

Material Strategy for Sustainable Hospitality in Ranthambore

Manya Jain¹, Nidhi Sharma², Shubhi Sharma³, Sunakshi Shokeen⁴

^{1,2,3}UG Student- Interior Architecture and Design, SOD, World University of Design, Sonapat, Haryana, India

⁴Assistant Professor- Interior Architecture and Design, Sonapat, Haryana, India.

Emails: Manyajain.23@wud.ac.in¹, nidhisharma.23@wud.ac.in², subhiashokkumar.23@wud.ac.in³, sunakshi.shokeen@wud.ac.in⁴

Abstract

Ranthambore has emerged as a prominent wildlife tourism destination, resulting in the development of hotels, resorts and other hospitality spaces to accommodate the growing number of visitors. While these spaces aim to provide comfort, luxury and memorable experiences, their construction and operation can place pressure on natural resources. The selection of materials is an important aspect of this impact, as extraction, processing, transportation, maintenance and disposal can contribute to environmental concerns. In the sensitive ecological context of Ranthambore, there is a need to explore material choices that are both environmentally responsible and suitable for hospitality environments. This research focuses on identifying strategies for sustainable hospitality while maintaining durability, functionality, aesthetics and the quality associated with luxury. The study aims to examine how locally available, renewable, recycled, reclaimed and low-impact materials can be incorporated into hospitality architecture and interiors in response to the region's environmental, climatic and cultural context. A qualitative research approach will be adopted through literature study, analysis of selected hospitality case studies, interviews, market study and field visits to Ranthambore, with materials evaluated based on their local availability, embodied energy, transportation requirements, durability, maintenance, recyclability and overall environmental impact. The research will identify material choices and applications that can reduce resource consumption and the ecological footprint of hospitality spaces while strengthening their connection with regional identity. The study will ultimately demonstrate how thoughtful selection can contribute to more sustainable hospitality environments, where environmental responsibility, local character and the comfort and aesthetic expectations of luxury can be achieved together.

Keywords: Ecological design, hospitality, local materials, luxury, sustainability

1. Introduction

What makes a space feel luxurious—the scale of a room, the richness of its materials, or the way it belongs to its surroundings? In an ecologically sensitive landscape like Ranthambore, luxury hospitality is not only about creating comfort but also about understanding what the environment can sustain. Known for its forests, wildlife, lakes, and strong regional character, Ranthambore has developed into an important wildlife tourism destination, bringing with it a growing network of hotels and resorts. These spaces often depend on materials, finishes, and construction systems that

shape not only the visual experience but also the environmental footprint of hospitality. The extraction, processing, and transportation of materials can consume energy and resources, while materials with short life cycles can contribute to maintenance and waste. At the same time, the use of generic or imported finishes can distance hospitality interiors from the architectural and cultural identity of the region. Sustainable hospitality therefore asks us to look beyond what a material looks like and consider where it comes from, how it is made, how long it lasts, and what happens to it after use. Local

stone, earth-based materials, natural fibers, reclaimed wood, and traditional crafts offer possibilities for creating spaces that are both environmentally responsive and rooted in place. Such materials can reduce transportation impacts while supporting local craftsmanship and allowing regional knowledge to become part of the guest experience. In this context, luxury need not be expressed through excess, but through materiality, authenticity, and a thoughtful connection with the landscape. The aim is to investigate how material selection and material-driven design can reduce the ecological footprint of luxury hospitality in Ranthambore while strengthening climatic responsiveness, regional identity and the overall guest experience. The objective of this research is to identify the environmental impacts associated with materials used in hospitality architecture and interiors, particularly in terms of sourcing, processing, transportation, durability and waste. To analyze the potential of locally available and low-impact materials, along with traditional construction techniques and regional craftsmanship, in reducing environmental impact while creating a stronger sense of place in Ranthambore. To derive material and design strategies that integrate these findings to achieve a balance between luxury, functionality, environmental responsibility, local identity and long-term conservation. This research carries the significance of the rapid growth of luxury tourism in ecologically sensitive destinations which highlights the need to reconsider how design decisions influence the surrounding environment and local context. In Ranthambore, hospitality development must respond to the delicate relationship between tourism, ecology and regional character. Material choices can play an important role in achieving this balance, as they influence not only environmental performance but also the visual and cultural identity of hospitality spaces. The study is therefore needed to explore how thoughtful material decisions can contribute to responsible development while preserving the qualities of luxury, comfort and place. The research focuses on material-driven design within selected luxury hospitality establishments in Ranthambore, examining its relationship with environmental responsibility, climatic response, regional identity

