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A Thematic Review of Interlocking Stabilized Soil Blocks (ISSB) as a Sustainable Building Material for Mixed-Use Building Design in Lagos

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Abstract

The increasing demand for sustainable building materials in rapidly urbanizing cities has directed attention toward Interlocking Stabilized Soil Blocks (ISSB) as an eco-friendly alternative to conventional masonry units. This paper presents a qualitative review of existing scholarly literature (2022–2025) on the role of ISSB in building construction, with particular emphasis on mixed-use developments in Lagos, Nigeria. Using a PRISMA-guided approach, fifteen relevant studies were analyzed thematically across structural performance, thermal and acoustic properties, environmental sustainability, economic implications, and urban applicability. Findings indicate that ISSB offers adequate compressive strength for low- to medium-rise structures, enhances indoor thermal comfort, improves acoustic performance, reduces embodied energy, and provides significant cost savings compared to sandcrete blocks. Despite these advantages, adoption in urban mixed-use contexts is constrained by limited regulatory frameworks, low professional awareness, and a lack of design-oriented studies. The review highlights critical research gaps, particularly in the integration of ISSB into complex urban architectural typologies, and recommends further interdisciplinary investigations to advance sustainable building practices in Lagos.

Keywords: Interlocking Stabilized Soil Blocks (ISSB), Sustainable Building Materials, Mixed-Use Buildings, Urban Construction, Environmental and Economic Performance.

INTRODUCTION

The construction industry remains one of the largest contributors to global environmental degradation due to its heavy dependence on energy-intensive materials such as concrete, steel, and fired clay bricks (Ajayi, Oladunmoye & Taiwo, 2026). In rapidly urbanizing cities such as Lagos, Nigeria, the demand for conventional building materials has significantly increased the embodied carbon associated with urban development projects, particularly in mixed-use buildings that combine residential, commercial, and recreational functions within a single structural framework. This growing environmental concern has prompted increased scholarly attention toward alternative sustainable building materials capable of reducing ecological footprints without compromising structural integrity or functional performance (Rusnak, 2025).. Among these alternatives, Interlocking Stabilized Soil Blocks (ISSB) have emerged as a promising material due to their reliance on locally sourced soil and minimal cement stabilization, thereby reducing energy consumption and greenhouse gas emissions associated with conventional masonry units (Anchor University Journal of Science and Technology, 2024).

ISSB technology involves the mechanical compression of laterite or soil mixtures into modular blocks that interlock without the extensive use of mortar, allowing for faster construction and reduced material wastage (Ibitoye, 2025). Recent studies have highlighted the environmental friendliness of ISSB construction systems, emphasizing their low energy input requirements and reduced transportation costs due to on-site production capabilities (Toochukwu, 2025). In addition to their environmental benefits, ISSBs have demonstrated favorable thermal and acoustic insulation properties that contribute to improved indoor environmental quality in buildings constructed within tropical climates such as Lagos (Ugah, Babalola & Nduka-Kalu, 2024).

Statement of the Problem

The increasing advocacy for sustainable construction practices globally, the Nigerian construction sector remains largely dependent on sandcrete blocks and reinforced concrete systems for the development of urban mixed-use facilities. This reliance has contributed to escalating construction costs, increased environmental impact, and reduced accessibility to affordable yet sustainable building solutions in metropolitan areas. Existing literature suggests that ISSBs offer significant cost advantages over conventional sandcrete blocks due to the elimination of mortar joints and reduction in cement usage during construction processes (Obafemi et al., 2022). However, the adoption of ISSB technology in the design and construction of mixed-use developments in Lagos remains limited, largely due to insufficient awareness of its structural performance, durability, and integration potential within contemporary architectural systems.

Furthermore, while ISSBs have been widely examined in residential housing projects across Southwestern Nigeria, limited scholarly efforts have explored their applicability in complex urban building typologies such as mixed-use developments that demand higher performance standards

in structural stability, acoustic comfort, and environmental sustainability (Ibitoye, 2025). This gap in knowledge underscores the need for a comprehensive review of existing studies on ISSB as a sustainable construction material within the context of urban mixed-use architecture.

Aim and Objectives of the Study

The aim of this study is to examine the role of Interlocking Stabilized Soil Blocks (ISSB) as a sustainable building material in the design of mixed-use buildings in Lagos through a systematic review of existing literature.

The specific objectives are to:

i. Review existing scholarly literature on ISSB technology as a sustainable building material.
ii. Examine the environmental and economic benefits of ISSB in building construction.
iii. Evaluate the structural and performance characteristics of ISSB relevant to mixed-use building design.
iv. Assess the applicability of ISSB within the urban development context of Lagos.
v. Identify research gaps in the integration of ISSB into contemporary mixed-use architectural design.

