

Sustainable Renovation of Traditional Housing Architecture of the Thai Ethnic Group in the Northwestern Region of Vietnam

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Abstract

The traditional housing of the Thai ethnic group in the Northwestern region of Vietnam not only serves as a living space but also embodies distinctive cultural, historical, and ecological values. However, due to the impact of socio-economic transformation and modernization, this architectural type is at risk of disappearing. This study aims to assess the current state, community awareness, and directions for renovating traditional Thai housing in a sustainable manner. Through field surveys, in-depth interviews, and the development of three pilot renovation plans in the Vang Pheo village, the study proposes a community-based sustainable renovation approach that preserves the core values of traditional architecture while improving living conditions. The results contribute to the academic discourse on sustainable heritage regeneration, as well as providing practical suggestions for local policies and architectural practices.

1. Introduction

The Northwestern region of Vietnam is located in the western mountainous area, with geographical coordinates from 15° to 22° North latitude and from 102° to 107° East longitude. Geographically, this region borders the People's Republic of China to the north, the Lao People's Democratic Republic to the west, the northeastern region of Vietnam to the east, and Thanh Hoa Province to the south. The Northwestern region includes the provinces of Hoa Binh, Son La, Dien Bien, Lai Chau, Lao Cai, and Yen Bai, covering a total area of 50,576 km², accounting for 15.3% of the country's total area as shown in Fig. 1.

The region is characterized by a high and strongly fragmented terrain, with high mountain ranges, deep valleys, ravines, and limestone plateaus at moderate altitudes. The complex terrain, coupled with the division by mountain ranges and rivers, has formed valleys, some of which have developed into basins such as in Nghia Lo and Dien Bien provinces. With its mountainous terrain, the Northwestern region is home to a dense and rich river system, including major rivers such as the Red River, Da River, flowing from northwest to southeast, and the upper stream of the Ma River, flowing from Dien Bien Province to the west of Son La Province and then turning towards Laos. Additionally, the Northwestern region is rich in mineral resources, especially hot springs, with more than 60 sources, providing significant potential for tourism development.

The climate in the Northwestern region of Vietnam is diverse, comprising several microclimates. Although located in the tropical monsoon zone, due to the altitude ranging from 800 to 3000 meters, the climate shifts towards subtropical, and many highlands experience temperate climates. The micro-regions exhibit distinct climate differences, with valleys being relatively warm while the plateaus are very cold. Temperature variations

between winter and summer are significant, with some places experiencing temperatures as low as below 0°C in winter, while in summer, the temperature can exceed 40°C [1].

The Thai ethnic group, one of the 53 ethnic minorities in Vietnam, has the third-largest population, with 1,820,950 people according to the 2019 census, accounting for approximately 1.74% of the national population. The Thai people mainly reside in the provinces of Son La, Lai Chau, Dien Bien, Lao Cai, Yen Bai, Hoa Binh in the Northwestern region of Vietnam, and in Nghe An and Thanh Hoa in the North-Central region. The Thai ethnic group is divided into several sub-groups, including White Thai, Black Thai, Red Thai, Muong Vat Thai, Do Thai, Thanh Thai, Lu Thai, and Da Bac Thai, with White Thai and Black Thai being the majority groups, and hence often referred to as White Thai and Black Thai. The Thai people have a distinctive culture expressed through various aspects such as lifestyle, customs, attire, cuisine, and community activities [2].



Fig. 1 Northwestern Vietnam and the locations of provinces with a significant Thai population

Traditional Thai housing in the Northwestern region is primarily stilt houses, designed to adapt to the hilly terrain, protect from floods and humidity, and provide a spacious living environment. The houses are typically rectangular, divided into multiple sections serving different functions such as a guest area, worship area, sleeping rooms, kitchen, etc. The houses are mainly constructed using natural materials such as wood, bamboo, rattan, and leaves. The steep roof allows for quick drainage during the rainy season. The traditional Thai house, with its unique structure and close relationship with the natural environment, not only serves as a living space but also embodies deep cultural, social, and ecological values [3, 4].

However, due to various reasons such as urbanization, the demands of modern living, difficulties in preservation, climate change, and the negative impact of tourism, traditional Thai housing in the Northwestern region of Vietnam faces serious challenges. Firstly, the number of traditional stilt houses is rapidly decreasing due to the trend of converting to ground-level houses in the style of the Kinh ethnic group or reinforced concrete houses to meet functional demands and cost-saving requirements. Many of the remaining stilt houses have also undergone significant changes in form, material, and structure, losing their original features such as removing traditional kitchens, replacing thatched roofs with cement fiber or corrugated iron, and removing traditional decorative details, wooden stairs, and bamboo walls [3].

For the reasons mentioned above, the sustainable renovation of traditional Thai housing is not only a technical requirement but also a pressing cultural, social, and environmental issue. Traditional stilt houses are an inseparable part of the Thai people's cultural value system, reflecting the bond between humans, nature, and the community. Without timely and appropriate renovation solutions, this valuable architectural heritage is at risk of being entirely replaced by modern housing models that are alien to local culture [2, 3].

The goal of this study is to analyze the current status and architectural value of traditional Thai housing in the Northwestern region of Vietnam, and to propose sustainable renovation directions that both preserve the ethnic cultural identity and meet modern functional requirements, climate adaptation, and community-based tourism development.

From this context and goal, the study focuses on clarifying the following questions:

1. What characteristics and values of traditional Thai housing in the Northwestern region of Vietnam need to be preserved today?
2. What is the current state of transformation and decline of traditional architecture, and the causes?

3. What principles and renovation solutions can ensure cultural, social, and environmental sustainability in the living spaces of the Thai community in the Northwestern region of Vietnam?

This research aims to identify the architectural values, the current status, and the causes of the decline in the number of traditional housings among the Thai ethnic group in the Northwestern region of Vietnam, and then propose sustainable renovation directions. Renovation not only helps preserve cultural identity but also improves living conditions, adapts to climatic conditions, and promotes community-based tourism. The research results can serve as a reference for regional development policies and be applied as a model for other ethnic minority communities in the northern mountainous region of Vietnam.

2. Literature Review

The traditional housing architecture of the Thai ethnic group in the Northwestern region of Vietnam has been extensively studied by domestic researchers from anthropological, cultural, and vernacular architecture perspectives. Nguyen [5] and Vương [6] researched the traditional housing of the Thai people before 1954, emphasizing the use of indigenous materials such as wood, bamboo, rattan, and palm leaves. These studies primarily describe the architectural structure, construction techniques, and the organization of living spaces in the traditional stilt houses of the Thai people within the contemporary socio-cultural context [5, 6]. Nguyen [7] and the Institute of Ethnology [8] identified the stilt house of the Thai people as a characteristic expression of the adaptation between humans and the natural environment, while also serving as a space that encompasses layers of social, religious, and family symbols. Lo Van Huu & Dinh Thi Hoa [9] conducted an in-depth analysis of the morphological structure of stilt houses, such as the floor plan, height, wall and roof construction, and the use of local materials, revealing the consistency between functional use and cultural expression. Additionally, Lo & Nguyen [10] clarified the role of community living spaces in traditional interior organization-places where community values, age, gender stratification, and indigenous rituals are preserved and recreated.

In recent decades, urbanization, lifestyle changes, and tourism development have significantly impacted the traditional housing architecture of the Thai people. Tran [11] warned about the rapid decline of stilt houses due to pressures from functional modifications, the use of modern materials and structures, and the lack of preservation policies for traditional housing. Numerous studies, such as those by Pham [12], Nguyen [13], Nguyen & Dang [14] point out that stilt houses are now undergoing alterations in form, space, and materials, resulting in a loss of cultural identity and the adaptive capacity of the traditional architecture to its environment.

In this context, some domestic studies have addressed the potential for adaptive reuse of traditional architecture. Nguyen [12] proposed that the renovation of stilt houses for community-based tourism should preserve the core traditional structure while incorporating modern amenities in a minimalist, energy-efficient manner. Several renovation models have been implemented in community tourism villages such as Ban Lac (Hoa Binh), Ban Pom Coong (Mai Chau), and Ban Mong (Son La), showing the initial success of integrating traditional housing with tourism activities. However, studies by Pham [13], Nguyen & Dang [14] argue that the renovation of stilt houses for community tourism must ensure the balance between cultural identity and modern functionality. Key criteria include reorganization of interior spaces, integration of modern sanitation, and the use of sustainable materials. However, many cases show a lack of professional guidance, arbitrary renovations by local residents, and external investment impositions, which have led to the standardization of stilt houses, diminishing their indigenous character and sustainability.

Globally, the renovation and adaptive reuse of traditional architecture has been approached as an effective way to balance heritage conservation with contemporary needs. Oliver [15] emphasized that vernacular architecture is the result of a socio-natural selection process, and thus, it should be restructured with a deep understanding of culture and the environment. Rapoport [16] suggested that any renovation must maintain the "spatial grammar" of traditional architecture while flexibly integrating modern elements such as lighting, plumbing, and living conveniences. Studies by Vellinga et al. [17] in Asia and Africa and Correia et al. [18] in Portugal demonstrated that sustainable renovation of traditional houses, when correctly combining technical, cultural, and community factors, can create housing models that are environmentally, economically, and heritage-viable. Experiences in Japan [19] and Thailand [20] also show that combining modern renovation techniques with indigenous knowledge is crucial for maintaining cultural identity in traditional living spaces.

In addition, several foundational international documents have shaped the principles of conservation and adaptive reuse of traditional architecture, including: Jokilehto [21] with *A History of Architectural Conservation*, the ICOMOS Charter on Vernacular Heritage [22], the Nara Document on Authenticity [23], and the International Cultural Tourism Charter [24]—all of which emphasize the importance of authenticity, cultural identity, and community involvement in the conservation of traditional architecture.