and guest experience. The study considers materials and construction approaches used in architecture, interiors and landscape, along with regional craftsmanship and traditional knowledge. It is limited to selected hospitality properties around Ranthambore and does not assess the ecological performance of the entire Tiger Reserve. As shown in Figure 1 Ranthambore Tourism Pressure, 2014 –2024 Source: Ranthambhore Tiger Reserve Conservation Plan; reported 2022–23 and 2023–24 tourism figures.



Figure 1 Ranthambore Tourism Pressure, 2014 – 2024

Source: Ranthambhore Tiger Reserve Conservation Plan; reported 2022–23 and 2023–24 tourism figures

2. Research Methodology

This study follows a qualitative, field-based approach, combining direct observations from the Ranthambore visit with secondary research and case-study analysis. The methodology moves from understanding the existing context to identifying material characteristics and finally translating the findings into relevant strategies for contemporary luxury hospitality. The field visit focused on selected hospitality properties, local surroundings, and architectural settings, documenting materials, climate response, and spatial character through photographs, sketches, notes, and material mapping. The literature review included research papers, government guidelines, tourism policies, and relevant hospitality case studies. The collected information was analyzed based on source, availability, processing,

transportation, durability, climatic suitability, cultural relevance, and reuse potential. The findings were then interpreted to develop practical material strategies for contemporary hospitality, balancing luxury, environmental responsibility, regional identity, and local craftsmanship [1 – 5].

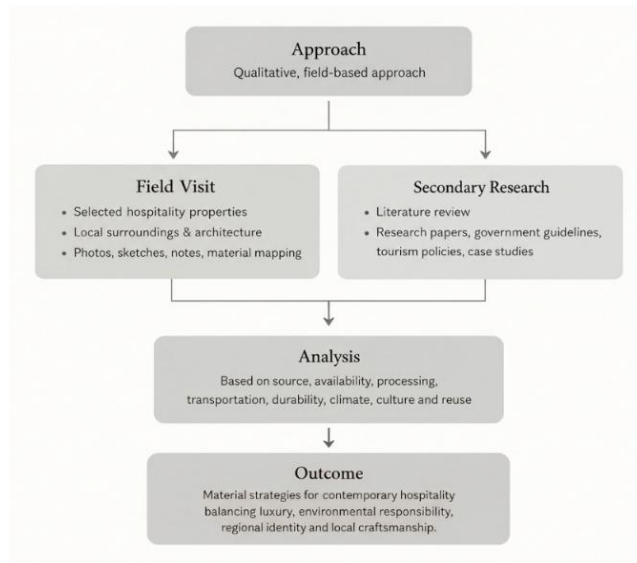


Figure 2 Flow of methodology
Source: Author

3. Literature Review

Material selection in hospitality has increasingly been studied as a design decision with direct environmental consequences. Kokulu and Acun Özgünler (2023) argue for a systematic method of selecting hotel finishes according to their production, processing and environmental impact. In hospitality interiors, stone and ceramic are suited to high-traffic floors because they resist wear and can remain in service for decades with periodic cleaning, sealing or joint maintenance. Timber is commonly used for furniture and wall cladding because surfaces can be refinished, repaired and reused when properly protected. Plaster and lime finishes require periodic patching but can be repaired without replacing entire surfaces, while carpets and upholstery generally have shorter replacement cycles because of continuous traffic, staining and cleaning. Glass and metals are non-biodegradable, but their long service life and recycling potential can reduce replacement demand. Earth, untreated timber and natural fibres can