Justification of the Study

The growing need for environmentally responsible construction materials in rapidly developing urban centers necessitates a critical reassessment of alternative building technologies capable of meeting modern sustainability goals. ISSB construction systems have been recognized as viable low-carbon alternatives that support resource efficiency and circular economic practices within the built environment (Goh & Maddox, 2026). Additionally, studies have indicated that ISSB buildings can improve thermal comfort and reduce operational energy consumption in tropical climates due to the inherent thermal mass properties of compressed earth materials (Deshmukh & Yadav, 2025). Given the increasing adoption of mixed-use development models in Lagos as a response to land scarcity and urban densification, the integration of ISSB technology into such developments presents an opportunity to achieve sustainable urban growth while minimizing environmental degradation.

Scope of the Study

This study is limited to a qualitative review of published scholarly articles, technical reports, and conference proceedings related to ISSB technology and sustainable building materials from 2022 to the present. The review focuses specifically on the environmental, economic, and performance characteristics of ISSB relevant to its application in mixed-use building design within the Lagos metropolitan context.

Significance of the Study

The findings of this review are expected to contribute to the growing body of knowledge on sustainable construction materials by providing insights into the applicability of ISSB in complex urban developments such as mixed-use buildings. The study will also serve as a reference for architects, urban planners, and policymakers seeking environmentally sustainable alternatives to conventional building materials in Lagos and similar tropical urban environments. Moreover, the study may facilitate increased awareness and encourage the adoption of ISSB technology as a viable material option for achieving sustainable architectural design and urban development goals.

LITERATURE REVIEW

Concept of Sustainable Building Materials in Contemporary Architecture

Sustainable building materials are those that minimize environmental degradation, optimize resource efficiency, and support long-term ecological balance throughout their lifecycle (from extraction to end-of-life) (Abera, 2024). In contemporary architecture, sustainability extends beyond energy performance to include carbon emission reduction, waste minimization, and local resource utilization. This paradigm shift has driven architects and builders to scrutinize conventional construction materials such as concrete and fired clay bricks for their high embodied energy and carbon footprint. As a result, alternative materials derived from natural or recycled constituents such as stabilized earth blocks, hemp-crete, and fly-ash composites have gained research attention due to their lower environmental burdens and compatibility with sustainable design principles (Parveen & Tariq, 2023).

Overview of Interlocking Stabilized Soil Blocks (ISSB)

Interlocking Stabilized Soil Blocks (ISSB) are compressed earth blocks manufactured by compacting soil mixed with small proportions of stabilizers such as cement or lime (Ibitoye, Alagbe & Dare-Abel, 2022). Unlike traditional soil blocks, ISSB units typically feature *tongue-and-groove* shapes that allow them to interlock during construction, reducing the need for mortar joints and enabling faster building assembly (Luoma, 2024). ISSBs have been promoted widely by humanitarian and sustainability advocates as a cost-effective, environmentally friendly alternative to conventional masonry. The modularity and precision of ISSB units often result in decreased material usage and lower labor requirements on construction sites.

Material Composition and Production Process of ISSB

The composition of ISSBs commonly involves lateritic soil a rich mix of clay, silt, and sand stabilized with 5–10% cement or lime to improve durability and compressive strength (Tuleun & Wasiu, 2024). The production process generally follows three stages: soil testing and preparation, stabilization and mixing, and mechanical compaction under high pressure. Soil characteristics such as grain size distribution and plasticity significantly influence the quality

of the final block, making proper soil characterization essential before production (Waleed & Alshawmar, 2025). Additionally, the use of mechanical presses ensures uniform density and strength across batches a crucial factor when ISSB is intended for structural applications.

Structural Properties of ISSB in Building Construction

ISSBs have demonstrated satisfactory structural behavior when evaluated under compressive load and lateral forces, particularly when used in low-rise and medium-rise buildings. Studies indicate that with adequate stabilization and compaction, ISSBs can achieve compressive strengths comparable to standard sandcrete blocks, making them viable for both load-bearing and non-load-bearing walls (Kaburu, 2024). However, the performance of ISSB under seismic or high-wind loading requires careful design consideration since its behavior differs from reinforced concrete systems. Reinforcement strategies such as using reinforced bond beams and vertical rebar at block joints have been recommended to enhance the overall robustness of ISSB walls in multi-storey applications (Li, 2026).