In Vietnam and Southeast Asia, several recent applied studies have addressed the issues of sustainable conservation and adaptive reuse of traditional houses. Le & Nguyen [25] analyzed the restoration of ancient houses in Hoi An for sustainable tourism development, integrating modern amenities while preserving indigenous

architectural details. Tran & Nguyen [26] studied the model of renovating traditional Khmer houses in Tra Vinh to adapt to climate change and improve living quality. Additionally, Hoang [27] proposed the conservation of Hue's Ruong houses by reconstructing traditional structures and using local materials, facilitating the development of responsible heritage tourism. Research by Tran et al. , Vu et al. and Nguyen in Hanoi and Ho Chi Minh City has shown the potential for adaptive reuse of both traditional and French colonial architecture in the context of rapid urbanization, particularly in transforming these spaces into commercial, tourism, cultural, and educational areas [28, 29, 30]. In the northern mountainous region, the study by Lan & Tran [31] in Sa Pa indicated that the renovation of ethnic houses for tourism must ensure both cultural identity and sustainable functionality. In Southeast Asia, Amphansuk & Isaratharmmanoon [32] explored the reuse of historic buildings in Bangkok for conversion into creative learning spaces. Studies in Singapore [33], Indonesia (Atmanti & Uekita [34]; Kwanda [35]), and Thailand highlight the effective combination of modern conservation techniques and indigenous knowledge in the renovation of traditional architecture, contributing to urban identity preservation while promoting sustainable tourism development.

An overview reveals that many studies have analyzed the cultural values and structure of traditional stilt houses, pointing out the risks of deterioration due to modern changes and some experiences in the renovation of traditional houses. However, there is a lack of in-depth and systematic research on sustainable renovation solutions for the traditional housing of the Thai ethnic group, particularly regarding the integration of cultural preservation, functional upgrades, and the application of green design principles. This is the gap that this study aims to address.

2.1 Theoretical Framework

The study of the sustainable renovation of traditional housing architecture of the Thai ethnic group in the Northwestern region of Vietnam is built upon an interdisciplinary theoretical foundation, combining approaches to vernacular architecture, sustainable development, conservation, and adaptive reuse. This theoretical framework helps clarify the relationship between traditional living spaces and social, cultural, economic, and environmental factors in the context of urbanization, modernization, and community-based tourism development.

2.2 Vernacular Architecture

According to Oliver [15] and Vellinga et al. [36] vernacular architecture is a product that reflects the close relationship between humans and the natural environment, as well as indigenous culture. It is formed through lived experience and the accumulated folk knowledge of many generations. The traditional housing of the Thai people is a typical example of vernacular architecture, built in harmony with the mountainous terrain, tropical humid climate, and cultural and social characteristics.

2.3 Concepts and Principles of Sustainable Development

Sustainable development, as defined in the Brundtland Report (WCED, 1987), refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs [37]. In architecture, this includes the balance between environmental factors (energy efficiency, use of local materials), economic factors (investment costs, maintenance capability), and cultural-social factors (preserving identity, meeting community needs) [37]. The renovation of traditional Thai housing must be placed within this framework to ensure long-term feasibility and relevance.

2.4 Theory of Traditional Architecture Renovation

Renovating traditional architecture is a crucial approach in cultural heritage conservation, particularly in the context of modernization and changing usage demands. Unlike preservation, which aims to maintain the status quo, renovation allows for the retention of core traditional elements—structure, materials, and space—while integrating new components to enhance usability, sustainability, and contemporary needs. This is particularly important for ethnic housing, which not only holds cultural memory but also serves as a practical living space [38, 39].

In the context of the Thai community in the Northwestern region of Vietnam, the theory of traditional architecture renovation not only helps preserve ethnic living spaces but also facilitates improving living conditions, developing community tourism, and addressing climate change. This requires a holistic approach where renovation is not only limited to construction techniques but also integrated into a sustainable development strategy that respects indigenous value systems.

2.5 Sustainable Development in Traditional Housing Architecture

The theory of sustainable development in architecture emphasizes the harmony between tangible and intangible elements. According to Guy and Farmer (2001), sustainable architecture aims not only to optimize energy efficiency but also to be shaped by the cultural-social specifics of each context [40]. In the Thai community, this includes preserving common living spaces, traditional structure, and materials while improving lighting, ventilation, sanitation, and utilizing new technologies to meet modern needs.

3. Methodology

This research is conducted through four main phases, employing a combination of qualitative methods, field surveys, and community interviews, aimed to identify the architectural values of traditional housing and proposing renovation principles that align with sustainable development:

- *Literature review*: Collecting, synthesizing, and analyzing domestic and international literature related to: Traditional Thai housing architecture, adaptive reuse of vernacular housing, the theory of sustainable development, and adaptive reuse. This phase will help define the interdisciplinary theoretical framework that combines approaches to vernacular architecture, adaptive reuse, and sustainable development.

- *Field survey*: The study area includes six villages in the Northwestern region of Vietnam, four of which are inhabited by White Thai people and two by Black Thai people. The data collection will include measuring, drawing, photographing, and documenting the architectural features of stilt houses; recording spatial structure, functions, building materials, and renovation trends.

- *Community interviews*: Collecting information about the community's awareness of the value of traditional housing, their desires, and needs for sustainable renovation.

- *Data analysis and synthesis*: Analyzing the collected data by theme, synthesizing it, and proposing renovation principles for the sustainable transformation of traditional Thai housing architecture.

4. Results and Discussion

4.1 Architectural Value of Traditional Housing of the Thai Ethnic Group in the Northwestern Region of Vietnam

Based on an analysis of existing literature on the vernacular housing of the Thai ethnic group in Vietnam [5, 6, 7, 8, 9, 10], along with a review of the model of the Thai traditional house at the Vietnam Museum of Ethnology, the research team observed that the vernacular architecture of the Thai people is highly distinctive, reflecting their adaptation to the natural environment, culture, and living customs. The primary housing type is the stilt house, built on wooden pillars approximately 2 meters above the ground, which helps avoid dampness, insects, wild animals, and creates ventilation. The house is rectangular, with a length that is twice its width, and commonly consists of 3 or 5 rooms (odd numbers are considered lucky by the Thai). The roof has a steep pitch to ensure rapid drainage, making it suitable for the tropical humid climate of the mountainous region. The materials used are mainly locally sourced, such as wood, bamboo, rattan, and leaves, which are renewable and environmentally friendly. The traditional construction technique is employed in assembling these materials. The interior space is organized according to a functional-symbolic model: a space for ancestor worship, a kitchen, a guest area, and sleeping quarters, all clearly separated as presented in Fig. 2. These elements not only carry profound cultural and social values but also demonstrate the ecological thinking of the Thai people in creating an adaptive living environment, conserving resources, and maintaining a close connection with nature. These are the values that must be preserved in the process of renovating traditional housing in a sustainable manner.

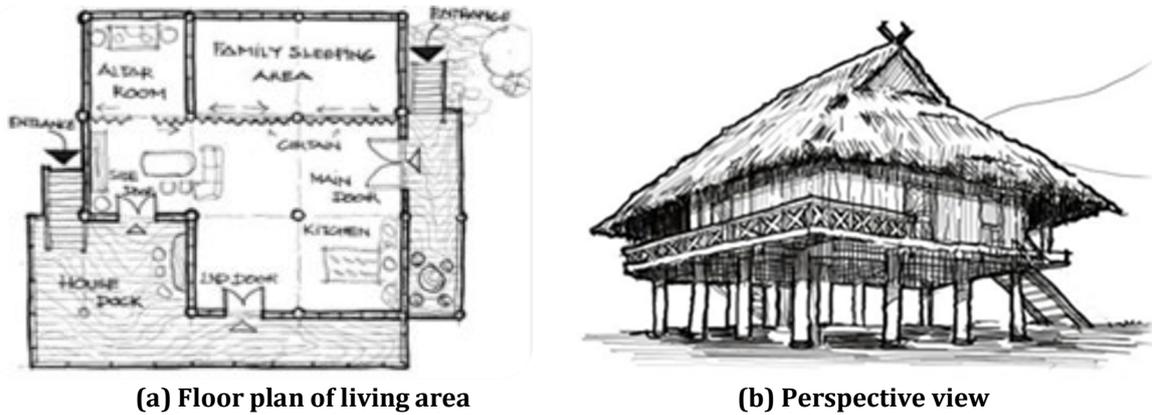


Fig. 2 Drawing of the traditional Thai house based on descriptions from old stilt house documents

The survey results of the traditional housing architecture of the Thai ethnic group conducted by the research team in 06 villages in the Northwestern region of Vietnam (Ngoang village, Tham Duong commune, Van Ban district, Lao Cai province; Vang Pheo village, Muong So commune, Phong Tho district, Lai Chau province; Men village, Thanh Nua commune, Dien Bien district, Dien Bien province; Mo village, Thanh Truong ward, Dien Bien Phu city, Dien Bien province; Van village, Van Nghia commune, Mai Chau district, Hoa Binh province; Ang village, Dong Sang commune, Moc Chau town, Son La province) revealed that the traditional housing of the Thai people in the Northwestern region still retains the main architectural features of the traditional house. Only the roof has undergone changes, with the traditional thatched roof being replaced by either fired clay tiles, corrugated iron, or cement fiber roofing due to the short lifespan of thatched roofs and leakage issues during heavy rainfall as shown in Fig. 3 and Fig. 4.

