Study on the Application of Vernacular Design to High-rise Apartment Planning in Vietnam

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(Received Nov. 01, 2013; Accepted Dec. 11, 2013)

ABSTRACT

This study proposes a prototype for high-rise apartments suitable for Vietnam, based on their vernacular dwelling. Vernacular design in this region reflects the unique characteristics and environmental system of traditional Vietnamese architecture. Through the research of vernacular design, specific design methods that can be used in designing high-rise apartments have been derived. Based on the derived methods, a natural ventilation system for high-rise apartments was developed and proposed in this research. In addition, culture and the spatial characteristics of the ‘tube house’ were studied and reflected in this system, which has been developed into a prototype for high-rise apartments in Vietnam. Through this study, an environmentally friendly and economic prototype was proposed which is expected to build a positive image of apartment houses among Vietnamese and to solve housing problems in the urban areas of Vietnam.

KEYWORDS: High-Rise Apartment, Natural Ventilation, Vernacular Design, Vietnam Housing, Prototype, Tropical Climate

1 Introduction

1.1 Background

Urban population in cities has increased due to rapid urbanization in Vietnam, a developing nation in Southeast Asia. This caused urban problems such as environmental issues and housing shortage which resulted in increasing demands for high-density housings such as apartment buildings. The Vietnamese government established policies to develop housings until 2020 which include ‘New Town Projects’ and ‘New Urban Area Projects’. These plans focus on building apartment housings to supply high-density houses. (KOTRA, 2005) However, apartments have not yet become a selectable housing type to the public in Vietnam cities. This is because apartment housings in Vietnam have lacked consideration of local climate conditions and housing cultures. Also, apartments in...
Vietnam were mostly constructed as luxurious houses. As oversea companies invest in apartment constructions in Vietnam, economic efficiency took priority over the application of locality in apartment designs. This phenomenon not only fails to ensure a comfortable living environment, but also causes inconvenience for residents.

In order to settle a new housing type in the region successfully, it is necessary to properly set a balance between the value of developing a new housing type and the value of reflecting traditional housing culture. Search for such solutions can start from research in vernacular architecture. Vernacular design indicates optimal designs which have been built through the process of adapting to socio-cultural and natural environments. In other words, traditional architecture is an aggregate of environment control methods and spatial characteristics of housing cultures. This is a great significance to the modern world which pursues a sustainable society. In this study, new types of apartment have been developed through research of the vernacular architecture in Vietnam and by considering locality and sustainability.

1.2 Methods

An apartment prototype has been presented in this study through research of vernacular architecture in Vietnam. Two main methods were used in this study. First, climate characteristics and cases of vernacular architecture in Vietnam were examined. Based on this process, climate control design methods were derived. Relationship between housing culture and space configuration were also examined. Local residents in Vietnam housing projects were interviewed for this matter. Study of housing culture was focused on the 'tube house' as it is a representative housing type in the cities of Vietnam for over a century. The 'tube house' has become the most generic housing type in Vietnam because it has constantly adapted to the influences from social, economical, and political matters. Also, a high proportion of people in Vietnamese cities live in these houses which represent housing cultures of Vietnam.

As a result, 2 prototypes of apartment houses were developed: the flat-type and the courtyard type. Building plans and unit plans of these prototypes are presented in this paper.

2 Vernacular designs in Vietnam

2.1 What is the Vernacular design?

Vernacular architecture is a built environment that is a result of human adaptation to external environment and expression of cultural characteristics. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and ways of living of the cultures that produce them. (Oliver, 1997). Therefore studying vernacular architecture of a certain region can give insights on the region’s culture and also specific ideas of ways to adapt to their environmental contexts.

There are two types of elements that give influence to the shape of vernacular architecture; Physical and Social elements. Physical elements are environmental factors such as climate and resources. Social elements are social and cultural factors such as economy and religion. In this research, we focused on the physical elements to discover how houses in Vietnam have developed in order to construct a pleasant residential environment.