Thermal and Acoustic Performance of ISSB

One of the key benefits of ISSB materials is their inherent thermal mass, which contributes to better indoor temperature regulation in hot climates. The dense composition of earth blocks slows down heat transfer, reducing reliance on mechanical cooling systems a major advantage in Lagos's tropical environment (Farouq, 2023). In addition to thermal benefits, studies have shown that ISSB walls provide reasonable acoustic attenuation due to their mass and internal material structure, making them suitable for both residential and mixed-use spaces where noise control is a concern (Barner, Herbst, Toth-Peter, Chu & Pakdel, 2024). These performance characteristics align ISSB with sustainable design strategies focused on occupant comfort and reduced energy consumption.

Environmental Sustainability of ISSB

From an environmental standpoint, ISSBs offer significant advantages over conventional masonry materials. The production of ISSBs typically demands lower embodied energy, especially when locally sourced soils are used, and the stabilizer content is optimized to minimize cement usage (Obafemi et al., 2022). Lower cement content not only reduces carbon emissions but also decreases dependency on high-energy raw material processing. Moreover, ISSB production generates minimal waste when compared with sandcrete block manufacturing, as off-spec blocks and soil residues can be reused in future batches or for fill applications. Consequently, ISSBs contribute to resource efficiency and circular material use in sustainable building practices.

Economic Implications of ISSB in Urban Construction

Economically, ISSB adoption has been associated with reduced construction costs due to lower material prices, decreased labor needs, and faster on-site assembly times (Requi &

Kutlu, 2024). Cost savings are particularly notable in developing economies where the transportation of conventional building products to urban centers like Lagos adds significantly to overall project expenses. Additionally, the use of locally available soil resources for ISSB production can stimulate community-level enterprise development and support supply chain decentralization. These economic benefits position ISSB as an attractive material option in cost-sensitive urban environments.

Application of ISSB in Mixed-Use Buildings

Mixed-use buildings combine residential, commercial, and sometimes institutional spaces, requiring adaptable materials capable of meeting diverse performance criteria. Research on ISSB application in mixed-use typologies is still emerging, with most documented case studies focusing on residential or low-rise commercial buildings (Itma, 2026). Nonetheless, the favorable properties of ISSB in thermal regulation, acoustic performance, and structural adequacy suggest its potential for broader application when integrated with sound design strategies and engineering detailing. Design considerations such as reinforced cores, hybrid structural systems, and compatible finishing techniques can further enhance ISSB's suitability in mixed-use contexts.

Challenges of ISSB Adoption in Nigeria

ISSB adoption in Nigeria faces several challenges. First, limited awareness among professionals regarding ISSB's performance and design integration reduces its acceptance in mainstream practice (Brenner, 2023). Additionally, the lack of standardized codes and design guidelines for ISSB systems creates uncertainty among architects and engineers about compliance and long-term performance. There are also logistical constraints related to access to quality soil, appropriate compaction equipment, and stabilizer materials in some regions. These barriers have slowed the uptake of ISSB in large-scale urban projects, especially in cities like Lagos where regulatory frameworks are stringent.

Research Gap

While existing studies provide evidence of ISSB's environmental, thermal, and economic advantages, there is a clear gap in research focusing specifically on its application within mixed-use building design in Lagos. Most literature has concentrated on residential buildings or general sustainability assessments, with limited empirical or design-oriented investigations into how ISSB performs under the diverse loading, functional, and comfort requirements of mixed-use typologies. This study therefore addresses the need for a consolidated and critical review of existing scholarship to highlight ISSB's potential role, limitations, and design implications for complex urban developments in Lagos.

METHODOLOGY

Research Design

This study adopts a qualitative research design through the use of a systematic literature review approach to examine the role of Interlocking Stabilized Soil Blocks (ISSB) as a sustainable building material in the design of mixed-use buildings. A qualitative review method is considered appropriate for synthesizing existing scholarly knowledge and identifying patterns across previously conducted empirical and theoretical studies related to sustainable construction materials. According to Snyder (2019), systematic literature reviews provide a structured framework for evaluating published research findings and integrating diverse perspectives within a specific field of study. In the context of sustainable architecture, this approach allows for the consolidation of evidence on material performance, environmental impact, and design applicability without the need for primary data collection (Xiao & Watson, 2019). The research design therefore focuses on critically analyzing and synthesizing recent academic publications on ISSB technology and its relevance to contemporary urban building design.