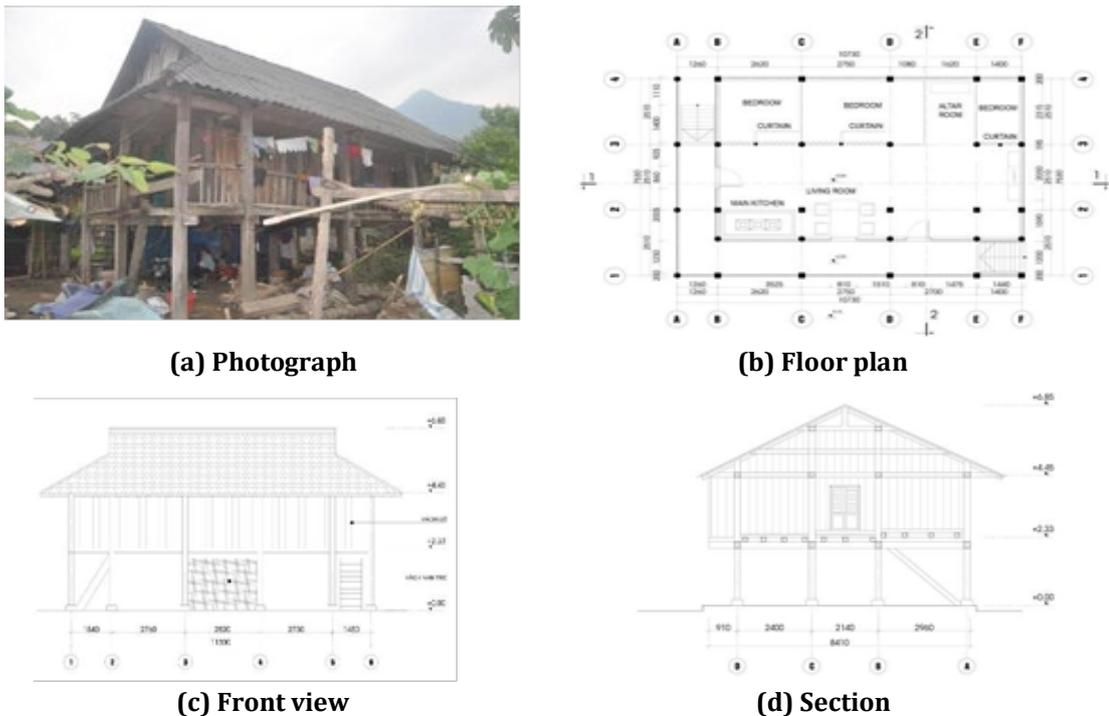


Fig. 3 Traditional housing of the White Thai people in Vang Pheo village, Lai Chau province (with cement fibre roofing)

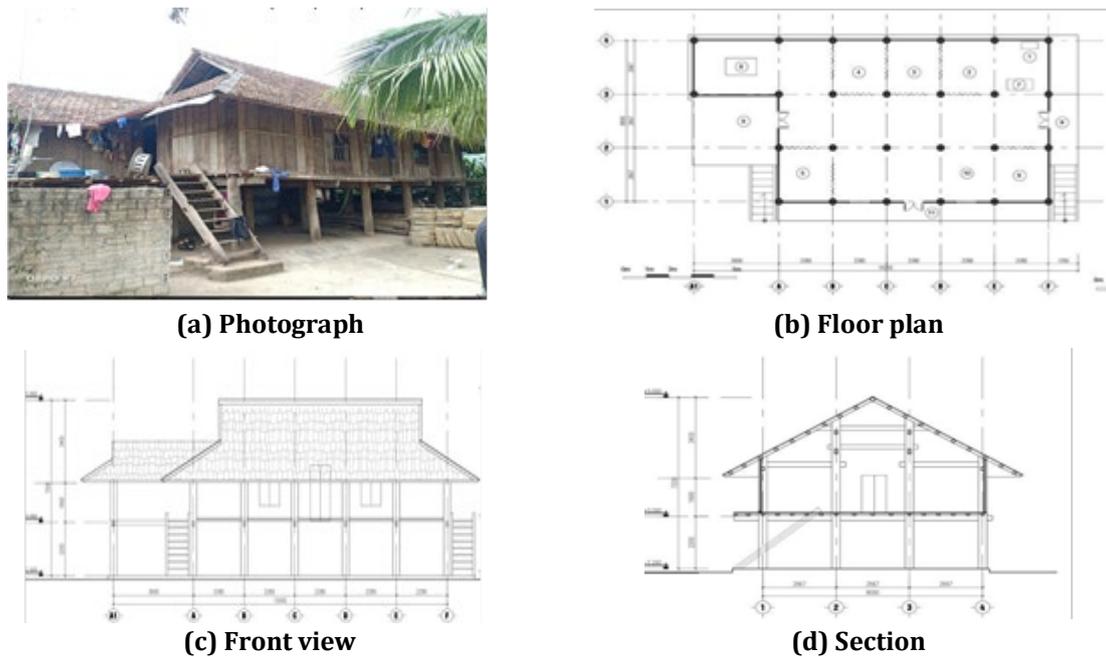


Fig. 4 Traditional housing of the Black Thai people in Men village, Dien Bien province (with fired clay tile roofing)

4.2 The Current Status of Traditional Housing of the Thai Ethnic Group in the Northwestern Region

Currently, the Vietnamese government's policies to improve housing conditions for ethnic minorities, along with the rural development policies, are helping to reduce the economic, cultural, and social gaps between mountainous and lowland areas, thus giving a new face to the housing architecture of ethnic minorities [41, 42]. Additionally, the migration process for economic development, from lowland to mountainous areas and among different ethnic groups, has led to the mixing of ethnic groups, resulting in a diverse cultural transformation in the Northwestern region of Vietnam. These impacts have caused significant changes in the economic, cultural, and social environment of ethnic minorities in this region [43, 44]. As a result, there has been a transformation in the housing morphology of these ethnic groups, including the Thai people in the Northwestern region of Vietnam.

According to the statistics of the General Statistics Office in cooperation with the Ethnic Minorities Committee, as of 2019 (the most recent statistics), 26.2% of households still live in traditional houses of their ethnic group, a decrease of 3.1 percentage points compared to 2015 (29.3%) [45]. According to the findings of the research project on developing a system of criteria to evaluate and rank the traditional housing architecture of ethnic minorities in the Northern Mountainous region, by 2023, traditional houses in this region only accounted for 20.2% of the total number of houses [46]. According to the survey results of our research team conducted in 2024 and early 2025 across 06 Thai villages in the Northwestern region of Vietnam, the percentage of traditional houses here was only 15.2% of the total housing stock as shown in Table 1 and Fig. 5. Although these are different statistical results, they indicate that the number of traditional houses of ethnic minorities, including the Thai people, is gradually decreasing.

Table 1 Number of traditional houses and total number of houses in 06 Thai villages in the Northwestern region of Vietnam

No	Village name	Location (Province)	Number of traditional houses	Total houses in the village	Percentage of traditional houses out of the total (%)
1	Ngoang	Lao Cai	25	96	26
2	Men	Dien Bien	34	110	31
3	Vang Pheo	Lai Chau	24	82	29
4	Van	Hoa Binh	12	97	12
5	Ang	Son La	15	335	4
6	Ban Mo	Dien Bien	11	73	15

NOTES:
 - Ngoang Village (Lao Cai): 25 traditional houses / 96 total houses
 - Men Village (Dien Bien): 34 traditional houses / 110 total houses
 - Vang Pheo Village (Lai Chau): 24 traditional houses / 82 total houses
 - Van Village (Hoa Binh): 12 traditional houses / 97 total houses
 - Ang Village (Son La): 15 traditional houses / 335 total houses
 - Mo Village (Dien Bien): 11 traditional houses / 73 total houses



Fig. 5 Number of traditional houses and total number of houses in 06 Thai villages in the Northwestern region of Vietnam

The decline in the number of traditional houses among ethnic minorities, including the Thai people, in the Northwestern region of Vietnam is a worrying phenomenon, reflecting the erosion of cultural values tied to ethnic identity. The main causes of this decline, synthesized from our practical research and theoretical literature in the field of traditional housing conservation, are as follows:

- *Impact of urbanization and modernization:* The expansion of infrastructure, transportation, and utility networks has changed people's perceptions of lifestyle and housing. Modern housing types built with new materials such as concrete, brick, and corrugated iron are seen as more convenient and a symbol of development. As a result, many traditional houses have been demolished to make way for modern housing types [47]. The relocation of villages to create new residential areas for industrial and transportation infrastructure projects has also contributed to the loss of traditional houses.

- *Changes in lifestyle and needs:* Modern lifestyles, with the demand for privacy, changes in family structure (nuclear families replacing extended families), and modern conveniences (private bathrooms, modern equipment), have made traditional houses less suitable [48]. Consequently, the indiscriminate expansion of stilt houses and even their demolition to make room for modern housing has become increasingly common [49].

- *Pressure from repair and restoration costs:* The availability of traditional materials such as wood and other natural resources has become scarce due to over-exploitation in previous years and the current forest protection policies of the government. Therefore, the cost of sourcing and processing these materials for the repair and restoration of traditional stilt houses has increased, making it more difficult to preserve these houses [50].

- *Impact of natural disasters and climate change:* Traditional houses, primarily made of wood, bamboo, and rattan, are well-suited to the natural conditions of the past but are highly vulnerable to extreme weather phenomena exacerbated by climate change. As a result, many traditional houses have been severely damaged and are difficult to maintain, forcing people to build new houses with concrete, brick, and corrugated iron.

