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INTERNATIONAL COLLOQUIUM ON
NEXTGEN CONSTRUCTION
2025

Future-Ready Construction and Facility Management:
Driving Research and Innovation for a Smart Built Environment

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ATTIC-CAUTION: A FLOOD-RESILIENT HOUSING TYPOLOGY FOR FUTURE-READY COMMUNITIES

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Abstract
Flooding poses a recurrent and intensifying threat to communities along the Chao Phraya River in Bangkok Noi, Thailand. The ATTIC-CAUTION project addresses this challenge by proposing a disaster-resilient housing typology that prioritizes human safety, material sustainability, and spatial adaptability. This initiative aims to enhance the survivability of residents and protect property by integrating an elevated attic structure within the traditional Thai house form. Designed to reduce flood vulnerability, the modified attic functions as both a refuge zone and an adaptive structural system. The project combines vernacular knowledge, spatial analysis, and passive environmental strategies to optimize form, elevate critical functions, and reduce dependence on costly infrastructure. Through a modular floating or semi-floating foundation system, the prototype adapts to fluctuating water levels, ensuring minimum displacement during disasters. Design interventions include reinforced trusses, lightweight materials, strategic openings for cross-ventilation, and solar-based energy independence. Methodologically, the project synthesizes architectural design research and disaster risk mitigation strategies, offering a replicable model for flood-prone areas. It contributes to the broader agenda of future-ready construction and facility management by promoting community resilience, lifecycle durability, and contextual relevance in built environments.

Keywords: disaster resilience, flood-adaptive design, future-ready housing, built environment, sustainable construction

1. INTRODUCTION

Flooding remains a major threat across Southeast Asia, especially in low-lying communities like Bangkok Noi along the Chao Phraya River. Recurrent inundation, driven by monsoons, rising sea levels, and urban expansion, puts residents and their homes at continual risk. Conventional housing often lacks the resilience needed to withstand these unpredictable events. In response, the ATTIC-CAUTION project proposes an innovative adaptation of the traditional Thai house integrating an elevated attic and modular flood-responsive base. This hybrid typology enhances survival potential during flood events while preserving cultural and spatial identity. It also aims to prolong the material life cycle through sustainable, low-tech construction. The study focuses on three objectives: (1) enhancing housing adaptability to floods, (2) aligning modular systems with local typologies, and (3) promoting community-based, resilient design strategies. By bridging vernacular traditions with adaptive innovation, the project offers a model for future-ready, disaster-resilient construction.

2. LITERATURE REVIEW

The rising threat of climate-induced disasters, particularly flooding, has urged the built

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environment sector to rethink conventional construction practices. Research underscores the importance of adaptive architecture and climate-resilient design in reducing vulnerabilities in flood-prone regions (Praveen et al., 2025; Hyder et al., 2024; Yahia & Shahjalal, 2024). Flood-resilient housing strategies commonly include elevation, flotation, and sacrificial components each tailored to varying levels of risk tolerance and economic feasibility. However, effective flood-resistant design also requires regional specificity, especially in coastal or riverine areas where rising water levels intensify exposure (Yahia & Shahjalal, 2024). In Southeast Asia, vernacular housing typologies such as the Thai stilt house offer passive resilience strategies embedded in local knowledge systems. These dwellings feature elevated floors, open ground levels, and lightweight materials that naturally adapt to flooding. Yet, modern implementation of these principles is often inconsistent, particularly as urban development disrupts traditional practices. Scholars have called for hybrid approaches that merge vernacular wisdom with contemporary materials and construction systems to achieve both cultural relevance and structural resilience (Noorwatha et al., 2024; Nursanty et al., 2024). In addition to physical resilience, architectural responses to flooding are increasingly viewed through socio-cultural lenses. Participatory, community-driven design enhances preparedness while promoting ownership and long-term adaptability. Synergistic strategies such as combining passive environmental design, modular construction, and local engagement have shown promise in achieving holistic resilience (Hyder et al., 2024). Nevertheless, much of the discourse remains centred on high-tech solutions, overlooking the potential of low-tech, context-sensitive innovations suited for informal or resource-limited settings. The ATTIC-CAUTION project positions itself within this overlooked space. By integrating vernacular design logic with modular innovation, it proposes an attic-based adaptive system that functions both as vertical evacuation space and a long-term spatial solution. This literature synthesis reinforces the urgent need for affordable, culturally grounded, and technically practical housing models that support future-ready construction in climate-vulnerable communities.