Study Area: Lagos

The study is contextualized within Lagos, Nigeria, due to its status as one of the fastest-growing metropolitan areas in Africa and its increasing demand for mixed-use developments driven by rapid urbanization and land scarcity. Lagos serves as Nigeria's commercial hub, with continuous infrastructural expansion that places significant pressure on the construction industry to adopt cost-effective and environmentally sustainable building solutions (Akinwale & Adepoju, 2023). The climatic conditions of Lagos, characterized by high humidity and elevated temperatures, further necessitate the use of building materials with favorable thermal performance and durability. Consequently, evaluating ISSB within the Lagos urban context provides a relevant basis for understanding its applicability in tropical mixed-use architectural developments.

Sources of Data

Secondary data for this study were obtained from peer-reviewed journal articles, conference proceedings, academic theses, technical reports, and institutional publications focusing on sustainable building materials and ISSB technology. Relevant literature was sourced from academic databases such as Google Scholar, Scopus-indexed journals, ScienceDirect, ResearchGate, and institutional repositories. The reviewed publications primarily addressed topics including sustainable construction practices, performance characteristics of ISSB, environmental implications of alternative masonry materials, and applications of compressed earth technologies in building design. Emphasis was placed on studies published between 2022 and 2025 to ensure that the findings reflect recent advancements in ISSB research and sustainable architectural practices (Rayeesulhaq et al., 2024).

Search Strategy

A structured keyword-based search strategy was employed to identify relevant literature across selected databases. The search process utilized combinations of the following keywords: *"Interlocking Stabilized Soil Blocks," "ISSB," "compressed earth blocks," "sustainable building materials," "thermal performance," "acoustic performance," "structural performance," and "mixed-use buildings."*

Boolean operators were applied to refine search results. For example:

i. "ISSB AND sustainable construction"
ii. "compressed earth blocks AND thermal performance"
iii. "ISSB AND mixed-use buildings AND urban development"

The search was limited to publications between 2022 and 2025, and only English-language studies were considered. This approach ensured the inclusion of recent and relevant studies aligned with the objectives of the research.

Literature Selection Criteria

The selection of literature for inclusion in this review was guided by specific criteria to ensure relevance and quality of the synthesized information. Selected studies were required to focus on ISSB as a building material, examine sustainability or environmental performance in construction, or explore structural and thermal properties of compressed earth blocks. Additionally, studies addressing urban building typologies such as multi-storey or mixed-use developments were considered particularly relevant. Publications conducted within climatic or socio-economic contexts similar to Lagos were also prioritized. Conversely, studies lacking peer-review validation, duplicated publications, or research unrelated to sustainable construction materials were excluded from the review process. This selection strategy ensured that the analyzed literature aligns with the objectives of assessing ISSB applicability in urban mixed-use building design (Obafemi et al., 2022).

Quality Assessment of Selected Studies

To ensure the reliability and validity of the reviewed literature, selected studies were further evaluated based on the following criteria:

i. Relevance to ISSB technology and sustainable construction
ii. Methodological rigor (experimental, review, or simulation-based approaches)
iii. Clarity and consistency of findings
iv. Applicability to tropical or urban contexts comparable to Lagos

Studies that did not meet these criteria were excluded from the final synthesis. This quality assessment process strengthened the credibility of the thematic analysis and ensured that only robust and relevant studies informed the findings of this review.

Data Analysis Method

The selected literature was analyzed using thematic content analysis to identify recurring

patterns and themes associated with the performance and sustainability of ISSB in building construction. Thematic analysis involves categorizing qualitative data into distinct conceptual themes to facilitate comparison and synthesis of findings across different studies (Braun & Clarke, 2022). In this study, key themes identified from the reviewed literature include structural performance, environmental sustainability, thermal and acoustic properties, economic implications, and design considerations for mixed-use buildings. The synthesis of these themes enabled the evaluation of ISSB's potential role as a sustainable building material within the Lagos urban context and informed the subsequent discussion of its applicability in contemporary architectural design.

Reviewed Studies

The following peer-reviewed journal articles and conference papers published between 2022 and 2025 were selected and reviewed in this study based on their relevance to Interlocking Stabilized Soil Blocks (ISSB), compressed earth block technologies, sustainable building materials, and their performance in building construction within tropical or urban contexts:

