INNOVATIVE APPLICATION OF SINGLE AND DOUBLE COIR GEOTEXTILES FOR SUSTAINABLE STABILIZATION OF SOFT CLAY USING STONE COLUMNS UNDER ACT IS 15284-1:2003INKODUMUDIPANCHAYATH UNION, TAMILNADU, INDIA

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Abstract
Soft cohesive soils present serious challenges for infrastructure development due to their low bearing capacity and high compressibility. Stone columns (SCs) are widely used to improve soft soils; however, in very soft clays, insufficient lateral confinement leads to bulging and reduced performance. Synthetic geotextiles have been used as encasements to mitigate this, but their environmental impact has driven the need for biodegradable alternatives. This study explores the innovative application of Single Geopanama Coir (SPC), Double Geopanama Coir (DPC), and Jute geotextile as natural encasements for stone columns. Laboratory experiments were conducted in reconstituted soft clay beds ($c_u \approx 33$ kPa, $w = 50\%$) replicating field conditions reported at the Kodumudi site, Erode District, Tamil Nadu, where silty clay and clayey soil strata with low SPT-N values (8–12) and safe bearing capacity of 60–70 kN/m² were identified. The performance of SCs encased with SPC, DPC, and jute was compared against unencased and synthetic encasement configurations across varying aspect ratios (L/D = 0.33–1.0). Results reveal that SPC-encased columns significantly enhance floating column performance, offering superior lateral support and load capacity, while DPC excels in end-bearing configurations, providing greater confinement and stiffness due to its dual-layer structure. The study identifies material-specific performance characteristics and highlights stitching limitations in natural geotextiles under large deformations. Overall, the research establishes natural coir geotextiles as viable, eco-friendly substitutes for synthetic encasements in soft clay stabilization, with direct applicability to sites like Kodumudi, thereby aligning geotechnical innovation with sustainability goals.

Keywords: Unencased stone column, encased stone column, geosynthetic, Single Geopanama Coir, Double Geopanama Coir, jute

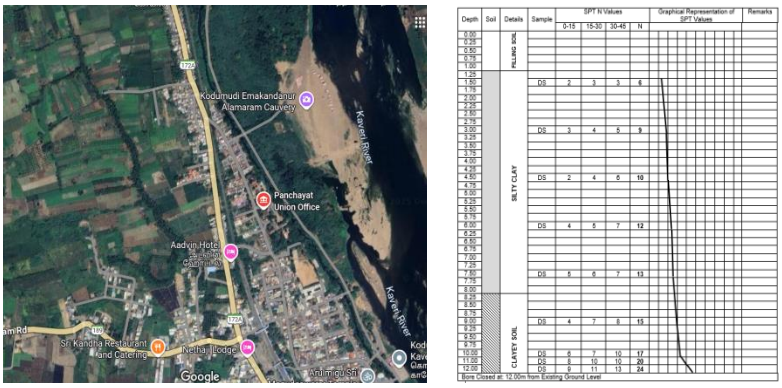
1. Introduction

Soft clay deposits pose significant geotechnical challenges because of their low shear strength, high compressibility, and excessive settlement potential. In the context of rapid urbanization and the scarcity of suitable land, infrastructure is increasingly being constructed on such problematic soils, which require systematic ground improvement. Among the various stabilization techniques, stone columns (SCs) have become one of the most widely adopted solutions for enhancing bearing capacity and reducing settlement in cohesive soils [1–3]. The efficiency of stone columns is strongly dependent on the lateral confinement provided by the surrounding ground [4–10]. In very soft clays, this confinement is often inadequate, leading to outward bulging of the column and a corresponding reduction in its load-carrying efficiency [11–17].

Encasing stone columns with geosynthetic materials has been shown to counteract this problem by providing hoop stiffness, which mobilizes circumferential resistance and restricts bulging. This confinement significantly improves strength and settlement performance [14, 18–28]. Experimental and numerical studies further confirm that geosynthetic encasements contribute additional stiffness, thereby enhancing column efficiency [29–35]. However, the long-term persistence of synthetic polymers such as polypropylene and polyester raises environmental concerns, particularly regarding microplastic generation and soil contamination. This has encouraged the exploration of natural, biodegradable alternatives such as jute and coir geotextiles [36].

Jute geotextiles have a proven record in civil engineering applications including pavements, erosion control, slope protection, and river training works [37–42]. Similarly, coir geotextiles, derived from coconut husk fibers, are characterized by higher lignin content, better durability, and improved frictional behavior compared to many synthetic products. Their applications in slope stabilization, embankment reinforcement, and soft soil improvement highlight their engineering potential [43–46, 48–50]. Recent sustainability-oriented studies further emphasize their affordability, eco-friendliness, and reduced carbon footprint when compared with conventional geosynthetics [51–56].

The relevance of such eco-friendly solutions is particularly evident from the recent geotechnical investigation conducted at Kodumudi, Erode District, Tamil Nadu, for the proposed Panchayat Union Office building[Latitude: 11.081401° N; Longitude: 77.885565° E]. The subsoil profile revealed filling soil underlain by silty clay and clayey deposits, with corrected SPT-N values ranging between 8 and 12 at depths of 3.0–4.5 m, The location of the study site at Kodumudi, Erode District, Tamil Nadu, along with the representative subsoil profile obtained from bore log data, is presented in Figure 1. Laboratory testing recommended a safe bearing capacity of 60–70 kN/m². These conditions closely represent soft clay strata prone to excessive settlement and low stability, highlighting the need for reliable and sustainable ground improvement.



(a) **(b)**

Figure 1. (a) Location of the Kodumudi site on Google Maps. (b) Subsoil profile from bore log data showing soil layers and SPT-N values.

In this context, the present study evaluates the performance of unencased stone columns (SC-WE) and stone columns encased with natural (SPC, DPC, and jute) and synthetic geotextiles, installed in a reconstituted clay bed prepared at 50% water content (cu ≈ 33 kPa) to replicate field conditions similar to those observed at Kodumudi. The influence of column aspect ratio (L/D = 0.33–1.0) on load–settlement response is analyzed in detail. The novelty of this work lies in its comparative assessment of Single Geopanama Coir (SPC) and Double Geopanama Coir (DPC) encasements in both floating and end-bearing configurations, demonstrating their suitability as eco-friendly, biodegradable alternatives to synthetic encasements. By linking laboratory findings with a real site profile, this research not only advances sustainable ground improvement but also demonstrates the practical feasibility of implementing natural fiber encasements in field conditions such as those encountered at Kodumudi.