3. METHODOLOGY

This project adopted a design research approach combining site-specific analysis, architectural prototyping, and scenario-based speculative development. Conducted within an international academic workshop, the process emphasized interdisciplinary collaboration and local socio-environmental awareness. Initial research involved mapping flood-prone zones in Bangkok Noi using historical data, topographic studies, and on-site observation of existing housing and informal flood adaptations. Insights from this analysis informed a typology matrix that guided the development of a modular prototype with an integrated attic refuge. The design responds through three key strategies: (1) elevated or buoyant foundations to mitigate flood impact, (2) passive environmental features such as rainwater drainage and natural ventilation, and (3) lightweight, modular construction using bamboo, timber, and joinery systems. Rather than high-tech solutions, this methodology centres on vernacular principles, affordability, and resilience offering an adaptive model tailored to the realities of flood-affected communities.

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4. FINDING AND DISCUSSION

The ATTIC-CAUTION project yielded a context-sensitive prototype that addresses both the architectural and social dimensions of flood resilience. Through iterative design exploration, the study produced a modular housing concept that can adapt to varied flood scenarios in Bangkok Noi, while retaining compatibility with the traditional Thai vernacular.

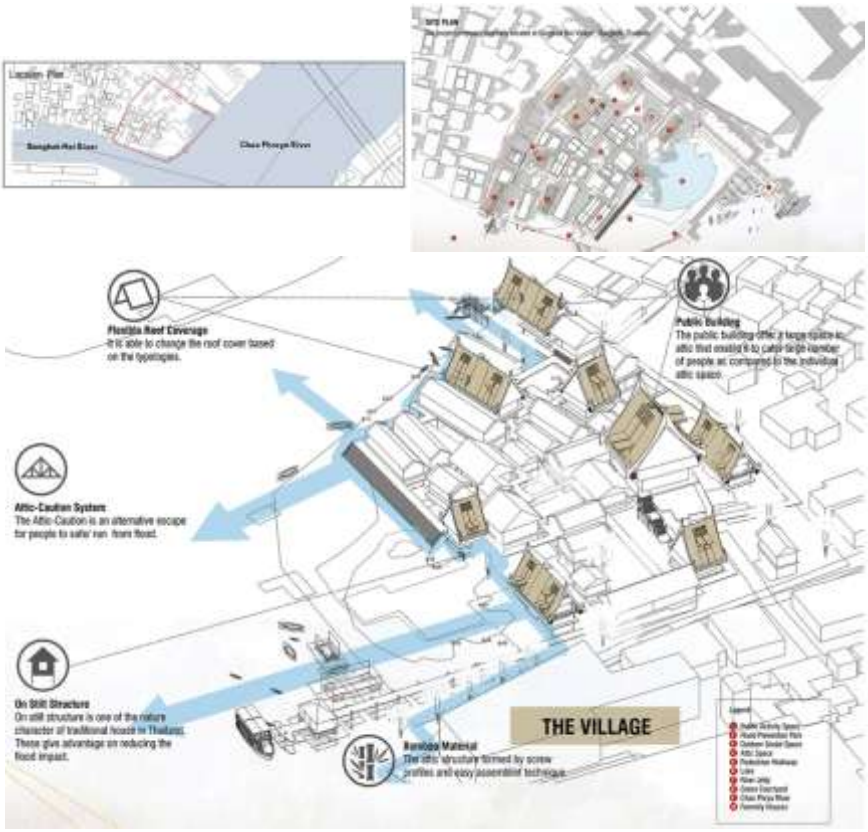

Figure 1. Mapping and Visual Synthesis of Bangkok Noi Village (Authors, 2025)

Key findings include the effectiveness of integrating an enhanced attic as a dedicated refuge and utility space. Unlike conventional stilt houses, the proposed attic system adds a vertical layer of safety, allowing residents to remain on-site during flooding without compromising health or personal belongings. This transforms the attic from a storage-only space into an active life-saving zone. The structural strategy leverages local materials and joinery systems, resulting in a construction method that is lightweight, repairable, and cost-effective. The use of bamboo and timber not only reflects vernacular wisdom but also supports environmental sustainability and ease of post-disaster reconstruction. The roof structure was designed to promote efficient rainwater runoff, while roof orientation and perforations support cross-ventilation and thermal comfort important qualities for passive survivability in hot, humid conditions.