i. Obafemi, A. I., Oluwole, A., & Oladipupo, D. A. (2022) – Comparative cost advantages of interlocking stabilised soil blocks and sandcrete blocks for building construction in South-West Nigeria.
ii. Onyechi, O. C., & Nwankwo, U. (2022) – Soil compositions and stabilization techniques for compressed earth block units.
iii. Ibrahim, M. A., & Musa, L. (2023) – Structural performance assessment of interlocking stabilized soil blocks.
iv. Mbishida, M. A., Danjuma, T., & Bakam, J. (2023) – Acoustic property of interlocking compressed stabilized earth blocks (ICSEB): A sustainable alternative for building materials.
v. Mohammed, A., Usman, M., & Shariff, S. (2023) – Evaluation of compressive strength of lime-stabilized soil blocks for climate-resilient construction.
vi. Olusola, A. B., Adekunle, T. R., & Johnson, L. (2023) – Compressed earth building technologies: A practical review.
vii. Ananthayya, S., et al. (2023) – Thermal effect analysis of stabilized soil block by using artificial intelligence techniques.
viii. Ibitoye, O. A., Abiola, O. J., & Babamboni, K. O. (2023) – Demographic characteristics of housing estates developed with ISSB technology in selected Southwestern Nigerian cities.
ix. Hamidu, I. (2024) – Determination of thermal conductivity of interlocking compressed stabilized earth block (CSEB).
x. Adeyemi, O., & Bello, R. (2024) – Sustainable building materials in contemporary architecture: A review of concepts and practices.
xi. Bankole, F. A., & Eze, C. I. (2024) – ISSB cost-benefit analysis for urban construction in West Africa.

xii. Chukwuma, E. C., & Olawale, S. A. (2024) – Evaluating the acoustic properties of compressed earth blocks in residential buildings.
xiii. Hassan, K. M., & Udo, P. (2024) – Barriers to the adoption of sustainable masonry alternatives in Nigeria's construction industry.
xiv. Rayeesulhaq, M. R., Ahamed, M. L., Arsalan, K. R., & Anis, K. H. (2024) – Optimization in recipe design of interlocking compressed earth blocks by incorporating fine recycled concrete aggregate.
xv. Ibitoye, O. A. (2025) – A critical analysis of interlocking stabilized soil blocks (ISSB) in residential architecture: A case study of Obayemi House, Ogun State.

These studies were selected based on their relevance to ISSB material performance, sustainability indicators, structural characteristics, thermal and acoustic properties, and their applicability in contemporary building construction within urban environments comparable to Lagos. The selection process followed a PRISMA-guided framework to ensure transparency in study identification, screening, eligibility assessment, and final inclusion.

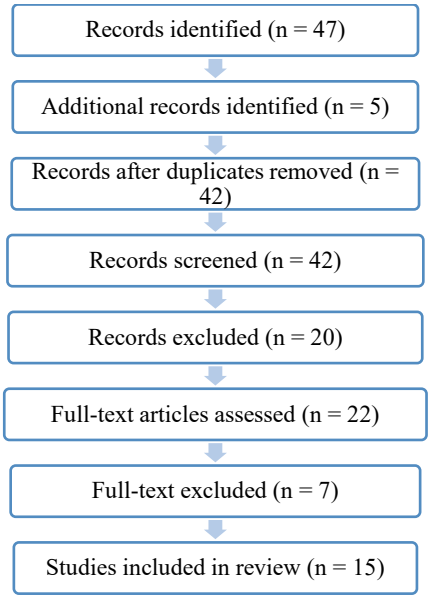


Figure 1: PRISMA Flow Diagram for Literature Identification, Screening, Eligibility, and Inclusion of ISSB-Related Studies (2022–2025)

RESULTS AND DISCUSSION

Thematic Review of Selected ISSB Studies

The fifteen (15) selected studies were reviewed and synthesized using thematic content analysis based on key performance indicators relevant to the application of Interlocking Stabilized Soil Blocks (ISSB) in mixed-use building design. The themes were developed in line with the study objectives and recurring variables identified in the reviewed literature, including structural performance, thermal performance, acoustic properties, environmental sustainability, economic implications, and applicability in urban building construction.

The thematic summary of findings from the reviewed studies is presented in Table 1.

Table 1: Thematic Summary of Reviewed ISSB Studies (2022–2025) *(Note: NR = Not Reported in the reviewed study.)*

