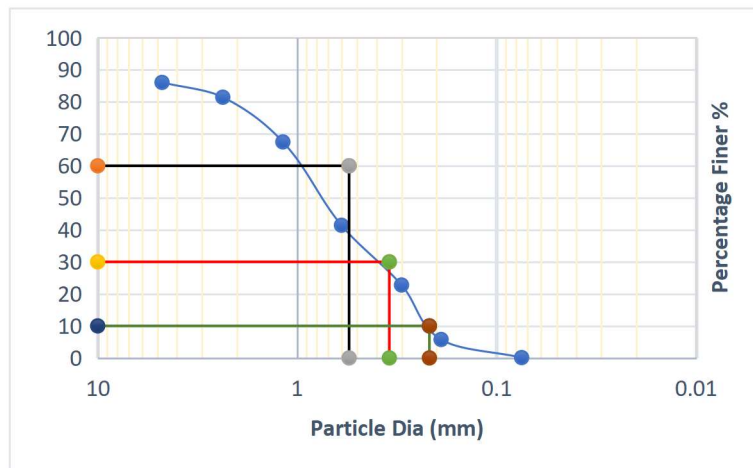


Fig. 10. Particle Size Distribution Curve with D60, D30, and D10

Fig. 10 presents the PSD curve with D60, D30, and D10, which are key indicators for calculating the uniformity coefficient ( $C_u$ ) and the coefficient of gradation ( $C_c$ ). These parameters determine whether the soil is well-graded, poorly graded, or gap-graded, influencing its mechanical properties. A high uniformity coefficient suggests a wide range of

particle sizes, contributing to better compaction and stability. In contrast, a lower value indicates uniform particle sizes, which reduce strength and increase compressibility. The presence of fine clay particles suggests that the soil has a plasticity index, directly affecting its shrink-swell behaviour under varying moisture conditions.

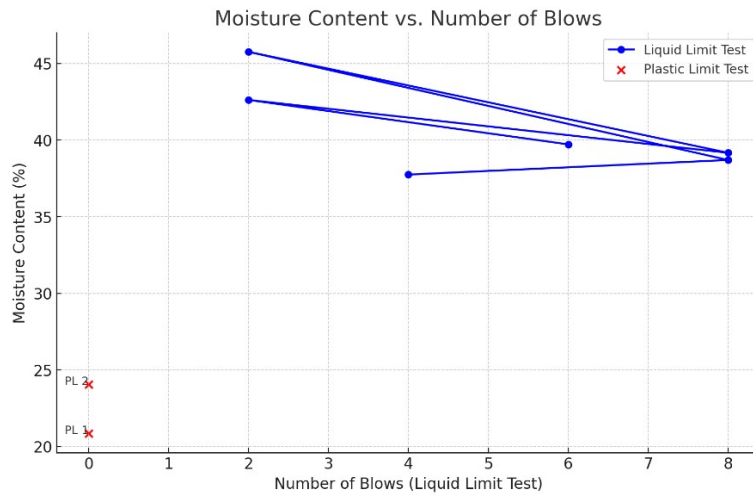


Fig. 11. Liquid test and Plastic limits

The liquid and plastic limit tests, as illustrated in Fig. 11, provide crucial insights into the soil’s consistency and plasticity characteristics. The liquid limit, determined by plotting moisture content against the number of blows, indicates the water content at which the soil transitions from a plastic to a liquid state. The steeper the curve, the more abrupt the change in consistency, highlighting the soil’s sensitivity to moisture variations. The plastic limit test results, marked by red points in the graph, show the moisture content at which the soil begins to exhibit plastic behaviours. The difference between these two limits, known as the plasticity index, measures the soil’s workability and potential

expansion under wet conditions. Higher plasticity index values suggest increased water retention capacity, which may affect the soil’s suitability for engineering applications.

Fig. 12 further explores the moisture content variations and their effect on soil consistency. The ability of ant hill soils to retain moisture while maintaining structural integrity suggests the presence of binding agents, likely derived from organic secretions by ants. These natural additives contribute to the soil’s resistance to cracking, making it a suitable material for applications requiring long-term durability and resilience.