- *Impact of tourism:* Tourism has become an important economic sector in the Northwestern region of Vietnam, providing many development opportunities for ethnic minority communities, including the Thai people. Although tourism can create economic benefits and increase cultural awareness, unsustainable tourism development leads to the renovation and alteration of traditional housing to meet commercial needs, which undermines their authenticity and cultural value. In some cases, the construction of modern tourist accommodation facilities has led to the demolition of traditional houses to make room for new buildings, reducing the number of traditional houses [51]. The main causes leading to the reduction in the number of traditional houses are summarized in Table 2.

Table 2 Main causes leading to the reduction in the number of traditional houses

No	Group of causes	Description of the impact
1	Urbanization and modernization	Infrastructure expansion, formation of new residential areas, and changes in traditional housing models
2	Changes in lifestyle and needs	Modern lifestyle and the demand for modern conveniences lead to changes in living space and housing form

3	Repair and restoration costs	High repair and restoration costs, scarcity of traditional materials, making it difficult to maintain traditional housing
4	Natural disasters and climate change	Traditional housing damaged by storms, floods, landslides, and extreme weather conditions
5	Impact of tourism	Unsustainable tourism development leading to the renovation of traditional housing in a commercialized direction, even resulting in the demolition of traditional houses

4.3 Community Awareness and the Need for Renovation of Traditional Housing of the Thai Ethnic Group

Community interviews play an important role in clarifying the relationship between traditional living spaces and contemporary living needs, thus contributing to guiding renovation solutions that align with the aspirations of local residents – a core principle emphasized in many studies on architectural heritage conservation with community participation (Feilden, 2003; UNESCO, 2013) [52, 53]. The information collected from community interviews provides a realistic and multifaceted view of the value that people attach to traditional stilt houses, as well as their expectations during the renovation process, seeking a balance between modernization and sustainability (Plevoets & Van Cleempoel, 2011; Nguyen, 2015) [54, 12].

To further clarify the community's perspective, we conducted an in-depth interview with a total of 253 residents, primarily representing families living in traditional houses, using structured questionnaires. Additionally, semi-structured interviews were held with 06 village chiefs and several elderly individuals. The interviews were carried out from 2024 to early 2025 across 06 Thai villages in the Northwestern region of Vietnam (Ngoang village, Tham Duong commune, Van Ban district, Lao Cai province; Vang Pheo village, Muong So commune, Phong Tho district, Lai Chau province; Men village, Thanh Nua commune, Dien Bien district, Dien Bien province; Mo village, Thanh Truong ward, Dien Bien Phu city, Dien Bien province; Van village, Van Nghia commune, Mai Chau district, Hoa Binh province; Ang village, Dong Sang commune, Moc Chau town, Son La province). The aim of this interview was to gather detailed information on their perceptions of the value of traditional housing, as well as their desires and needs for renovating existing homes in a sustainable manner. The results of these interviews are presented in detail in Table 3.

Table 3 Results of community interviews on the preservation and renovation of traditional housing

No	Issues surveyed	Percentage of "Agreement"
1. Architectural Value of Traditional Housing		
1.1	Cultural value	86.95%
1.2	Historical value	77.07%
1.3	Aesthetic value	70.35%
1.4	Construction technique	61.26%
2. Preservation of Traditional Housing		
2.1	Very important	73.91%
2.2	Important	21.34%
2.3	Less important	4.74%
2.4	Not important	0%
3. Priority Goals for Renovating Traditional Housing		
3.1	Preserve cultural and original architectural values	65.21%
3.2	Suit modern living conditions	81.81%
3.3	Increase sustainability and resilience to climate change	62.05%
3.4	Incorporate business/tourism services	47.94%
4. Factors Needing Improvement in Traditional Stilt House Architecture		
4.1	Increase living space	65.61%
4.2	Improve heat/cold insulation	79.44%

4.3	Increase material durability	59.28%
4.4	Improve water and sanitation systems	82.21%
5. Desire to Integrate Modern and Sustainable Elements		
5.1	Renewable energy systems	56.91%
5.2	Smart technology	41.50%
5.3	Modern living conveniences	81.81%
6. Renovation Costs		
6.1	Appropriate	30.14%
6.2	A bit high but acceptable	47.95%
6.3	Too high, difficult to implement	21.92%
7. Desire for Support		
7.1	Financial support for construction	68.49%
7.2	Technical and design consultation	57.53%
7.3	Support for building materials	72.60%
7.4	Technical training	52.05%

Based on the results of the community interviews, the following observations can be made:

- *High appreciation for traditional values:* The community shows a deep awareness of the cultural and historical values of traditional stilt houses, with 86.95% and 77.07% of respondents highly valuing these aspects. This indicates that traditional housing is not only seen as a living space but also as an integral part of the cultural identity and heritage of the community. In addition, the aesthetic and construction techniques of traditional stilt houses are also highly valued by the community (70.35% and 61.26%, respectively). This demonstrates that people appreciate not only the cultural and historical aspects but also the beauty and craftsmanship involved in building these houses.

- *Strong desire for preservation:* The majority of respondents (73.91%) expressed that preserving traditional stilt houses is "very important". This shows the community's deep interest and high sense of responsibility towards maintaining and promoting their cultural heritage.

- *Priorities for improvement:* When asked about the aspects that need improvement in traditional stilt house architecture, the community focused on aspects related to comfort and convenience in daily life. The top priorities included water and sanitation systems (82.21%), heat/cold insulation (79.44%), and increasing living space (65.61%). Additionally, improving the durability of building materials (59.28%) was also considered an important factor for improvement. This shows that the community is not only concerned with improving living quality but also with developing the economy and tourism based on traditional cultural values.

- *Integration of modern and sustainable elements:* Besides preserving traditional values, the community also desires the integration of modern and sustainable elements into their housing. The modern elements prioritized include living conveniences (83.56%), renewable energy systems (58.90%), and smart home technology (41.10%). Additionally, the priority goals for renovating traditional housing include making it "suitable for modern living conditions" (83.56%) and "increasing sustainability and resilience to climate change" (63.01%). This reflects the growing awareness of environmental issues and the desire for homes that are not only comfortable but also environmentally friendly and adaptable to the challenges posed by climate change.

- *Cost obstacles:* Renovation costs are seen as an obstacle for some people. Nearly half of the respondents (47.95%) stated that renovation costs are "a bit high but acceptable". This shows that renovating traditional housing could create a financial burden for many people. More than one-fifth of respondents (21.92%) considered the costs to be "too high, difficult to implement". This represents a significant barrier to renovating traditional homes, especially for low-income individuals.

- *Desire for support:* The community expressed a strong desire for support from local authorities and relevant organizations in several areas, including financial support for construction (68.49%), technical and design advice (57.53%), building material support (72.60%), and technical training (52.05%). This highlights the importance of comprehensive community-based support programs to ensure the success of heritage preservation and sustainable development efforts.

The results of the community interviews show that people are fully aware of the cultural and historical value of traditional housing. They desire to preserve and renovate their homes to meet modern living conditions while also increasing sustainability and resilience to climate change. However, renovation costs represent a major

obstacle, especially for low-income households. To encourage the preservation and sustainable development of traditional housing, financial support from local authorities and relevant organizations is necessary. Additionally, technical support, design guidance, and training programs are essential to ensure the success of these efforts.

4.4 Direction for the Sustainable Renovation of Traditional Thai Housing

Based on the analysis of the main causes leading to the decline in the number of traditional houses of the Thai ethnic group in the Northwestern region of Vietnam, along with the results of the community survey, the study has established several directions for the sustainable renovation of traditional housing architecture:

- *Preserving traditional house structures and architectural forms*
 - Retain the stilt house form and the characteristic four-pitched roof.
 - Maintain the traditional spatial organization, such as the ancestor worship space, kitchen, living area, and sleeping quarters.
 - Limit interventions to the main structural framework, such as the wooden columns and roof trusses.
 - Preserve and restore traditional carvings and decorative patterns that reflect the cultural identity of the Thai people.
- *Enhancing amenities and functionally to meet modern needs*
 - Reorganize the interior spaces to meet modern living requirements, ensuring comfort and convenience for the occupants.
 - Improve ventilation and natural lighting conditions to create a cool and fresh living environment.
 - Renovate or build new sanitation systems, kitchens, and common areas to align with current living conditions.
- *Improving Materials and Construction Techniques*
 - Use traditional materials combined with new sustainable materials, such as engineered wood and fire-resistant materials.
 - Employ traditional handcraft techniques in combination with small-scale construction equipment.
 - Prioritize the use of locally available materials or locally produced items, such as fired bricks, to reduce costs and carbon emissions.
- *Responding to Natural Disasters and Climate Change*
 - Strengthen the structural integrity of the houses to improve resilience to natural disasters such as heavy rainfall and storms.
 - Select materials that are durable in adverse weather conditions and resistant to pests and mold.
 - Design houses that can adapt to climate changes, such as incorporating drainage systems to prevent flooding and soil erosion, and enhancing the planting of trees around the house for shading and erosion control.
- *Economic and Social Development*
 - Renovate houses to accommodate community-based tourism activities, creating a stable income source for local residents.
 - Create communal living spaces within the homes or in surrounding areas to foster stronger ties between family members and the broader community.
 - Preserve and promote traditional crafts to create artisanal products, contributing to the preservation of traditional occupations while generating income.
- *Ensuring Environmental Sustainability*
 - Prioritize the use of renewable local materials, reuse old materials, and limit the use of industrial materials that contribute to pollution.
 - Design homes to maximize the use of natural light and wind, promoting energy savings.
 - Diversify the types of plants grown in household gardens to maintain ecosystem balance.
 - Design rainwater harvesting systems for household use and irrigation, along with simple on-site wastewater treatment systems.
 - Install small-scale solar energy systems to provide basic electricity to households

4.5 Case Study in Vang Pheo Village

Vang Pheo village, located in Muong So commune, Phong Tho district, Lai Chau province, is an ancient village of the White Thai people and serves as a typical Thai village in the Northwestern region of Vietnam. The village is situated in a unique geographical location, where two streams, Nham So and Nham Tun, converge and is surrounded by high mountains. The houses in the village are primarily traditional stilt houses, with 24 stilt houses preserving their original structure, accounting for 29% of the total number of houses in the village as shown in Fig. 6. The traditional culture in the village is relatively well-preserved, and the tourism and service activities in the village are well-developed, attracting a large number of tourists.