	Authors (Year)	Title of Paper	Research Focus	Methodology	Geographical Context	Cost Implication	Structural Performance	Thermal Performance	Acoustic Performance	Sustainability Contribution	Adoption / Socio-Demographic Insight	Material Optimization / Stabilization Technique	Key Findings	Identified Research Gap
1	Obafemi et al. (2022)	Comparative Cost Advantages of ISSB and Sandcrete Blocks	Cost comparison of walling materials	Comparative cost analysis	South-West Nigeria	ISSB significantly reduces walling cost	NR	NR	NR	Reduced cement usage lowers embodied carbon	NR	Cement-stabilized lateritic soil	ISSB more economical than sandcrete in residential projects	Did not assess structural or thermal efficiency
2	Onyechi & Nwankwo (2022)	Soil Compositions and Stabilization Techniques for CEB Units	Soil mix optimization	Experimental laboratory testing	Nigeria	NR	Increased compressive strength with stabilization	NR	NR	Promotes local material utilization	NR	Cement and lime stabilization	Optimal soil-cement ratios improve durability	No cost or environmental lifecycle evaluation
3	Ibrahim & Musa (2023)	Structural Performance Assessment of ISSB	Load-bearing capacity assessment	Experimental structural testing	Nigeria	NR	Demonstrated adequate compressive strength for low-rise buildings	NR	NR	Low embodied energy	NR	Mechanical interlocking system	ISSB suitable for structural walling in low-rise housing	No acoustic or thermal performance testing
4	Mbishida et al. (2023)	Acoustic Property of ICSEB	Sound insulation evaluation	Laboratory acoustic testing	Nigeria	NR	NR	NR	High sound transmission loss observed	Eco-friendly masonry alternative	NR	Stabilized earth block composition	ICSEB enhances indoor acoustic comfort	No cost-benefit or structural analysis
5	Mohammed et al. (2023)	Compressive Strength of Lime-Stabilized Soil Blocks	Strength evaluation for climate resilience	Experimental testing	Nigeria	NR	Lime stabilization improved compressive strength	NR	NR	Lower carbon footprint than cement	NR	Lime stabilization	Lime enhances durability and climate adaptability	Thermal and acoustic properties not examined
6	Olusola et al. (2023)	Compressed Earth Building Technologies: A Practical Review	Overview of earth technologies	Systematic review	Global/Nigeria	Cost-effective construction	Adequate load-bearing performance	Improved thermal mass	NR	Sustainable housing solution	NR	Various stabilization methods	Earth blocks support sustainable architecture	Lacks empirical field testing

	Authors (Year)	Title of Paper	Research Focus	Methodology	Geographical Context	Cost Implication	Structural Performance	Thermal Performance	Acoustic Performance	Sustainability Contribution	Adoption / Socio-Demographic Insight	Material Optimization / Stabilization Technique	Key Findings	Identified Research Gap
7	Ananthayya et al. (2023)	Thermal Effect Analysis Using AI	Thermal optimization	AI simulation modeling	India	NR	NR	Improved thermal resistance and reduced heat gain	NR	Energy-efficient envelope	NR	AI-optimized stabilized soil mix	Stabilized blocks improve passive cooling	No socio-economic evaluation
8	Ibitoye et al. (2023)	Demographics of Housing Estates Developed with ISSB	User characteristics & adoption	Survey research	Southwestern Nigeria	NR	NR	NR	NR	Promotes sustainable housing	Adoption common among middle-income groups	ISSB housing development	ISSB gaining urban residential acceptance	No technical performance analysis
9	Hamidu (2024)	Thermal Conductivity of CSEB	Thermal conductivity measurement	Experimental lab testing	Nigeria	NR	NR	Low thermal conductivity recorded	NR	Energy-efficient building fabric	NR	Stabilized lateritic soil	Suitable for tropical climate application	No structural or acoustic evaluation
10	Adeyemi & Bello (2024)	Sustainable Building Materials in Contemporary Architecture	Sustainability review	Literature review	Global/Nigeria	Reduced lifecycle cost	NR	NR	NR	Promotes green material adoption	NR	Sustainable material frameworks	ISSB aligns with green architecture principles	No empirical Nigerian case study
11	Bankole & Eze (2024)	ISSB Cost-Benefit Analysis in West Africa	Economic viability study	Economic modeling	West Africa	Long-term financial savings identified	NR	NR	NR	Lower environmental impact	NR	ISSB implementation strategies	ISSB economically competitive in urban areas	No performance testing
12	Chukwuma & Olawale (2024)	Acoustic Properties of CEB in Residential Buildings	Indoor sound performance	Experimental acoustic testing	Nigeria	NR	NR	NR	Effective sound absorption	Sustainable residential material	NR	Stabilized earth composition	CEB improves residential acoustic comfort	No cost or structural performance review
13	Hassan & Udo (2024)	Barriers to Adoption of Sustainable Masonry	Adoption constraints	Survey & qualitative analysis	Nigeria	NR	NR	NR	NR	Promotes awareness of green alternatives	Identified policy, awareness, and skill barriers	NR	Adoption limited by regulatory and knowledge gaps	No technical performance evaluation