2. Materials

To simulate ground conditions typically encountered during stone column installations, a high-plasticity clay was selected for preparing the test bed. The particle size distribution of the clay was determined in accordance with the relevant standard procedure [57], and the results are presented in Figure 2.

The plasticity characteristics of the clay, including liquid limit (LL), plastic limit (PL), and shrinkage limit (SL), were measured following codal provisions [58, 69]. The specific gravity of the soil was also obtained [61], and the overall classification was carried out using the Unified Soil Classification System [60]. These values are summarized in Table 1a. To replicate the strength of field soft clay deposits, the undrained shear strength was maintained within 20–40 kPa. Vane shear testing [62] confirmed that at a water content of 50%, the clay achieved an undrained shear strength of approximately 33 kPa. Accordingly, all clay beds used in the study were prepared at this water content.

To strengthen the practical relevance of the experimental program, the laboratory soil was benchmarked against the Kodumudi site (Erode District, Tamil Nadu), where a detailed geotechnical investigation was conducted for the proposed Panchayat Union Office building. The site consists of a surface layer of fill, underlain by silty clay and deeper clayey strata. Corrected SPT-N values were observed between 8 and 12, with a recommended safe bearing capacity of 60–70 kN/m², and cohesion values ranging from 8–12 kPa. These properties are consistent with the prepared laboratory clay bed (cu ≈ 33 kPa), validating the representativeness of the test conditions. A summary of the site parameters is presented in Table 1b.

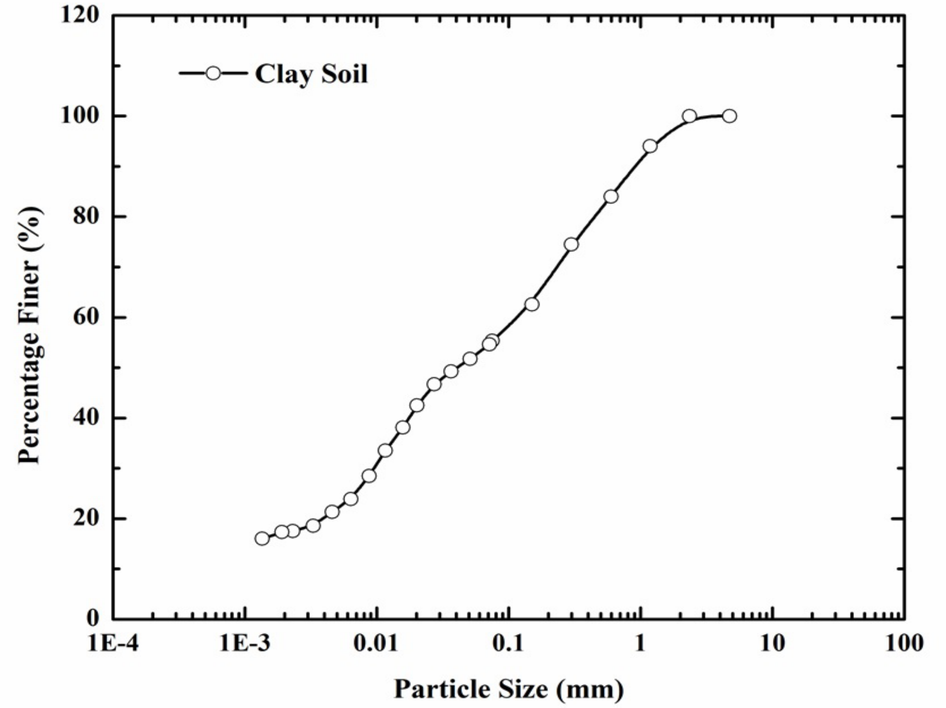


Figure 2: Particle size distribution of clay soil

Table 1a: Physical characteristics of clayey soil

Property	ASTM Code	Clayey Soil
Specific gravity, G	D854-23	2.72
LL (%)	D4318	57
PL (%)		20
PI (%)		37
SL (%)	D427	4.8
Classification of soil	D2487	CH
Vane Shear Test	D2573	
Undrained Shear Strength (kPa)		33
Water content, WC (%)		50

Table 1b. Representative soil parameters from Kodumudi site (Erode District, Tamil Nadu)

Depth (m)	**Soil Type**	**Corrected SPT-N**	**Cohesion (kPa)**	**Unit Weight (kN/m³)**	**SBC (kN/m²)**
0–1.5	Fill soil	4–8	5	15.0	–
1.5–4.5	Silty clay	8–11	8–12	15.5–16.0	60–70
4.5–10.0	Clayey soil	11–15	12–20	16.0–16.5	60–70

In this study, both natural and synthetic geotextiles were examined to assess their effectiveness when used as encasement materials for stone columns. The natural geotextiles selected were coir fabrics, obtained from Eco Coir Cluster India Pvt. Ltd., Pollachi, Tamil Nadu—a region well recognized for its coconut cultivation and coir-based industries. Coir, extracted from the husk of coconuts, is a biodegradable fiber that has long been applied in erosion control and soil reinforcement works. Jute geotextiles, with a mass per unit area of 724 g/m², were also included in the program and sourced from Birla Corporation Ltd., Birlapur, West Bengal. For comparative purposes, a commercial synthetic geotextile supplied by Parikh Sales Agency, Gujarat, was used. Synthetic geotextiles, typically manufactured from polypropylene or polyester, are valued for their high durability, tensile strength, and resistance to biological and chemical degradation, making them suitable for long-term ground improvement applications. Photographs of the geotextile materials used in the investigation are shown in Figure 3.