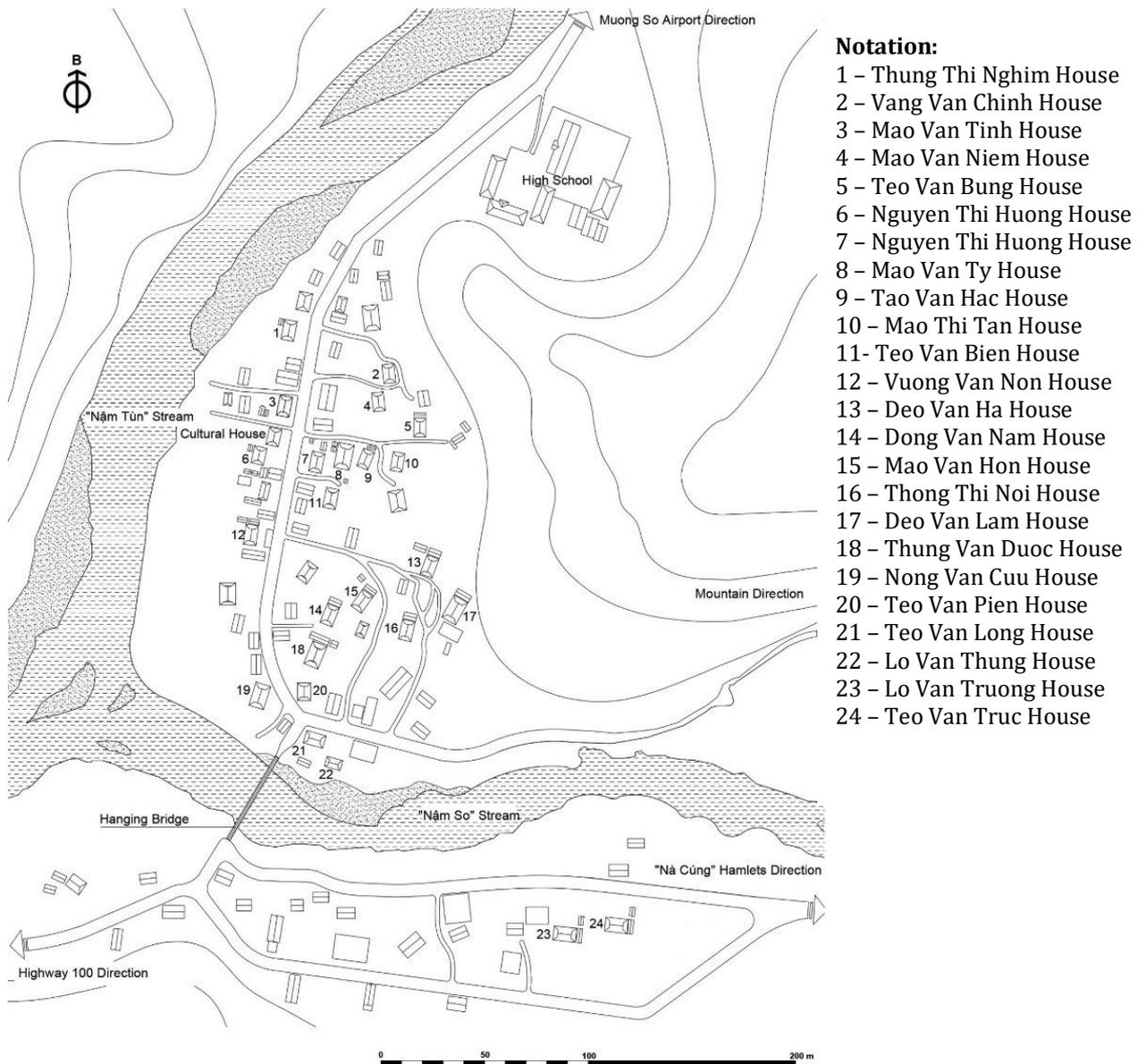


Fig. 6 Overall plan of Vang Pheo village with the location of traditional houses [28]

Based on the proposed renovation directions and the results of community interviews, the study proceeded to develop renovation plans for three traditional houses in Vang Pheo village, including: the house of Mr. Mao Van Hon (No. 15 on the village map), the house of Mrs. Nguyen Thi Huong (No. 7), and the house of Mr. Vuong Van Non (No. 12). All three houses are traditional stilt houses built more than 50 years ago, still retaining the basic architectural form, except for the replacement of the thatched roof with fired clay tiles or cement fibre roofing. These houses are all built along the road, but only Mr. Vuong Van Non's house, in addition to the main traditional house, has two new houses for his children. Mr. Mao Van Hon's house has an additional annex next to the road, and Mrs. Nguyen Thi Huong's family has only one residential house. The household heads of these three houses all expressed a desire to renovate their homes sustainably; however, economic conditions are still limited—especially for the households of Mr. Mao Van Hon and Mrs. Nguyen Thi Huong, who are classified as poor households—so they hope to receive financial support, materials, and technical advice during the renovation process.

The renovation options are based on the sustainable approach to renovating traditional residential architecture proposed in Fig. 7 until Fig. 9. However, Mr. Vuong Van Non's house, with the largest usable area of the main house being converted into a homestay, has the most space since his children have their own houses. Mr. Mao Van Hon's house has been partly renovated into a homestay, while the annex has been converted into a souvenir shop selling local products. Mrs. Nguyen Thi Huong's house has been renovated to use part of it as a homestay.