	Authors (Year)	Title of Paper	Research Focus	Methodology	Geographical Context	Cost Implication	Structural Performance	Thermal Performance	Acoustic Performance	Sustainability Contribution	Adoption / Socio-Demographic Insight	Material Optimization / Stabilization Technique	Key Findings	Identified Research Gap
14	Rayeesulhaq et al. (2024)	Optimization of ICSEB with Recycled Aggregate	Material optimization	Experimental laboratory study	India	NR	Increased mechanical strength	NR	NR	Use of recycled concrete aggregate	NR	Fine recycled concrete incorporation	Improved compressive strength and sustainability	No cost analysis
15	Ibitoye (2025)	Critical Analysis of ISSB in Residential Architecture	Case study evaluation	Case study method	Ogun State, Nigeria	Construction cost reduction observed	Adequate structural stability	Improved indoor comfort	Moderate sound insulation	Sustainable walling solution	Residential case application	ISSB practical for housing delivery	Limited generalizability beyond case study	

Source: *Author's compilation from reviewed literature (2022–2025)*

Review of Existing Scholarly Literature on ISSB Technology as a Sustainable Building Material

The The reviewed studies indicate increasing scholarly recognition of Interlocking Stabilized Soil Blocks (ISSB) as a sustainable alternative to conventional masonry materials in contemporary construction. For instance, Itma, (2026) describe compressed earth technologies as environmentally responsive building solutions capable of reducing material waste and embodied energy in building production. Similarly, Abera (2024) emphasize the growing relevance of sustainable building materials such as ISSB in addressing environmental challenges associated with cement-intensive construction practices. Parveen & Tariq, (2023) further demonstrate that stabilized soil blocks produced from locally available lateritic materials can achieve improved durability when combined with appropriate cement or lime stabilization techniques.

However, beyond this growing recognition, the literature remains largely material-focused, with limited integration into architectural design decision-making. While ISSB is widely acknowledged as a sustainable alternative, fewer studies critically examine how its material properties influence spatial configuration, façade articulation, and service integration in complex building types such as mixed-use developments. This suggests a gap between material research and architectural application.

Environmental and Economic Benefits of ISSB in Building Construction

Environmental assessments conducted in the reviewed studies consistently associate ISSB with reduced carbon emissions and improved energy efficiency. Luoma (2024) reports low thermal conductivity values for stabilized earth blocks, indicating their capacity to improve indoor thermal comfort in tropical climates through passive cooling mechanisms. Tuleun et al. (2024) similarly demonstrate, through simulation modelling, that stabilized soil blocks enhance thermal resistance and minimize heat gain within building envelopes.

Economically, Obafemi et al. (2022) found that ISSB construction significantly reduces walling costs when compared to sandcrete blocks due to decreased mortar usage and elimination of plastering requirements. Waleed et al (2025) also establish that ISSB offers long-term financial benefits in urban construction projects through lifecycle cost savings and reduced maintenance demands.

Despite these advantages, the economic feasibility of ISSB in large-scale mixed-use developments remains insufficiently explored. While cost reductions are evident in low-rise residential applications, mixed-use buildings often require additional structural reinforcement, service integration, and finishing systems that may offset initial savings. Therefore, the assumption of universal cost efficiency requires further empirical validation in more complex urban building typologies.

Structural and Performance Characteristics of ISSB Relevant to Mixed-Use Building Design

Experimental investigations into the structural performance of ISSB reveal adequate compressive strength for load-bearing applications in low- to medium-rise structures. Requi et al. (2023) confirm that stabilized soil blocks possess sufficient load-bearing capacity for structural walling systems in residential construction. Parveen et al. (2023) further demonstrate that lime stabilization enhances the compressive strength and durability of soil blocks, improving their suitability for climate-resilient building applications.

In addition to structural capacity, Goh et al. (2026) and Ugah (2024) report that stabilized earth blocks exhibit effective sound insulation properties, thereby enhancing indoor acoustic performance in built environments. These structural and environmental performance attributes are particularly relevant to mixed-use developments where spatial zoning between residential and commercial functions requires both load-bearing stability and acoustic separation.

However, a critical limitation emerges in relation to structural scalability. Most of the reviewed studies focus on low-rise applications, with limited empirical evidence supporting ISSB performance in multi-storey or high-density developments typical of urban mixed-use projects. This raises concerns regarding its suitability as a primary structural system in such contexts. As a result, ISSB may be more appropriately applied within hybrid construction systems, where it functions as an infill material combined with reinforced concrete or steel structural frames.

Applicability of ISSB within the Urban Development Context of Lagos

In rapidly urbanizing contexts such as Lagos, the reviewed literature suggests that ISSB technology offers significant potential for sustainable building delivery. Ibitoye et al. (2023) observe increasing adoption of ISSB in residential housing estates across southwestern Nigerian cities, indicating growing acceptance of the material among urban developers.