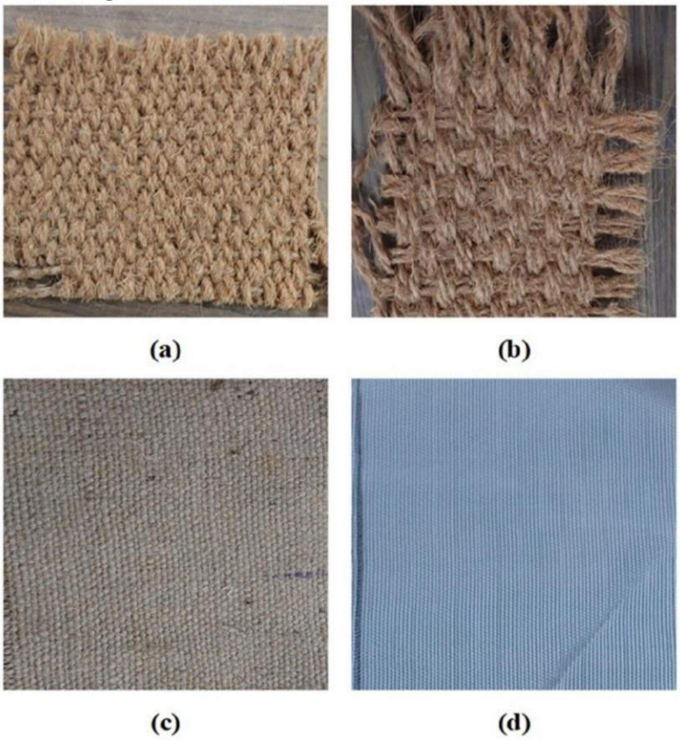


Figure 3: Photographic image of (a) SPC (b) DPC (c) Jute (d) GS geotextiles

The geotextile samples were tested to determine their mechanical and physical characteristics, following the relevant codal specifications. The outcomes of these evaluations for coir, jute, and synthetic fabrics are presented in Table 2. Among the natural fibers, Single Geopanama Coir (SPC) and Double Geopanama Coir (DPC) were chosen because of their comparatively higher tensile strength (14.13 MPa for SPC and 11.11 MPa for DPC) and greater elongation capacity, both of which enhance their ability to absorb and distribute loads effectively. The presence of a higher lignin content in coir, when compared with fibers such as jute or hemp, delays its biodegradation and provides a functional service life of about 2–3 years. Furthermore, the frictional resistance offered by coir is superior, making it especially advantageous in stone column applications where improved lateral confinement is essential.

Table 2: Physical and mechanical properties of synthetic and natural geotextiles

S. No	**Properties**	**Unit**	**GS**	**Jute**	**Single Geopanama**	**Double Geopanama**
1.	Mass per unit area	g/m^2	200	724	800	800
2.	Tensile Strength	Mpa	7.00	10.22	14.13	11.11
3.	Elongation	%	18.72	16.07	18.72	20.85

3. Methodology

In India, the design and construction of stone columns are guided byIS code [63], which provides recommendations on column dimensions, installation methods, and performance evaluation in soft cohesive soils. In this study, the experimental program was planned in line with the provisions of this code, ensuring that the unit cell dimensions, column aspect ratios, and material selection reflect field practice.

Specifically, [63] emphasizes the need for adequate lateral confinement in very soft clays to control bulging and enhance load-bearing efficiency. This aligns directly with the research objective of assessing geotextile encasements—both natural and synthetic—as sustainable confinement measures. By benchmarking laboratory clay properties against the Kodumudi site investigation (SPT-N = 8–12; SBC ≈ 60–70 kN/m²), and by following codal recommendations for column geometry, the test conditions were designed to realistically represent field installations in Indian soft clay deposits.

3.1 Preparation of clay bed

The objective of this study was to investigate the influence of geotextile-encased stone columns (SCs) on the load–settlement response of soft soils under controlled laboratory conditions. A cylindrical unit cell measuring 300 mm × 600 mm was adopted to represent field conditions, enabling a systematic evaluation of stone column behavior under applied loading. Before testing the performance of SCs—both with and without encasement—the load–settlement response of the clay bed alone was obtained to establish a baseline reference. The entire test setup is shown in Figure 4.

Importantly, the soil profile adopted in the laboratory was designed to simulate the conditions encountered at Kodumudi, Erode District, Tamil Nadu, where a recent geotechnical investigation for the proposed Panchayat Union Office building identified soft deposits of silty clay and clayey soil with corrected SPT-N values ranging from 8 to 12 and a safe bearing capacity in the range of 60–70 kN/m². These parameters were used to benchmark the laboratory-prepared clay bed (undrained shear strength ≈ 33 kPa at 50% water content), ensuring the experimental program reflects realistic site conditions.

3.2 Preparation of stone column without encasement

The first phase of the experiment focused on the performance of SC-WE, for this purpose a stone column of 60mm diameter and varying length (L) of 200 mm, 300 mm, 400 mm, and 600 mm as shown in Figure 5 is constructed as per the procedure detailed in the following.

The main objective of this phase was to examine the influence of different aspect ratios on the columns' load-bearing capacity and settlement response. The following methodology was used for the stone column installation.

The preparation of clay bed in the unit cell is similar to the procedure as explained earlier. Subsequently, a steel pipe with inner and outer diameters of 60 mm and 63 mm, respectively, was positioned at the center of the prepared soil bed. Depending upon the aspect ratio, the spiral steel augers were used to remove soil from the clay bed, creating a cavity for the stone column. The inner surface of the steel pipe was lightly oiled to facilitate easy removal. The cavity's volume was used to calculate the amount of stone aggregate required, aiming for a relative density of 60-70%. The stone aggregate was split into five equal portions; each compacted in the cavity using a steel tamper. The entire process of installing the stone column is detailed in Figure 6. Once the stone column is installed, the entire set up is transferred to the testing unit to measure the load-settlement characteristics as explained above.

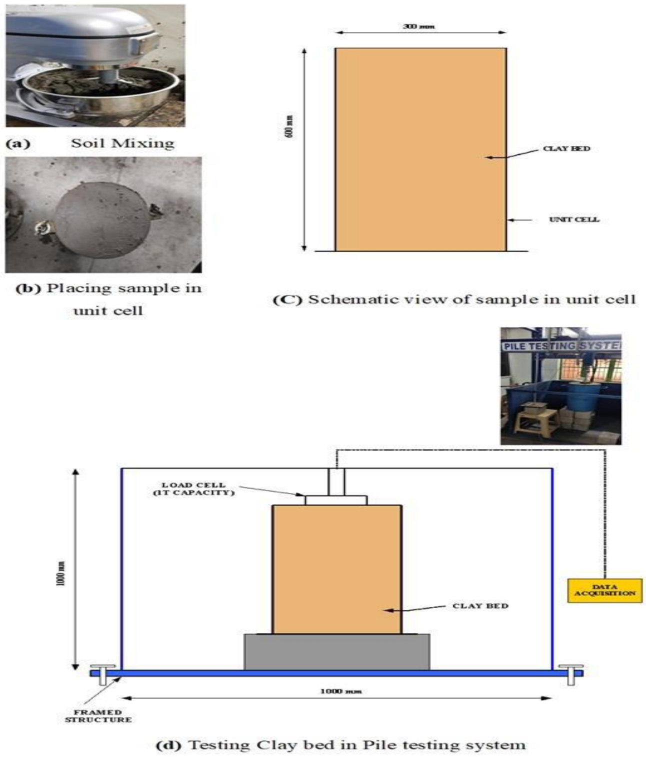


Figure 4. Sequence of preparing clay bed for testing

3.3 Preparation of Encased stone column

In addition to testing SC-WE columns, the study also examined SC encased with different geotextile materials to compare their effectiveness in enhancing load-bearing capacity and stability. The diameter of all SC was kept constant at 60 mm to ensure that any performance differences resulted from encasement and aspect ratios rather than variations in column size. Encased stone columns were constructed by covering the geotextile material around the steel pipe, which was then placed in the soil bed. The stone aggregate was added using the same procedure as for SC-WE. After the steel pipe was removed, leaving the geotextile encasement in place, load-settlement testing was performed in the same manner as discussed in case of SC-WE. The process of preparing sample for encased stone column is detailed in Figure 7. This research contributes to the understanding of how geotextile encasements improve the stability and effectiveness of SC in geotechnical applications.