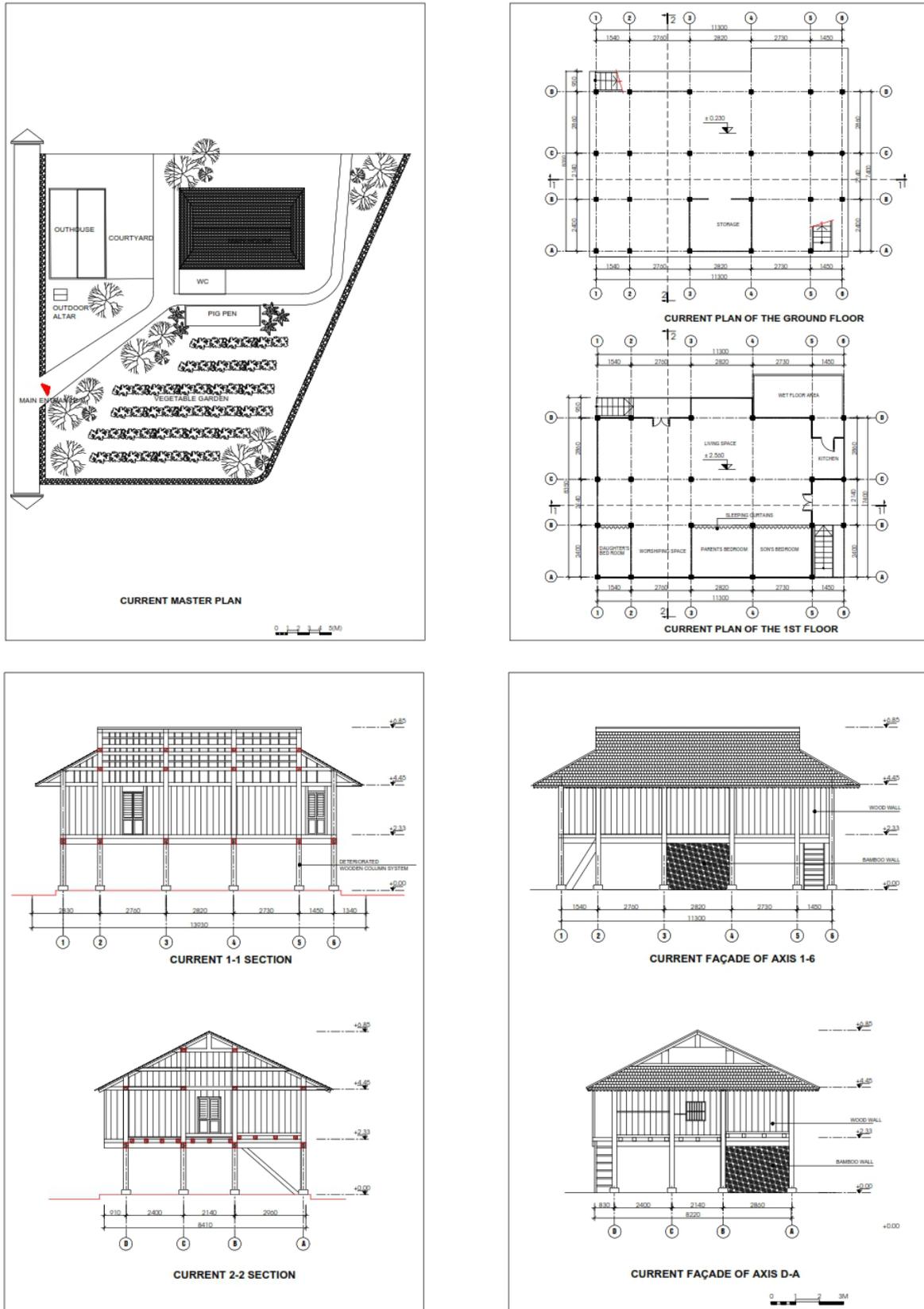


Fig. 7a Current condition of Mr. Mao Van Hon's house

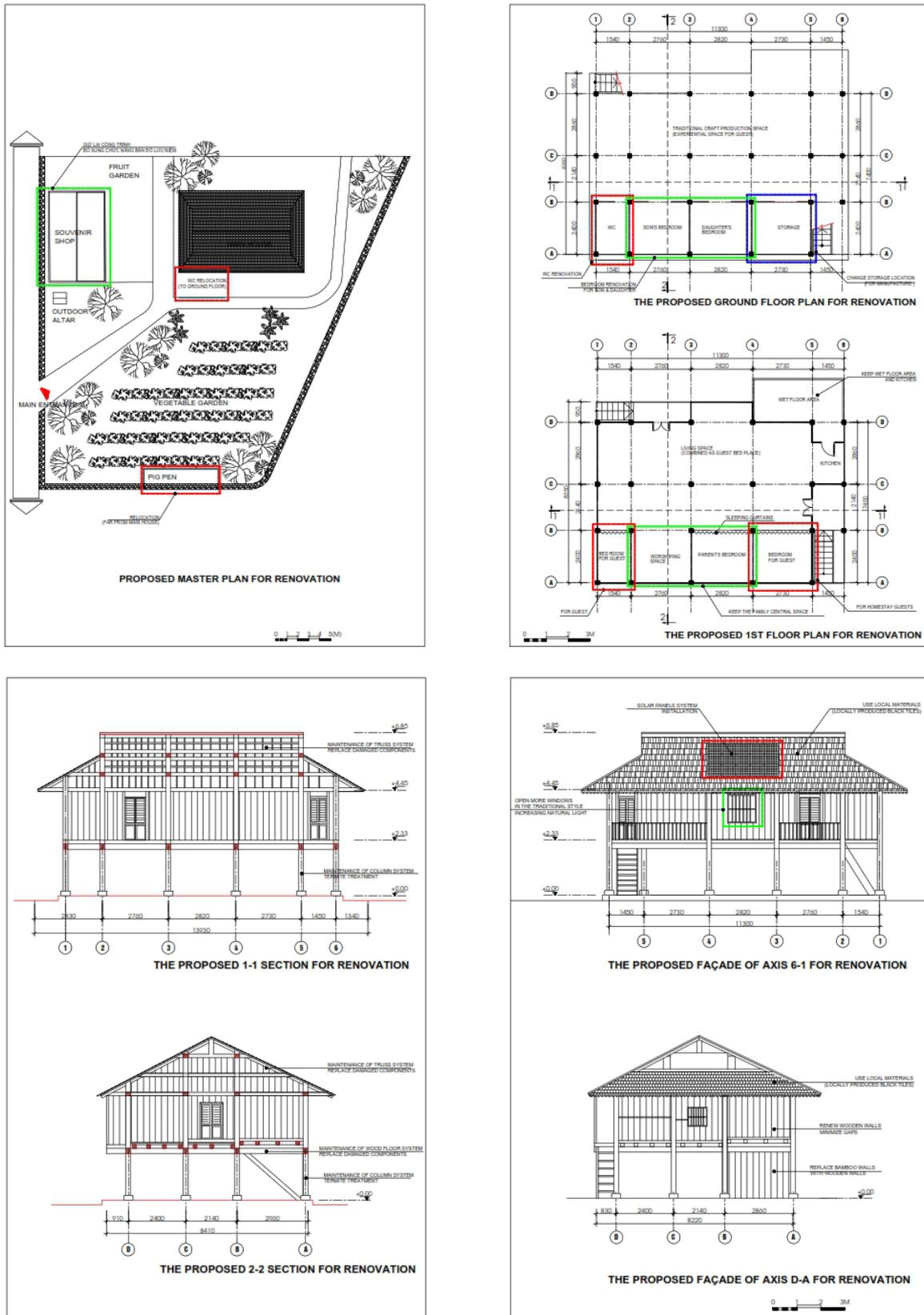


Fig. 7b Proposal for the renovation of Mr. Mao Van Hon's house

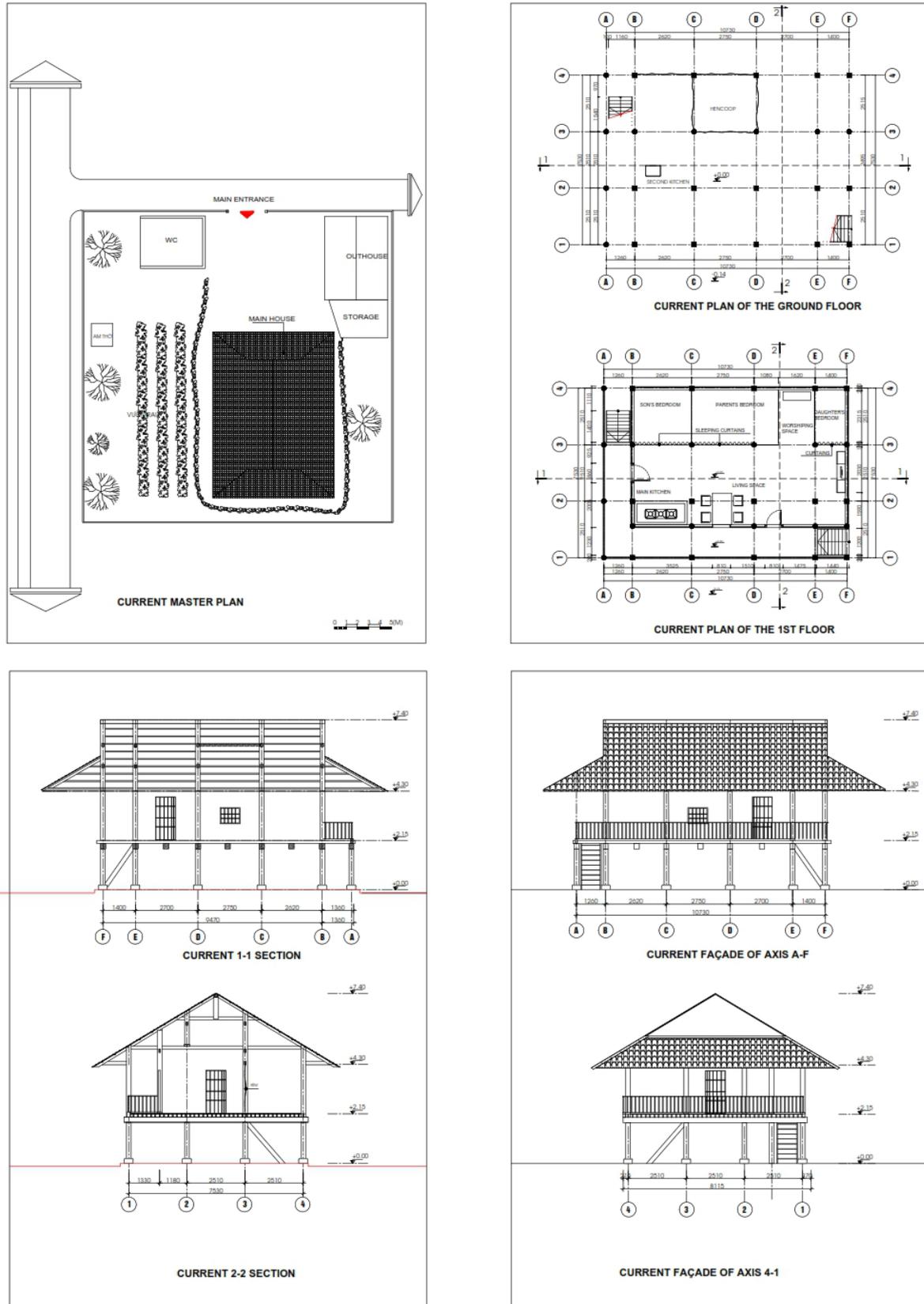


Fig. 8a Current condition of Mrs. Nguyen Thi Huong's house

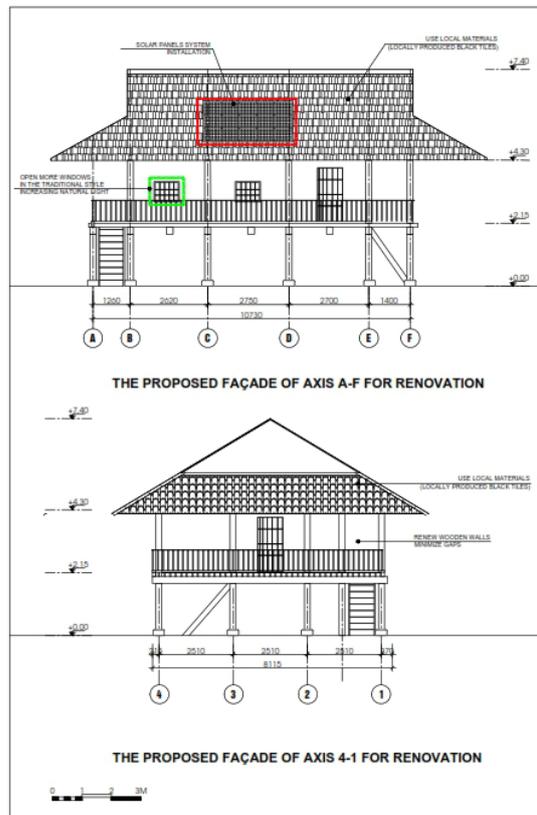