biodegrade under suitable conditions like dry, stable, and well-ventilated indoor environments, whereas stone, ceramic and metals depend more on durability, reuse and recycling for their environmental value. A related body of research examines materials through a life-cycle perspective, beginning with extraction and continuing through manufacture, transportation, use, maintenance and disposal. Zhang et al. (2024) distinguish embodied carbon from operational carbon and identify material specification as an important stage for reducing environmental impact. In a hospitality setting, material performance also affects solar heat gain, conductive heat transfer, thermal mass and the cooling load required to maintain indoor comfort. Earth walls can absorb and release heat slowly, helping reduce temperature fluctuations, while stone and masonry provide thermal mass when their thickness and placement are appropriately designed. However, their environmental advantage depends on sourcing and transport. For interior applications, durability is equally significant: stone flooring may require periodic sealing, timber needs protection and refinishing, while textiles require frequent cleaning and eventual replacement. Designing for repair, component replacement, refurbishment and reuse can extend service life and reduce the environmental burden of repeated renovation. Research from Rajasthan offers useful evidence of how regional materials can respond to environmental conditions while retaining cultural value. Saridhe and Selvaraj (2021) documented traditional limecrete construction in Udaipur using quicklime, brick bats, sand, plant extracts and hemp fibres. Lime-based surfaces can be renewed through localised repair rather than complete replacement, giving them practical value in long-life construction. Kalla and Kumar (2025) investigated Dulmera sandstone for its heat absorption and emission behaviour, connecting the material with thermal comfort in Rajasthan's hot climate. In practical hospitality applications, sandstone can serve as flooring, wall cladding or paving because of its wear resistance; earth can form thick walls where thermal mass is required; lime can provide breathable wall finishes; and natural fibres can be used in screens, rugs and upholstery. Each material therefore has a specific reason for use, and its sustainability depends

on performance, maintenance requirements, expected service life and eventual reuse, rather than simply being classified as traditional or natural. Existing hospitality projects around Ranthambore demonstrate several practical applications of these principles. The Earth at Ranthambore uses rammed mud, cob earth, wood and limestone, with its earthen walls providing thermal stability and reducing dependence on mechanical heating and cooling. Aamaghati Wildlife Resort uses unbaked mud bricks for walls, clay-and-hay plaster for surfaces, sandstone for flooring, Bidasar brown marble in bathrooms, clay tiles for roofs and bamboo matting for ceilings, assigning different materials according to their functional requirements. The Ranthambhore Bagh combines local stone with compressed wood-waste furniture and natural fabrics, extending the idea of reuse into interiors. These examples show how material selection can address several requirements at once: thermal regulation, surface durability, ease of repair, reduced replacement, local craftsmanship and regional expression. They also demonstrate that sustainable luxury does not require eliminating durable non-biodegradable materials; instead, it can come from choosing materials that perform well, last longer, require manageable maintenance and can be reused or responsibly recovered at the end of their service life[6 – 10].

4. Gap in Literature

Existing research provides useful knowledge on sustainable materials, vernacular construction, life-cycle impacts and green hospitality, but these findings are rarely combined into a practical material-selection system for luxury hospitality in Ranthambore. Existing projects use rammed earth, sandstone, lime, bamboo, reclaimed wood and natural finishes, yet their selection depends largely on individual project conditions. This research aims to address this by developing a context-specific material strategy that considers sourcing, extraction, processing, transportation, climatic performance, durability, maintenance, application and end-of-life potential. Materials can then be assessed according to their suitability for walls, floors, ceilings, furniture, textiles and landscape elements. Such a framework can support early design decisions, encourage responsible procurement and strengthen the use of

local resources while maintaining the comfort and character expected from luxury hospitality. As shown in Figure 3 List of sustainable materials

Source: Author and AI.



Figure 3 List of sustainable materials

Source: Author and AI

5. Case Studies

5.1.Primary Case Study

Sterling Bagh Ranthambore, located in Sawai Madhopur, Rajasthan, is a contemporary wildlife resort spread across approximately 2 acres, with 36 rooms and suites. The resort is planned around landscaped areas, a central courtyard and swimming pool, with open and semi-open spaces that encourage natural light, ventilation and interaction with the outdoors. Earthy tones, textured surfaces, timber-look elements, stone-like finishes and traditional decorative details reflect the regional character of Rajasthan. The interiors use a warm, neutral palette with beige and brown tones, complemented by wooden furniture, upholstered furnishings and warm artificial lighting. The resort's landscape includes approximately 11,000 sq. ft. of manicured lawns, garden areas and a central courtyard with a swimming pool surrounded by palm trees. The Pool View Suites directly overlook the pool and Aravalli backdrop, creating a visual connection between the accommodation and the outdoor landscape [11].