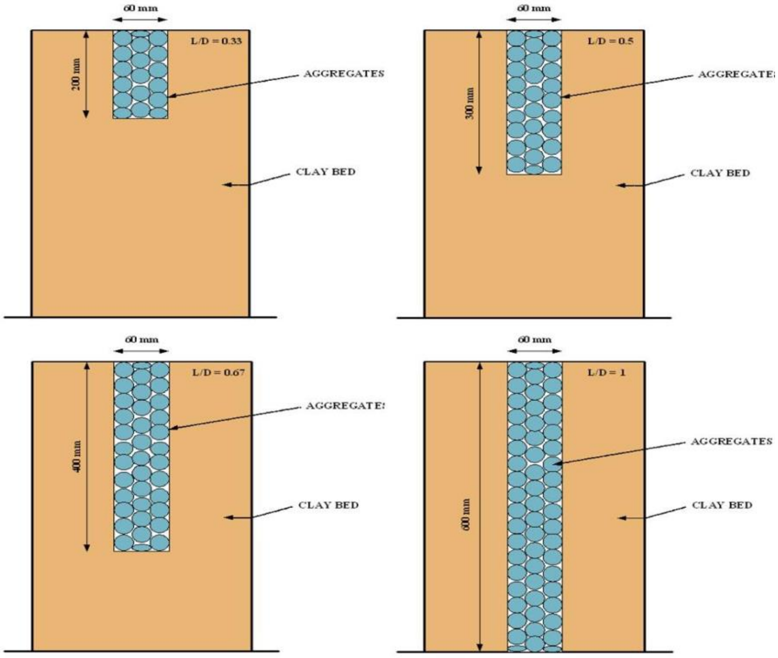
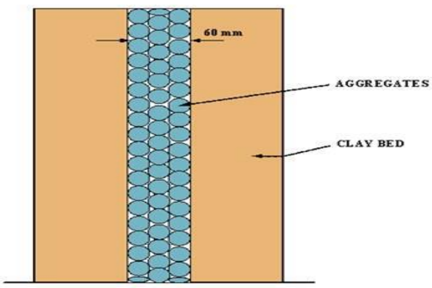


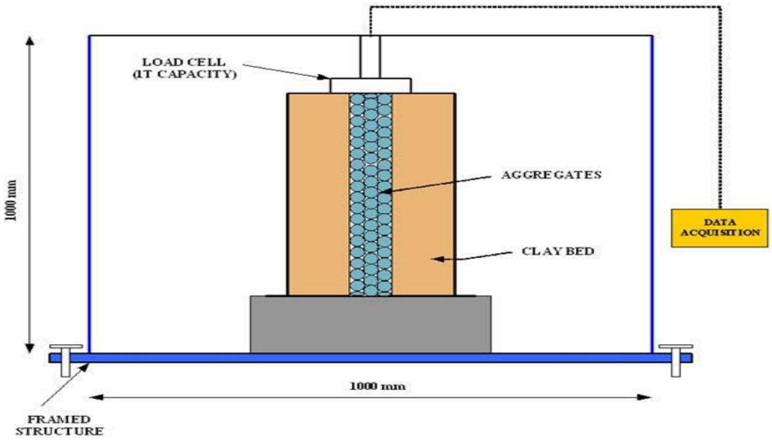
Figure 5: Schematic view of SC-WE prepared at different aspect ratio

(a) Placing aggregates in the prepared clay bed

(b) Stone column without encasement in unit cell



(c) Schematic view of Stone column without encasement in unit cell



(d) Testing Unencased stone column in Pile testing system

Figure 6: Sequence of preparing SC-WE for testing

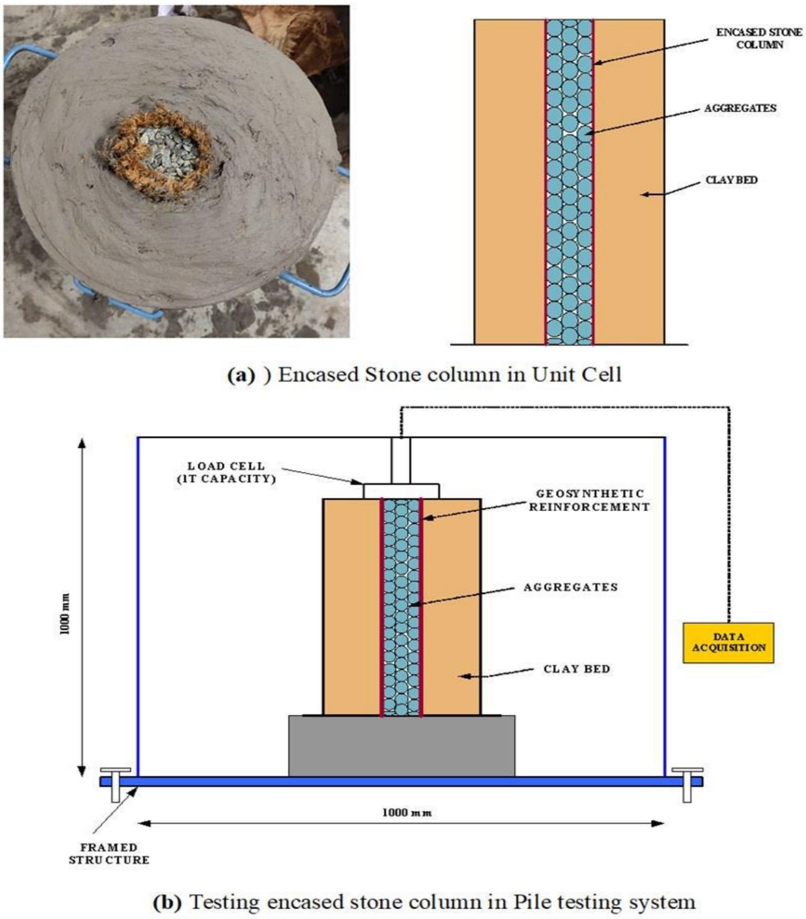


Figure 7: Sequence of preparing encased stone column for testing

4. Results and Discussion

4.1 Load-Settlement Characteristics

The load-settlement response of the clay bed without a stone column was evaluated using the previously outlined methodology. This data serves as a baseline to measure the improvement in load-bearing capacity when SC are introduced. The load-settlement characteristics for the clay bed are shown in Figure 8. According to the experimental results, the clay bed alone can support a load of 0.623 kN.