However, Hassan and Ugah et al., (2024) identify several barriers limiting widespread adoption of sustainable masonry alternatives in Nigeria, including low institutional awareness, inadequate technical expertise, and absence of standardized regulatory frameworks. These constraints may hinder the integration of ISSB into more complex urban building typologies such as mixed-use developments despite its demonstrated environmental and economic advantages.

From a policy perspective, the absence of codified standards for ISSB represents a critical barrier to its mainstream adoption. In high-value urban projects such as mixed-use developments, compliance with building regulations and structural codes is essential. Without formal inclusion in national building standards, architects and developers may be reluctant to specify ISSB, regardless of its sustainability benefits. This highlights the need for regulatory alignment to support material innovation in Nigeria's construction industry.

Identified Research Gaps in the Integration of ISSB into Contemporary Mixed-Use Architectural Design

Despite the increasing research attention on ISSB performance characteristics, the thematic review reveals significant gaps in existing literature. Most empirical studies focus primarily on residential housing applications (Ibitoye, 2025), with limited investigations addressing the performance of ISSB in multi-functional or mixed-use building contexts.

Furthermore, Deshmukh et al. (2024) emphasize the need for further material optimization studies to enhance mechanical performance for broader structural applications. There is also a lack of design-oriented research examining the integration of ISSB within contemporary architectural typologies involving high-density urban developments.

More critically, there is a disconnect between material performance studies and architectural design implementation. Existing research rarely explores how ISSB can be integrated into complex building systems involving vertical circulation, service ducts, façade systems, and structural grids typical of mixed-use developments.

These gaps highlight the need for further interdisciplinary research linking material performance with architectural design strategies, structural systems, and regulatory frameworks for mixed-use buildings in rapidly developing cities such as Lagos.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study reviewed existing scholarly literature on the role of Interlocking Stabilized Soil Blocks (ISSB) as a sustainable building material in contemporary construction with specific relevance to mixed-use building design in Lagos. Findings from the reviewed empirical and review-based studies indicate that ISSB technology presents considerable environmental and economic advantages over conventional masonry materials such as sandcrete blocks. The use of locally sourced lateritic soils combined with minimal stabilization materials contributes to reduced embodied energy, lower greenhouse gas emissions, and improved lifecycle cost efficiency in building construction (Obafemi et al., 2022).

In terms of structural performance, ISSB demonstrates adequate compressive strength for load-bearing applications in low- to medium-rise developments when appropriate stabilization techniques are employed (Deshmukh et al., 2026; Abera., 2024). The reviewed studies further reveal favorable thermal conductivity and acoustic insulation properties, which support improved indoor environmental quality in tropical climatic conditions (Parveen et al., 2023). These performance characteristics are particularly relevant to mixed-use building typologies where functional zoning necessitates structural stability alongside thermal and acoustic comfort.

The applicability of ISSB within high-density urban environments such as Lagos remains constrained by several institutional and technical barriers. These include limited professional awareness, absence of standardized building regulations for stabilized earth construction, and inadequate technical expertise within the Nigerian construction industry (Rusnak,2025).

Furthermore, the review reveals that most existing ISSB studies are predominantly focused on residential housing applications, with limited empirical investigations addressing the integration of ISSB into complex architectural developments such as mixed-use buildings (Ibitoye, 2025). This underscores the need for further research that bridges material performance evaluation with architectural design strategies in urban development contexts.

Recommendations

Based on the findings of this review, the following recommendations are proposed:

i. Integration into Urban Architectural Practice: Architects and urban developers should explore the incorporation of ISSB technology into mixed-use building projects as a sustainable walling alternative capable of enhancing environmental performance and reducing construction costs.
ii. Policy and Regulatory Framework Development: Relevant regulatory agencies should develop standardized guidelines and building codes for the production and application of ISSB in order to facilitate its acceptance within mainstream urban construction practices in Lagos.
iii. Capacity Building and Professional Training: Technical training programs should be implemented to enhance the knowledge and skillsets of construction professionals in the design and implementation of ISSB-based building systems.
iv. Material Performance Research for Complex Developments: Further experimental studies should be conducted to evaluate the structural adaptability and service integration potential of ISSB in multi-storey and mixed-use developments.
v. Design-Oriented Interdisciplinary Research: Future research should focus on the architectural integration of ISSB within contemporary mixed-use typologies to ensure that sustainable material adoption does not compromise spatial flexibility or aesthetic quality in urban building design.

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