Figure 4 Pool and Facade
Source: Author

The resort also uses regional references through its dining and interior experience. Sawai Restobar incorporates imagery of Ranthambore's wildlife and serves Rajasthani dishes, while the bar uses rich wooden interiors and vintage décor. These elements establish a connection with the local setting through visual themes, landscape and cultural references rather than through documented use of specific locally sourced construction materials. As shown in Figure 5 Lounge and bar area Source: Author [13].



Figure 5 Lounge and bar area
Source: Author

5.2.Secondary Case Study

Ranthambhore Bagh, near Sawai Madhopur, is a small-scale ecological hospitality property comprising five guest cottages, designed by Matharoo Associates. It uses natural and locally sourced stone with traditional construction techniques. Open spaces, shade, natural light and

cross-ventilation respond to the hot, dry climate, while the earthy stone palette reflects the surrounding Aravalli landscape. A key feature is its focus on reuse and local craftsmanship. Reclaimed wood is used for furniture, while surplus fabric and discarded objects are repurposed into lighting, décor and accessories. Local skills reduce dependence on highly processed finishes and strengthen the connection to the region. These strategies effectively reduce waste and create a strong sense of place, although the highly site-specific approach may be difficult to replicate in larger hospitality projects. As shown in Figure 6 Open space Source: Ranthambore bagh [12].



Figure 6 Open space
Source: Ranthambore bagh

The ecological approach extends to rainwater harvesting, solar energy, composting, edible gardens and indigenous planting. Rewilding supports biodiversity and water retention, enhancing the nature-based guest experience. The main learning for Ranthambore hospitality is to combine local sourcing, adaptive reuse, passive climatic design and landscape regeneration as integrated strategies for sustainable development [14].



Figure 7 Landscape study
Source: Ranthambore bagh

6. Comparative Analysis

The comparison highlights how material principles identified in the literature are translated into practical hospitality applications.

Table 1 Literature Review

Aspect	Literature Review	Case Studies
Material Selection	Focuses on sourcing, impact, lifespan and reuse.	Applies stone, earth, lime, wood and bamboo to specific functions.
Climate Response	Relates material properties to heat gain, thermal mass and cooling demand.	Uses earth walls, shaded spaces and stone to moderate indoor conditions.
Maintenance & Lifespan	Supports durable, repairable and reusable materials.	Demonstrates reclaimed wood, natural finishes and long-lasting stone.
Regional Identity	Connects vernacular materials with cultural and climatic value.	Uses local stone, traditional techniques and regional craftsmanship.
Luxury Experience	Links comfort and visual quality with responsible consumption.	Creates richness through texture, craftsmanship and landscape connection.
Design Application	Provides criteria for evaluating materials before selection.	Demonstrates their application across architecture, interiors and landscape.

6.1.Recommendation / Suggestion

- The study recommends developing a context-

specific material selection guide for luxury hospitality projects in Ranthambore, where materials are chosen according to their source, lifespan, maintenance, climatic performance and environmental impact.

- Locally available sandstone, lime, earth, bamboo, reclaimed timber and natural fibres can be considered according to their suitability for floors, walls, ceilings, furniture and interior elements rather than being used only for visual character.
- Preference should be given to durable and repairable materials that reduce frequent replacement, while reclaimed and reusable components can help minimise construction and renovation waste.
- Material selection should also consider transportation distance, processing requirements and opportunities for local craftsmanship.
- These strategies can be introduced during the early design stage through a simple material-selection matrix, helping designers compare alternatives.
- Such an approach can support luxury hospitality that maintains comfort, regional identity and aesthetic quality while reducing resource consumption and ecological impact.

Conclusion

The study establishes that material selection can play a significant role in shaping more responsible luxury hospitality in Ranthambore. The literature and case studies show that materials such as sandstone, lime, earth, bamboo, reclaimed timber and natural fibres can contribute to climatic comfort, durability, regional identity and reduced resource consumption when appropriately selected and applied. The research also highlights that sustainability depends on more than choosing natural or local materials; sourcing, transportation, maintenance, lifespan, performance and reuse must be considered together. The proposed material-selection framework translates these findings into a practical design approach for hospitality projects, helping designers determine which material should be used, where it should be used and why. This creates a balance

between luxury, comfort, local character and ecological responsibility.