To assess soil performance improvement, SC with a diameter of 60 mm were installed at different lengths—200, 300, 400, and 600 millimeters — under consistent soil conditions. The columns with lengths of 200 mm, 300 mm, and 400 mm were designed to represent floating columns, while the 600 mm column simulated an end-bearing column. An "end-bearing column" refers to a stone column whose base, or toe, is placed directly on a hard stratum. In contrast, "floating columns," also known as partially penetrated SC, only partially penetrate the soft soil layer, as the hard stratum lies much deeper below the surface [64-66]. Load-settlement response was recorded for each setup, as illustrated in Figure 9.

The results show that SC of different lengths produced notable enhancements in load-settlement characteristics. In particular, the end-bearing column (600 mm) demonstrated a significantly higher load-carrying capacity than the floating column. This suggests that the longer column, which reaches a firmer or deeper layer, more effectively transfers loads, thereby enhancing the overall soil performance [30].

The load-settlement performance of SC encased with various geotextiles (GS, SPC, DPC, and Jute) was analyzed. The lengths of the encased stone columns (200 mm, 300 mm, 400 mm, and 600 mm) were kept consistent with those of the SC-WE, and the diameter was maintained at 600 mm. Testing was carried out on these encased columns following the methodology outlined in the study. The load-settlement characteristics for each geotextile-encased column are shown in Figure10.

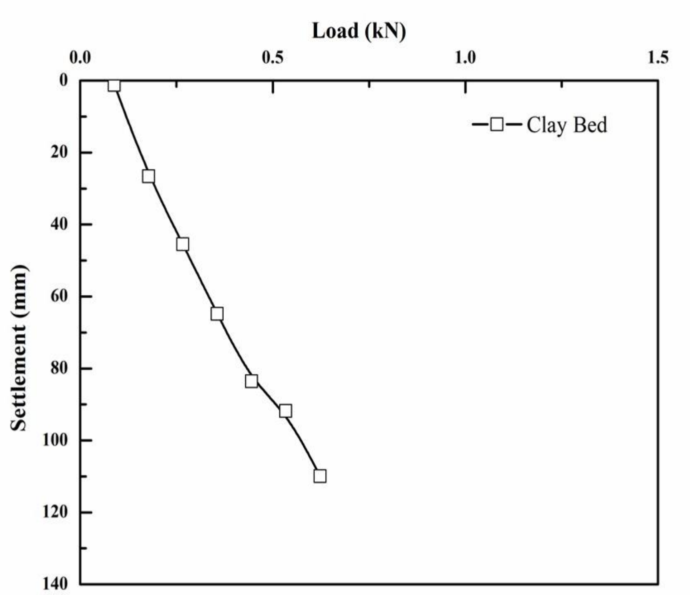


Figure 8: Load-settlement behavior of clay bed in the absence of stone columns

The results reveal that the load-bearing capacity of the encased stone columns increases with column length. This enhancement is attributed to the geotextile material's ability to resist bulging, mobilize hoop stress, and provide greater depth for stress distribution with longer columns [67, 68]. The 600 mm encased stone column (end-bearing type) showed improved load-settlement performance, benefiting from both the support of the geotextile encasement and the presence of a firm layer at its base [67].