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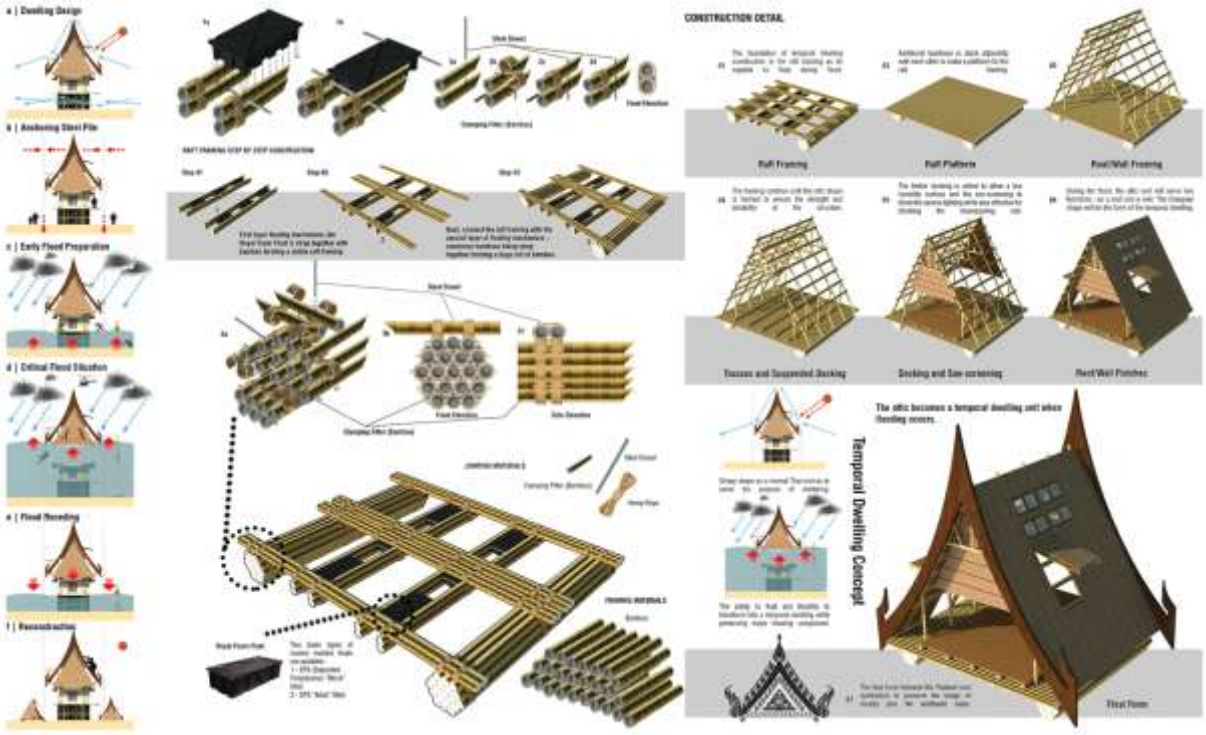

Figure 2. ATTIC-CAUTION conceptual design and construction (Authors, 2025)

A secondary insight emerged through the analysis of community integration: the prototype can be deployed in clusters to form micro-resilient neighbourhoods. This adds value not only in terms of physical survival but also social cohesion and shared resource management. The system also demonstrates flexibility across different foundation typologies from fixed stilts to semi-floating or fully floating bases offering adaptability across various urban and rural flood-prone contexts. In comparison with existing flood mitigation strategies often reliant on relocation, high-cost engineering, or external aid the ATTIC-CAUTION model emphasizes proactive, self-reliant adaptation. This positions it as a viable alternative for near-future construction paradigms that prioritize localized resilience and sustainability over techno-centric infrastructure.

5. CONCLUSION

The ATTIC-CAUTION project demonstrates how design innovation rooted in local context can offer practical, resilient solutions for communities facing recurring floods. By reimagining the traditional Thai house through modular construction and an enhanced attic system, the project provides a flexible and culturally sensitive response to climate-related hazards. Key contributions include a flood-adaptive housing typology that integrates low-tech strategies, passive environmental design, and community-oriented adaptability. Beyond its physical structure, the prototype encourages a shift toward self-reliant, decentralized resilience in future-ready construction. This work underscores the potential of architecture not only to protect but to empower offering a

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replicable design approach for vulnerable settlements throughout Southeast Asia and beyond. Future iterations may explore community feedback, material testing, and long-term performance in real-world scenarios.

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7. REFERENCES

Hyder, A. H. A., Awad, J., Jung, C., & Sher, B. K. (2024). Enhancing Climate Resilience Against Flooding in Housing Design Through Synergistic Strategies in Pakistan. *Future Cities and Environment*, *10*(1).

Noorwatha, I. K. D., Santosa, I., Adhitama, G. P., & Remawa, A. A. G. R. (2024). Design Methods of Vernacular Architecture: Insights from Ngundaginin by Undagi: Bali, Indonesia. *Design Methods*.

Nursanty, E., Cauba Jr, A. G., & Waskito, A. P. (2024). Vernacular branding: sustaining city identity through vernacular architecture of indigenous villages. *Place Branding and Public Diplomacy*, *20*(4), 482-503.

Praveen, G., kashi Vishwanath, N., Sree, C. C., & Rohith, D. (2025). CLIMATE-RESILIENT URBAN PLANNING. *International Journal of Advances in Agricultural Science and Technology*, *12*(3), 226-234.

Yahia, A. K. M., & Shahjalal, M. (2024). Implementing Flood-Resistant Design Strategies in Coastal Regions. *Non-human journal*, *1*(01), 10-70008.

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