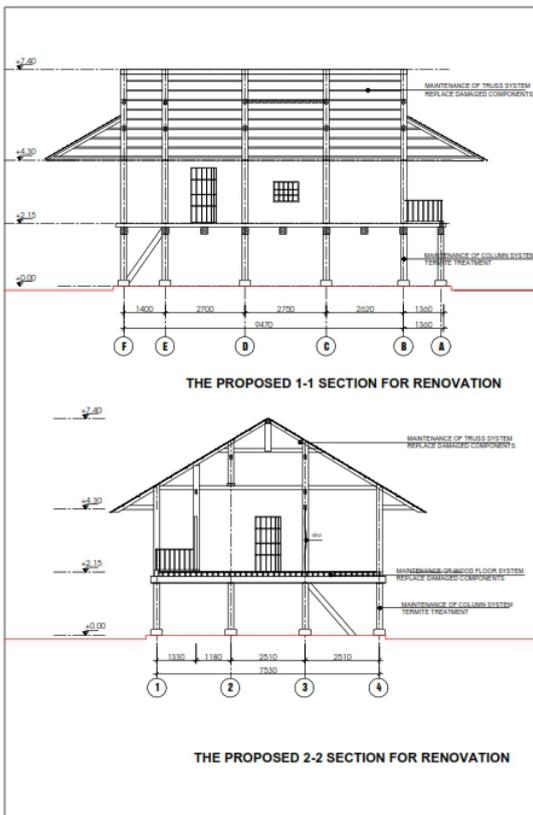
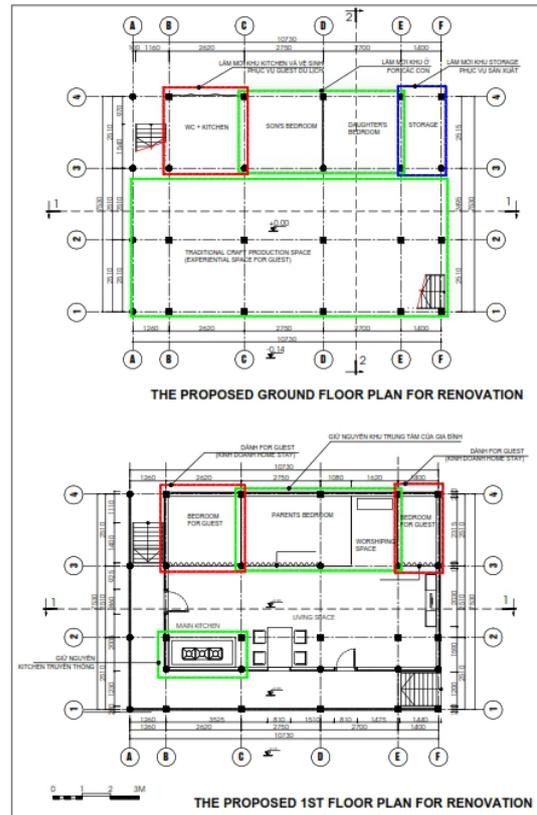
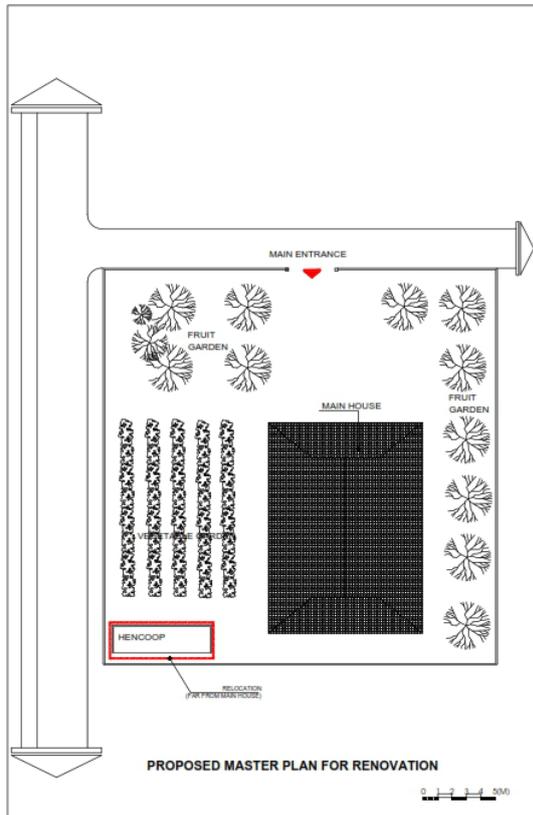


Fig. 8b Proposal for the renovation of Mrs. Nguyen Thi Huong's house

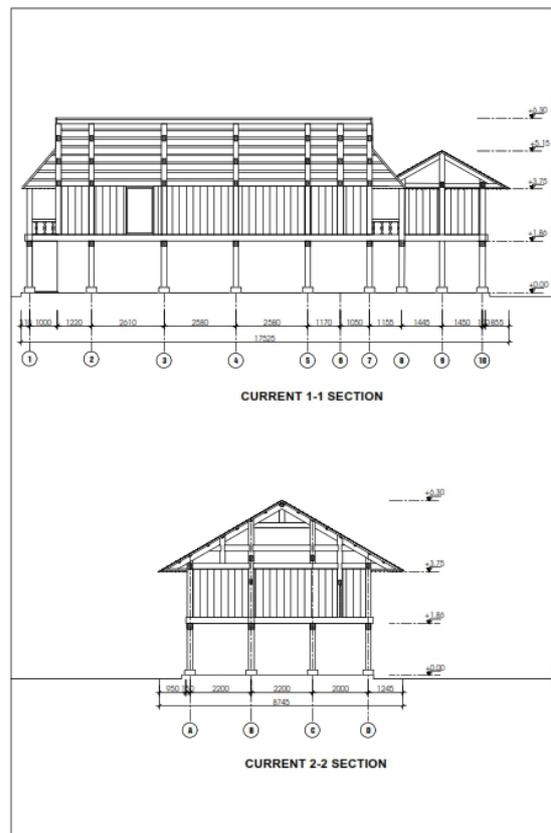
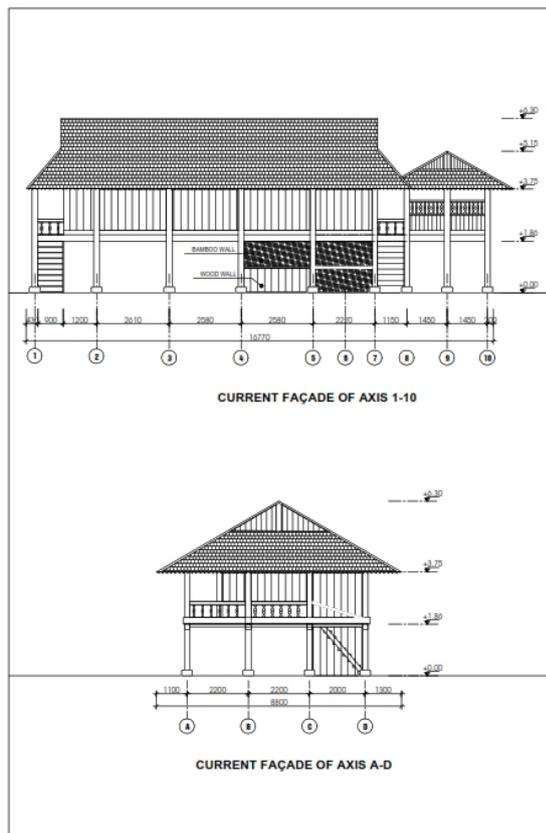
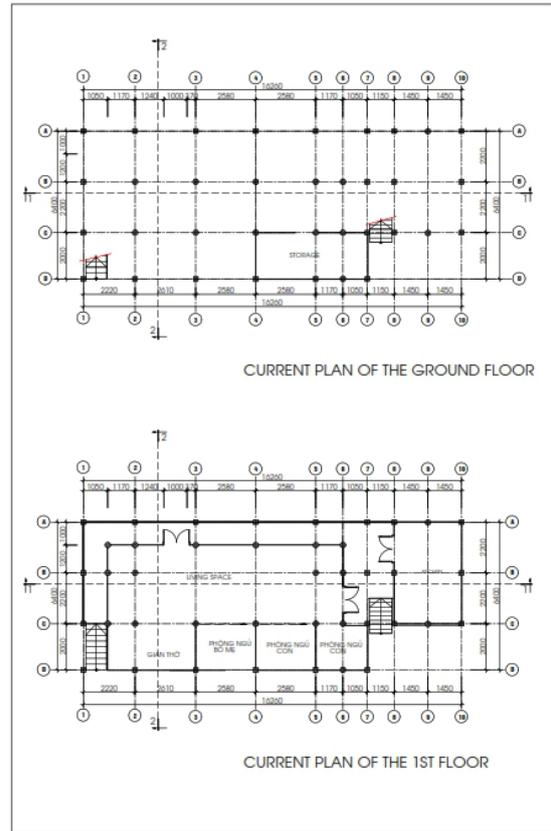
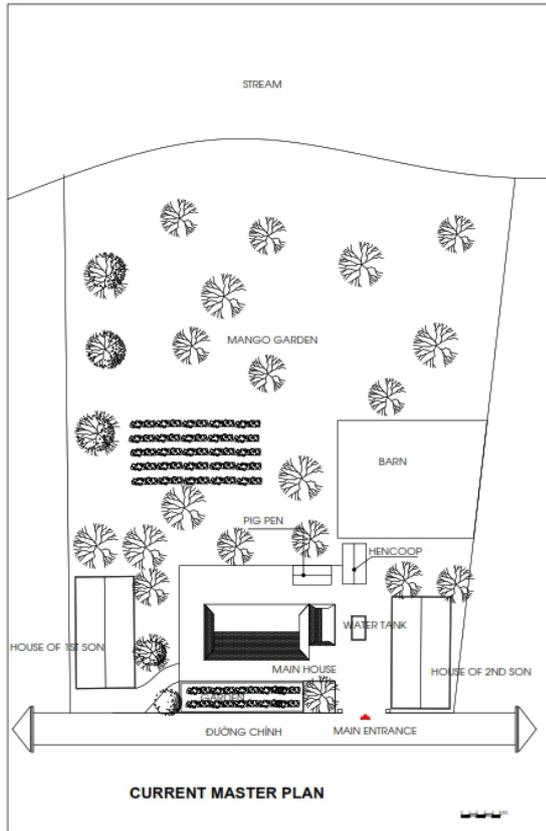