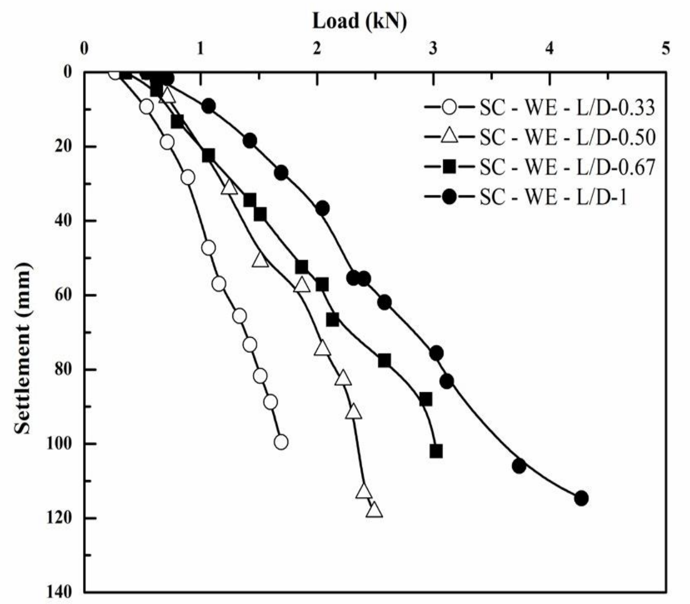


Figure 9: Load-settlement behavior of SC-WE

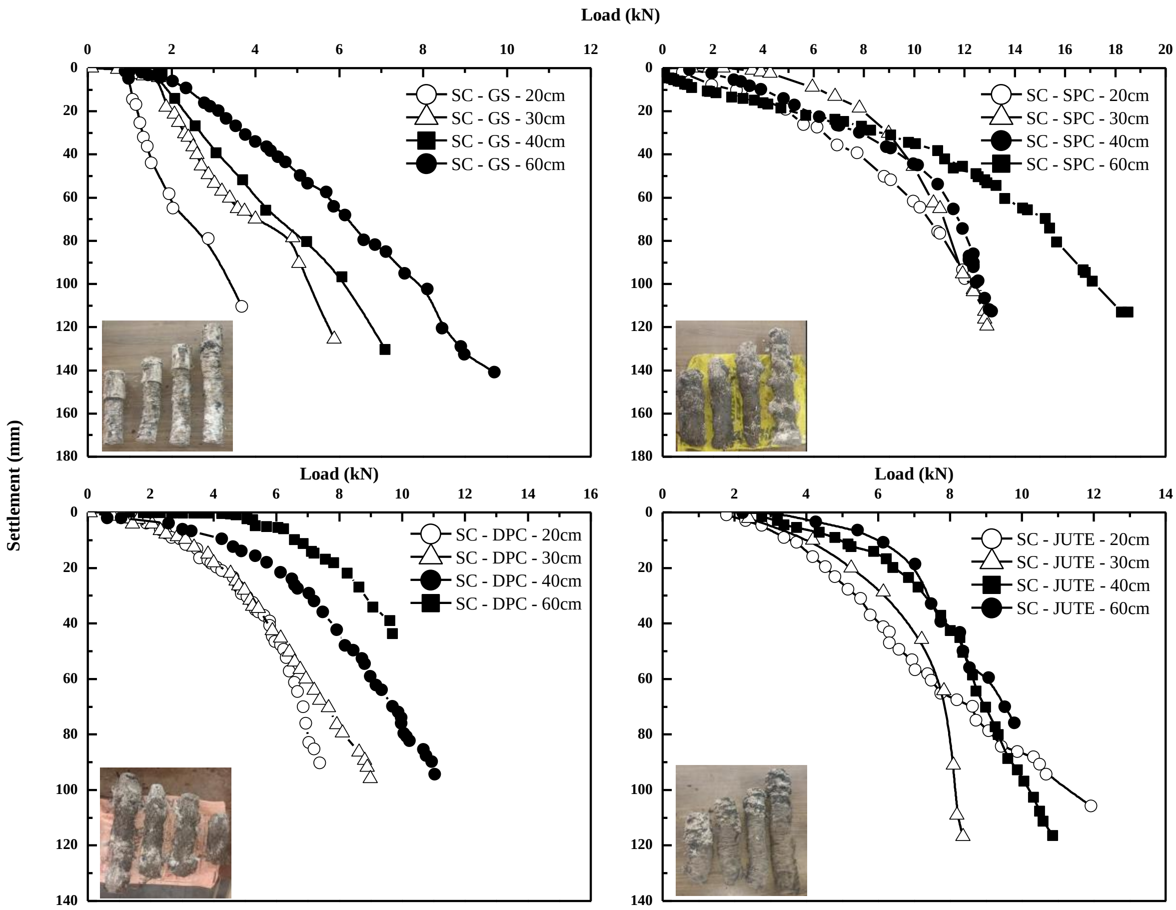


Figure 10: Load-settlement characteristics of stone column encased using different geotextile materials

Figure 11 compares the improvements in load-settlement characteristics for soil samples prepared with various stone column configurations used in this study. The results indicate that, regardless of column length, the SPC-encased stone column exhibits the highest strength, followed by columns encased with DPC/Jute and GS, with the SC-WE showing the lowest strength. The inherent flexibility of the SPC encasement aids in the prompt engagement of lateral tensile forces, thus mitigating bulging effects in floating stone column configurations. DPC, with its thicker dual-layer structure, offers increased radial stiffness and superior resistance to deep lateral deformation, particularly in end-bearing scenarios where vertical load is concentrated at the toe. To evaluate the effect of different geotextile encasements relative to the unreinforced stone column, load values at specific settlement levels were compared, as illustrated in Figure 12.

The results indicate that for floating stone columns (with lengths of 200 mm, 300 mm, and 400 mm), the highest load-carrying capacity is achieved with SPC (Single-Ply Coir) encasement, followed in descending order by Jute, DPC (Double-Ply Coir), GS (Geosynthetic), and SC-WE (Stone Column without Encasement). Interestingly, for the 300 mm and 400 mm floating columns, Jute encasement demonstrates superior performance at lower settlement ranges (30–40 mm), whereas DPC shows enhanced performance at higher settlements exceeding 40 mm. This behavior is largely attributed to the distinct mechanical characteristics of the encasement materials. Although Jute possesses lower tensile strength compared to DPC, it exhibits higher initial stiffness and a tighter weave structure, which effectively resists early-stage deformations and lateral bulging. These properties enable Jute to perform better in the initial phases of loading. In contrast, DPC's advantages become prominent at larger strains, where its higher tensile strength is fully mobilized, resulting in increased hoop strain within the encasement and consequently greater confinement and column stiffness. For end-bearing stone columns, DPC encasement consistently delivers a significantly higher load-carrying capacity than the other types of geotextiles. This improvement is primarily due to its higher tensile strength and increased interface friction with the surrounding clay, as also supported by previous findings [48].

However, at advanced settlement stages, the load-carrying capacities of both DPC- and Jute-encased columns become unreliable due to failure of the stitching material. This observation correlates with earlier work [37] that reported degradation-induced strength losses in natural fiber-based geotextiles subjected to high moisture content and tensile loading. This stitching failure under lateral stresses limits the structural integrity of the encasement, as illustrated in Figure 13. The failure of stitching material in DPC and jute encasements was visually observed and corroborated by photographic evidence. Corresponding load-settlement curves exhibited plateauing or sudden shifts, indicating failure onset. These events were noted and excluded from final performance interpretation beyond the stitching failure point.

The improvements in load–settlement performance obtained through natural fiber encasements are particularly relevant to field conditions at the Kodumudi site, Erode District, Tamil Nadu. The site investigation confirmed that the subsoil consists predominantly of soft silty clay and clayey deposits with corrected SPT-N values of 8–12 and a safe bearing capacity of 60–70 kN/m². Given the absence of a hard stratum up to depths of 10–12 m, stone columns installed at this site would behave as floating columns. The experimental results highlight that SPC encasement provides the greatest improvement in floating column performance, while DPC encasement shows superior behavior in end-bearing configurations. These findings suggest that adopting SPC-encased stone columns at Kodumudi would provide an effective and sustainable solution for mitigating settlement and enhancing load capacity in the weak silty clay layers, thereby addressing the foundation challenges associated with the proposed construction works.