References

- [1]. Kokulu, N., & Acun Özgünler, S. (2023). Investigation of methods and studies for determining the material selection criteria with low environmental impact in hotel buildings. *Journal of Architectural Sciences and Applications*, 8(1), 25–37. doi:10.30785/mbud.1185227
- [2]. Wildlife Institute of India. (2013). Ranthambhore Tiger Reserve: Ecological and tourism-related issues. Wildlife Institute of India, Ministry of Environment and Forests, Government of India.
- [3]. Zhang, Y., Sattar, S., Cook, D. T., Johnson, K. J., & Fung, J. F. (2024). Systematic review of embodied carbon assessment and reduction in building life cycles. *National Institute of Standards and Technology, NIST SP 1324*. doi:10.6028/NIST.SP.1324
- [4]. Melià, P., Ruggieri, G., Sabbadini, S., & Dotelli, G. (2014). Environmental impacts of natural and conventional building materials: A case study on earth plasters. *Journal of Cleaner Production*, 80, 179–186. doi:10.1016/j.jclepro.2014.05.073
- [5]. Saridhe, S. P., & Selvaraj, T. (2021). Reporting the ancient green construction technology of limecrete slabs adopted in Udaipur, Rajasthan. *Journal of Cleaner Production*, 280, 123682. doi:10.1016/j.jclepro.2020.123682
- [6]. Kalla, R., & Kumar, R. (2025). Vernacular materials for thermal comfort: Utilizing Dulmera sandstone tiles in Rajasthan's arid climate. *Engineering, Technology & Applied Science Research*, 15(1), 20229–20234. doi:10.48084/etasr.8524
- [7]. Yonzan, A., Li, Z., Zhang, Q., Bajracharya, D., & Song, G. (2025). Thermal environment in rammed earth structures: A systematic review on thermal comfort, thermal performance, and climate strategies. *Energy and Buildings*, 349, 116542. doi:10.1016/j.enbuild.2025.116542
- [8]. Duan, Z., Huang, Q., & Zhang, Q. (2022). Life cycle assessment of mass timber construction: A review. *Building and Environment*, 221, 109320. doi:10.1016/j.buildenv.2022.109320
- [9]. Gan, J., Chen, M., Semple, K., Liu, X., Dai, C., & Tu, Q. (2022). Life cycle assessment of bamboo products: Review and harmonization. *Science of the Total Environment*, 849, 157937. doi:10.1016/j.scitotenv.2022.157937
- [10]. Manandhar, R., Kim, J.-H., & Kim, J.-T. (2019). Environmental, social and economic sustainability of bamboo and bamboo-based construction materials in buildings. *Journal of Asian Architecture and Building Engineering*, 18(2), 49–59. doi:10.1080/13467581.2019.1595629
- [11]. Xu, P., Tam, V. W. Y., Li, H., Zhu, J., & Xu, X. (2025). A critical review of bamboo construction materials for sustainability. *Renewable and Sustainable Energy Reviews*, 210, 115230. doi:10.1016/j.rser.2024.115230
- [12]. El-Barmelgy, M. M., Heyba, E. H., & Salama, D. A. E. M. G. (2025). The economic feasibility of sustainable hotel buildings using local materials. *International Journal of Computational and Experimental Science and Engineering*, 11(4). doi:10.22399/ijcesen.4806
- [13]. Verma, M., Negandhi, D., Khanna, C., Edgaonkar, A., David, A., Kadekodi, G., Costanza, R., Gopal, R., Bonal, B. S., Yadav, S. P., & Kumar, S. (2017). Making the hidden visible: Economic valuation of tiger reserves in India. *Ecosystem Services*, 26, 236–244. doi:10.1016/j.ecoser.2017.05.006
- [14]. Chundawat, R., Raju, V. U., Rajora, H., & Matthews, J. (2018). The value of wildlife tourism around Ranthambhore Tiger Reserve in Rajasthan for wildlife conservation and local communities. *TOFTigers*