Fig. 9a Current condition of Mr. Vuong Van Non's house

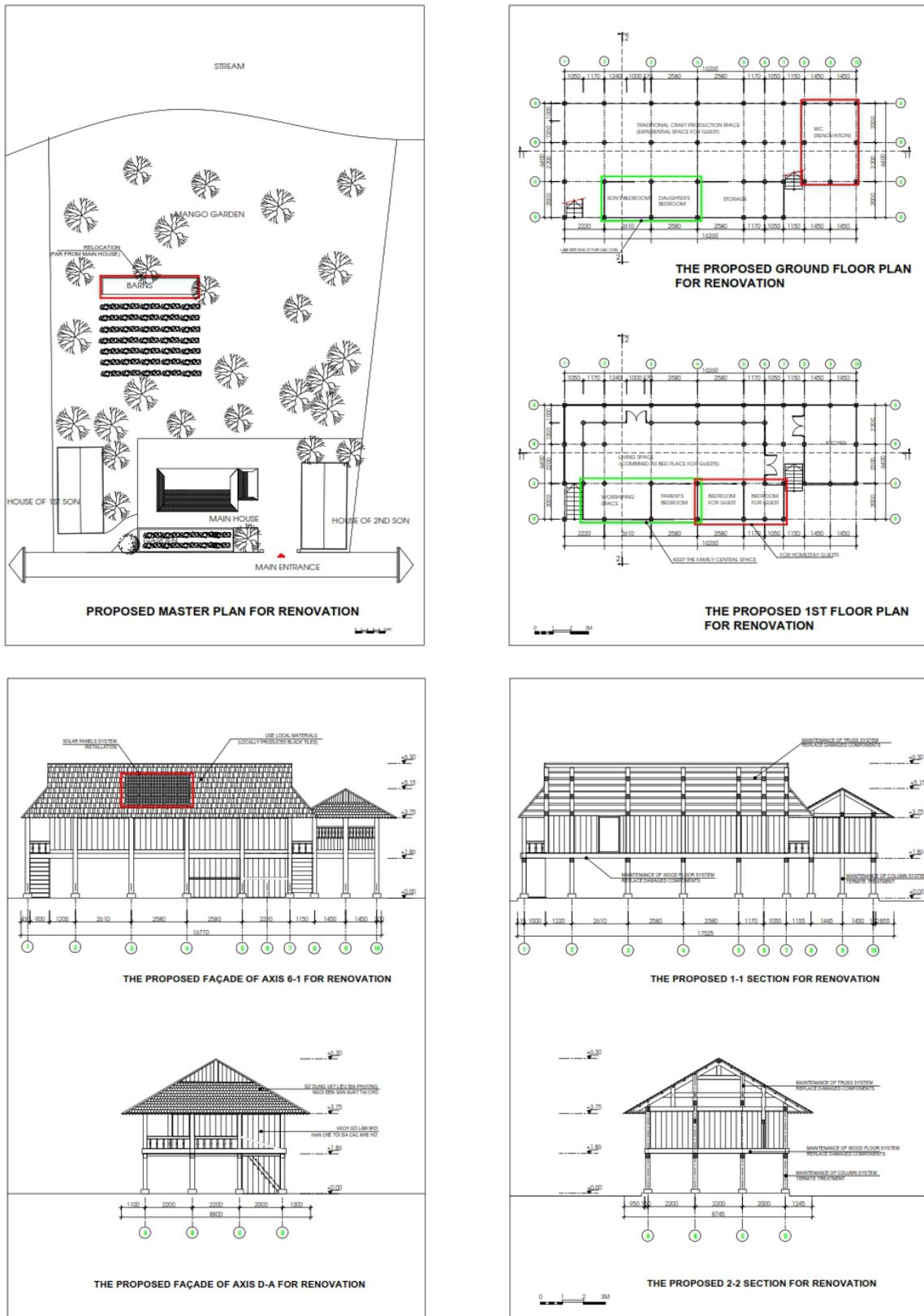


Fig. 9b Proposal for the renovation of Mr. Vuong Van Non's house

5. Discussion

The research results show that traditional housing of the Thai people is not just a simple living space, but also a cultural entity that carries historical values, ethnic identity, and a close relationship with the natural environment. However, under the pressures of modern life and the increasingly changing socio-economic conditions, the traditional stilt house model is facing the risk of disappearing without proper renovation interventions.

The survey and analysis of the community's needs show that while people still have an awareness of preserving traditional houses, they also wish to improve living conditions such as water systems, heat/cold insulation, and sanitation facilities. This underscores the urgency of adaptive renovation - preserving the core elements of traditional architecture while integrating technological, material, and spatial solutions that meet contemporary needs.

In comparison with international experiences (Plevoets & Van Cleempoel, 2011; Bullen & Love, 2011), successful sustainable renovation models often have three key factors: (1) meaningful community participation, (2) flexible application of new technologies and materials, and (3) support policies from the government or development organizations [55, 56]. In the context of Vietnam, especially for ethnic minorities such as the Thai people, these three factors have not yet been systematically integrated. While the restoration of stilt houses for tourism creates short-term economic value, it often leads to commercialization, diminishing cultural value if there is no active involvement of the local population (Nguyen & Nguyen, 2020) [57].

The renovation plans for the three specific houses in Vang Pheo village, based on field surveys and the householders' wish, demonstrate the feasibility of a sustainable traditional housing renovation model at a low cost, while ensuring the preservation of cultural and ecological values. However, scaling up this model requires coordinated involvement from local authorities, design experts, and the resident community, with technical consultation and financial policy support being prerequisites. However, for this model to be effectively and sustainably scaled, a multi-layered strategy needs to be developed, including:

- Technical – Design Strategy: Develop a set of renovation design criteria that can be adapted to local conditions while adhering to the framework of traditional architectural identity.
- Financial Strategy: Explore mechanisms for micro-financing, green credit, or rural development programs with conservation components to enable large-scale renovation implementation.
- Training – Communication Strategy: Organize workshops for local craftsmen on sustainable renovation techniques and raise community awareness about the value of traditional spaces.
- Institutionalization Strategy: Propose policies that support the renovation of traditional houses in conjunction with community tourism planning and heritage conservation at the local level.

The potential for scaling the model is not limited to the Vang Pheo village but can be applied to Thai communities in the Northwest region with appropriate contextual adjustments. To achieve this, it is essential to develop an evaluation framework for the renovation model, including criteria on energy efficiency, cultural preservation, community satisfaction, and scalability.

Finally, this study also suggests that the renovation of traditional housing should not only be approached as static preservation but should adopt a "regenerative heritage" mindset - a new approach used by many countries to create living spaces that adapt to the present while still maintaining strong ties to cultural roots [58].

6. Conclusion

The study has clarified the distinctive cultural, technical, and ecological values of the traditional housing architecture of the Thai ethnic group in the Northwestern region of Vietnam, while also identifying the challenges faced in preserving this architectural style in the modern context. Through field surveys and community interviews, the research shows that people still desire to preserve traditional housing, but face many difficulties related to economic, technical, and informational constraints when undertaking renovations.

The proposed sustainable renovation principles and specific renovation plans for three traditional houses in Vang Pheo village serve as proof of the feasibility of an adaptive renovation approach, integrating the preservation of traditional values with the requirements of modern living. This model could become a significant practical foundation for replication in other ethnic minority communities in the region.

7. Recommendations

To effectively preserve and sustainably renovate traditional Thai housing in the Northwestern region of Vietnam, a multi-dimensional approach is essential. At the policy level, local and central governments should develop and implement targeted policies that provide financial assistance, access to sustainable building materials, and technical support to households undertaking renovation projects. Such policies would not only alleviate the economic burden faced by low-income families but also encourage broader community participation in preserving cultural heritage. At the community level, it is vital to enhance the involvement of local residents in all stages of the preservation and renovation process. This participatory approach ensures cultural ownership and aligns

renovation efforts with the real needs and values of the people. The role of experts is also crucial; architectural and conservation professionals should be actively engaged to offer design consultations that strike a balance between traditional architectural integrity and modern living standards.

For future research, the development of a "living lab" model is recommended, where communities can co-design, test, and evaluate renovation solutions in real-time. This participatory research approach would generate valuable data for shaping future policies and help ensure that renovation efforts are both culturally respectful and practically applicable across ethnic minority regions.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Author Bao Tran Quoc, Author Thuan Le Tien; **data collection:** Author Thuan Le Tien; **analysis and interpretation of results:** Author Bao Tran Quoc, Author Thuan Le Tien, Author Long Dang Viet, Author Anh Dao Quynh; **draft manuscript preparation:** Author Thuan Le Tien, Author Bao Tran Quoc. All authors reviewed the results and approved the final version of the manuscript.*

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