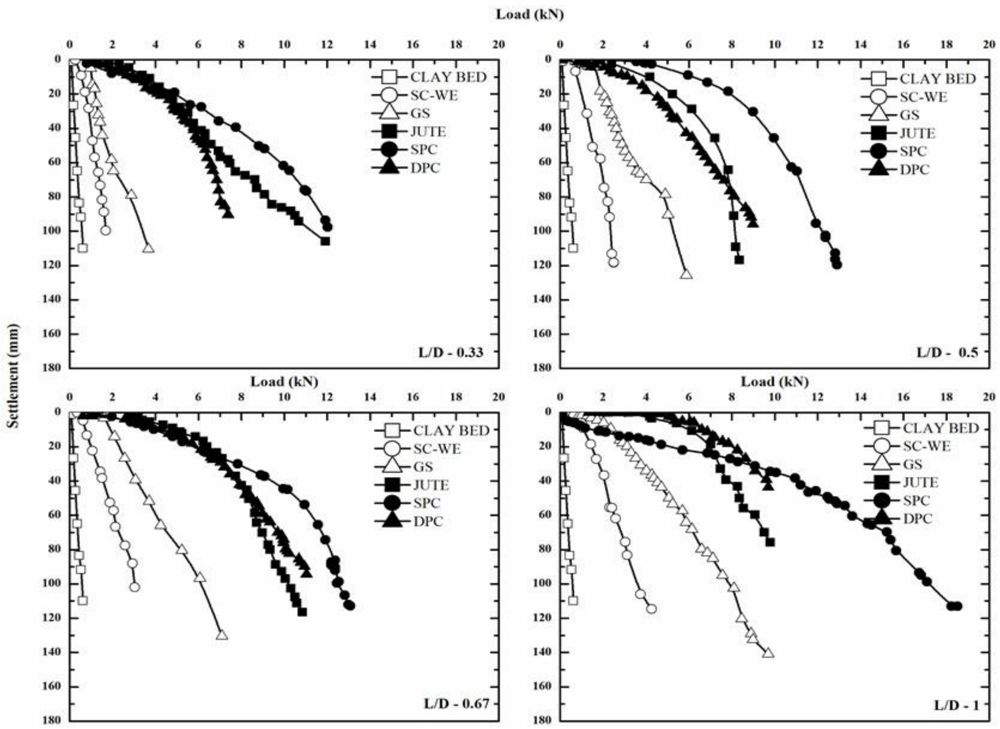


Figure 11: Comparison of load-settlement characteristics of clay bed, SC-WE and stone column encased using different geotextile materials at different aspect ratio

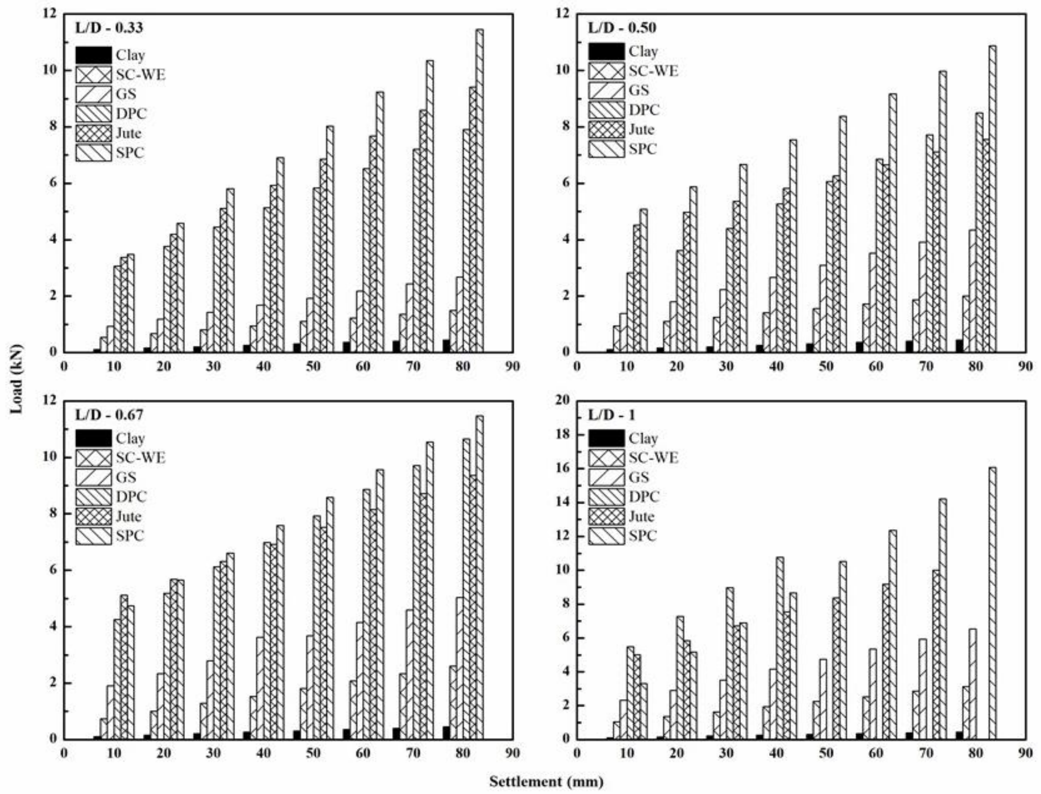


Figure 12: Comparison of load characteristics of clay bed, SC-WE and stone column encased using different geotextile materials at different settlement and aspect ratio

Figure 13: Failure of DPC at aspect ratio 1

4.2 Load Ratio (LR)

The load ratio is a key metric used to assess the increase in load-carrying capacity of soil stabilized with SC. It is expressed as the ratio of the ultimate load transferred by the soil with a stone column (q_R), encased or unencased, to the ultimate load transferred by soil without a stone column (q_O), the load ratio (LR) is represented in equation 1 [69,70].

$$LR = \frac{q_R}{q_O} \tag{1}$$

Figure 14 illustrates the variation of load ratio with settlement for both encased and unencased stone columns (SC). For floating columns with lower aspect ratios (L/D = 0.33 and 0.5), a marked improvement in load-bearing capacity is observed with SPC (Single-Ply Coir) encasement, followed by Jute, DPC (Double-

Ply Coir), GS (Geosynthetic), and finally the unencased SC-WE. At an intermediate aspect ratio of 0.67, all encasements using natural geotextiles demonstrate a comparable enhancement in performance. This behavior can be explained by the activation of circumferential strain in the encasing material, which draws upon the material's tensile strength to reinforce lateral confinement and improve structural rigidity [31,68]. The highest load ratio is achieved at an aspect ratio of 1.0, corresponding to end-bearing columns. In this configuration, the encasement provides maximum lateral confinement, effectively minimizing radial bulging and significantly enhancing load capacity [71].

These findings highlight that for floating stone columns with aspect ratios less than 1, SPC encasement delivers the most substantial improvement in load-bearing capacity in soft clay, followed in order by Jute, DPC, GS, and SC-WE. In contrast, for end-bearing columns (L/D = 1), DPC-encased columns outperform all other types due to their superior tensile properties and enhanced interaction with the surrounding soil. However, it is important to note that at higher settlement levels, the stitching material used in DPC encasements occasionally failed under increased lateral stresses. This suggests that, with improved stitching techniques, DPC could serve as a highly effective encasement material for both floating and end-bearing stone columns. Despite these isolated stitching failures, all performance comparisons were made using pre-failure data, ensuring the reliability of the reported results. Future research will focus on optimizing stitching strength to mitigate such failures and enhance the durability of natural geotextile encasements.