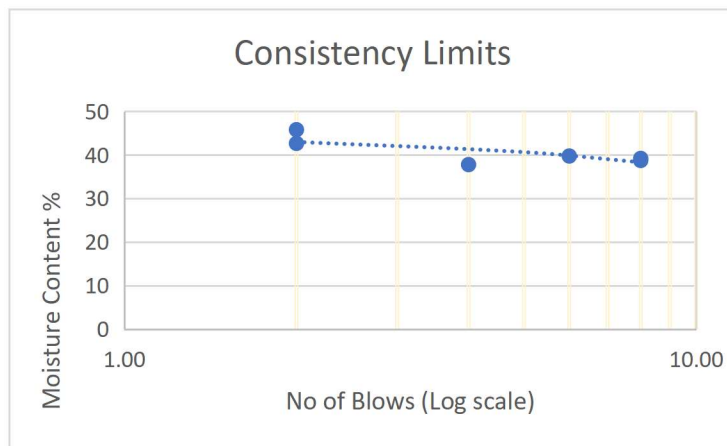


Fig. 12. Moisture Content (Consistency Limit)

Here is the moisture content graph showing the relationship between the number of blows (for the liquid limit test) and the moisture content. The red points indicate the moisture content for the plastic limit tests (PL1 and PL2), which do not involve blows. The blue line represents the liquid limit test

results.

#### IV CONCLUSION AND RECOMMENDATIONS

##### 4.1 Conclusion

The study's findings underscore the unique properties of anthill soils, which exhibit enhanced plasticity and stability due to ant secretions. These secretions appear to significantly reduce the susceptibility of anthill soils to cracking compared to natural clays. This characteristic can be highly beneficial for construction materials, particularly in applications where durability and resilience are critical. These properties infer that anthill soils could significantly improve the quality of building materials. Specifically, for road construction, the reduced susceptibility to cracking and the ability to maintain structural integrity under varying moisture conditions make anthill soils a viable and sustainable alternative in developing regions.

1. **Specific Gravity:** The specific gravity of anthill soils was found to be 1.875, which is lower than the typical range for clay soils (2.6 to 2.9). This lower specific gravity suggests the presence of Kurnakovite compounds, a magnesium borate mineral known for its lightweight and unique properties. The inclusion of such compounds can potentially enhance the soil's suitability for lightweight construction applications.
2. **Water Absorption and Drying:** Anthill materials demonstrated enhanced water absorption and quick-drying properties, leading to a hardened structure that withstands extreme weather conditions. These properties make anthill soils ideal for creating construction materials that require rapid setting and resistance to moisture-related degradation.
3. **Soil Structure and Fertility:** The mixing of soil and organic matter by ants improves the soil structure and fertility. This natural enhancement process results in a more robust and cohesive soil matrix, which can be advantageous for construction purposes. Additionally, the improved fertility of the soil indicates its potential for use in agricultural applications, promoting sustainability in land use.

The study also highlights the dual impact of anthills on sustainability, economics, and the environment. Conclusively, the unique properties of these soils, combined with their environmental benefits, make them a promising alternative to traditional construction materials.

##### 4.2 Recommendation

Nene and Parihar (2003) describe termites as natural soil engineers due to their ability to alter and stabilize soil properties while constructing their habitats. Their study highlights several key characteristics of termites and their anthills. Termites gather nearby soil particles for building, binding them with a rapidly hardening secretion from their mouths, solidifying them into a rock-like material over time. The structural strength of anthills increases as they age. Additionally, anthills can take on various shapes and sizes, such as pyramidal, mushroom-like, or columnar, depending on the termite species responsible for their formation. The degree of saturation, voids ratio, and unit weight of moist soils can all be determined using the specific gravity of the soil. When calculating pressure settlement and stability issues in soil engineering, the unit weight is necessary. A deeper scientific understanding of the multipart and adaptable structures created by ant colonies is warranted. Ant colony behaviour demonstrates a high degree of coordination and complexity stemming from individual ant-environment interactions. Understanding these mechanisms could provide significant utility in resolving human-related issues. The structural similarities between ant nests, various biological processes, and human architectural designs offer a valuable reference for advancing architectural engineering.

From the standpoint of structural engineering, the mechanical and ventilation properties of the ant nest structure are viable. Civil structures with tree-trunk geometry could be built thanks to the extra robustness brought by the ant nest's special structure. From a civil engineering perspective, research on the fundamental characteristics of soil and calcined ant nest clay and their impact on the resilience and compressive strength of concrete presents strong evidence supporting the potential of calcined ant nest clay powder as a sustainable biomimetic construction material. Exploring the viability of ant hill soils as a sustainable alternative for construction and infrastructure development reveals their unique properties. The inherent plasticity, stability, and moisture resistance of these soils position them as a promising material for innovative engineering applications. To fully capitalize on their potential in large-scale projects, future research efforts should concentrate on refining the processing techniques and enhancing the material properties of ant hill soils.

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