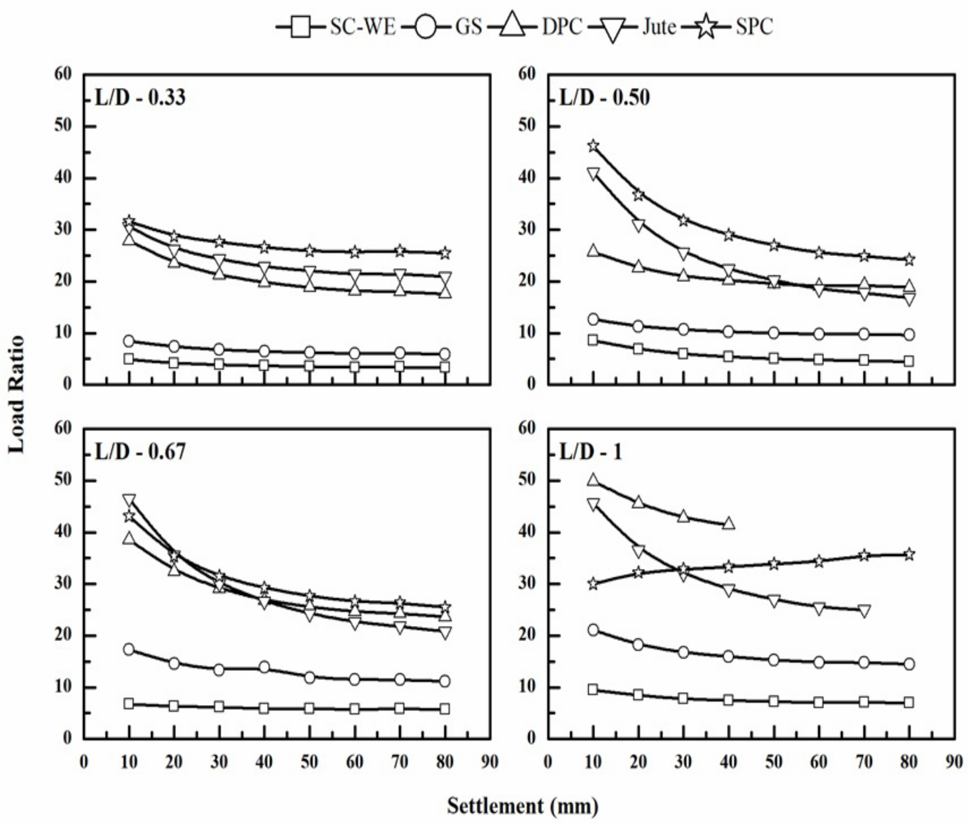


Figure 14: Variation in load ratio of SC-WE and stone column encased using different geotextile materials at different settlement and aspect ratio

For the Kodumudi site, where silty clay and clayey soils with SPT-N values of 8–12 and a bearing capacity of 60–70 kN/m² dominate, the higher load ratios achieved by SPC encasement in floating columns are especially significant, as no shallow hard stratum exists up to 10–12 m depth. This indicates that SPC offers the most effective confinement for enhancing performance under Kodumudi-like conditions. In contrast, DPC encasement can be reserved for scenarios where deeper or stiffer layers are encountered, providing superior load ratios in end-bearing situations.

5. Conclusion

The study investigated the load–settlement characteristics of stone columns (SC) in both unencased (SC-WE) and encased forms, using synthetic and natural geotextiles. The influence of the column's aspect ratio on load-carrying capacity and settlement response was also evaluated. Based on the experimental findings, the following conclusions are drawn:

- For floating stone columns, the highest load-carrying capacity was achieved with SPC encasement, followed in descending order by Jute, DPC, GS, and SC-WE.
- For intermediate-length columns (300 mm and 400 mm), jute encasement performed better at lower settlements (30–40 mm), while DPC showed greater improvement at higher settlements (>40 mm).
- For end-bearing stone columns (L/D = 1), DPC encasement exhibited the highest load capacity, attributed to its superior tensile strength and enhanced soil–fabric interface friction.
- Load ratio analysis confirmed that SPC is the most effective encasement for floating columns (L/D < 1), while DPC provides maximum improvement in end-bearing conditions.
- Failure of stitching in DPC and jute was observed at higher settlements, suggesting that improved stitching methods would further enhance the reliability of natural fiber encasements.

Overall, SPC is identified as the most effective solution for floating stone columns, while DPC offers superior confinement for end-bearing columns. The adoption of natural geotextiles such as SPC and DPC significantly reduces environmental impact when compared to synthetic alternatives, as they are biodegradable, renewable, and contribute to lower carbon emissions. While their biodegradable nature implies a gradual reduction in confinement strength, this is not expected to compromise performance, as the majority of settlement occurs within the first 1–2 years after installation.

Field Relevance – Kodumudi Site:

Importantly, the laboratory-prepared clay bed was designed to replicate the soft clay profile at Kodumudi, Erode District, Tamil Nadu, where subsoil investigations reported SPT-N values of 8–12 and a safe bearing capacity of 60–70 kN/m². Since no hard stratum was encountered up to 10–12 m depth, stone columns installed at Kodumudi would behave primarily as floating columns. In such conditions, the superior performance of SPC encasement observed in this study makes it the most suitable and sustainable ground improvement option for Kodumudi. For deeper strata or adjacent areas where end-bearing conditions may be encountered, DPC encasement can be effectively employed. Thus, the findings of this research provide direct, site-specific applicability for adopting natural coir geotextile encasements as sustainable foundation solutions in Kodumudi and other similar soft clay deposits.

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ABBREVIATIONS

CH	Cay of high plasticity
DPC	Double Geo Panama Coir
G	Specific gravity

GS	Synthetic Geotextile Material
GSM	Grams per square meter
L/D	Length to Diameter Ratio
LL	Liquid limit
LR	Load Ratio
PI	Plasticity index
PL	Plastic limit
q_o	ultimate load carried by soil without a stone column
q_r	Ultimate load carried by the soil with a stone column
SC	Stone Column
SC-DPC	Stone Column Encased using Double Geo Panama Coir
SC-GS	Stone Column Encased using Synthetics Geotextile
SC-SPC	Stone Column Encased using Single Geo Panama Coir
SC-WE	Stone Column Without Encasement
SL	Shrinkage limit
SPC	Single Geo Panama Coir
WC	Water Content

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