2.2 Climate in Vietnam

Located in the heart of Southeast Asia between 8.30° and 23.22° N, Vietnam is located in the tropical and temperate climate zone. Due to the influence of strong monsoon, many days are sunny while
precipitation and humidity appear high. The average annual temperature of Hanoi is 23.2°C with the average temperature is 29.2°C in the summer and 17.2°C in the winter. In houses located in Hanoi and Ho Chi Minh City, demands for air conditioning are very high and heating is required only during 20% of the year. Air ventilation in Hanoi and Ho Chi Minh City is very important, as high humidity can cause corrosion and fungal decay. (Na, 2011)

![Avg. Precipitation and Humidity](image)

![Avg. Temperature per month](image)

**Fig. 1 Climate in Vietnam**  
(Climate data from http://www.gaisma.com)

### 2.3 Vernacular designs in Vietnam

In hot and humid climates, such as Vietnam, heat storage and maximizing natural ventilation is a critical issue when designing houses. Natural ventilation in vernacular architecture was considered in three aspects; material, shape, and orientation. Materials of vernacular houses in Vietnam have low heat capacity which minimizes heat storage. Also, houses are shaped and designed in order to promote natural ventilation. Design methods of the vernacular architecture in Vietnam were studied and categorized as shown in Table 1.

As seen in Table 1, improving ventilation was a critical matter when designing traditional houses. This is a common matter in hot and humid regions. These design elements were considered and applied in the developed prototypes. Contrary to contemporary Vietnamese houses, orientation was also considered relevant to natural ventilation in the past. While orientation is overlooked these days, most of the houses in the past faced south.

### Table 1  Design Methods of the Vernacular Architecture in Vietnam

<table>
<thead>
<tr>
<th>Element</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Ventilation</td>
<td>Cross Ventilation</td>
</tr>
<tr>
<td></td>
<td>Stack Effect</td>
</tr>
<tr>
<td>South/Southeast Orientation</td>
<td>Courtyard</td>
</tr>
<tr>
<td>High floor height</td>
<td>Light material wall</td>
</tr>
<tr>
<td>Shading</td>
<td>Balcony</td>
</tr>
<tr>
<td></td>
<td>Light material wall</td>
</tr>
<tr>
<td></td>
<td>Exterior Shading</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Open space (Courtyard) activity</td>
</tr>
<tr>
<td></td>
<td>Long and narrow shape</td>
</tr>
</tbody>
</table>

South-facing orientation is the most basic planning method to adapt to the climate. By maximizing the temperature difference between the rear and the front of the building, south-facing orientation causes natural airflow. As the sun warms the front of the south-facing the building, the back of the building is cool because of the shade. Cool air flows from the back of the house through the front opening of the house. This system allows comfort and ventilation for residents.

![South-facing orientation](image)

**Fig. 2 Traditional Housings of Ethnic groups in Vietnam**
3. Urban Living Patterns in Vietnam

3.1. Tube House

Since the late nineteenth century, ‘Tube house’ became a representative type of housings in the cities of Vietnam. ‘Tube house’ is a term for deep and narrow houses which usually are developed in commercial cities. Tube houses in Vietnam are called ‘Nhà ống’ which are commonly 2~4m wide and 20~60m long. Due to the hot and humid climate in Vietnam, tube houses have courtyards to promote natural ventilation.

![Typical Floor Plan of Tube House](image)

Even today, 75% of Vietnam houses are Tube Houses. (Ha, 2002) However, these tube houses have changed compared to those built in the past. One of the main changes is the courtyard, which had a significant role in promoting natural ventilation. Courtyards were outdoor spaces with stairs that connects to the upper floor. But as air-conditioning became available and old tube houses have vertically expanded, outdoor courtyards were converted into indoor spaces. As a result, tube houses are no longer adaptive to the local climate conditions.

![Spatial Change in Vietnam Tube Houses](image)

3.2. Interviews

Residents in Vietnam were interviewed to gather perspectives about apartment buildings and to examine living environments and housing cultures. Through interviews of local residents, modern lifestyle, living conditions, and preference of housing types were examined. The results were used as references for planning the prototype. Contents of the interviews can be categorized into 5 elements: climate, culture, city, society and economy.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Main Contents of Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element</td>
<td>Content</td>
</tr>
<tr>
<td>Climate</td>
<td>Hot-Humid Climate</td>
</tr>
<tr>
<td></td>
<td>Air-conditioning System is Needed</td>
</tr>
<tr>
<td>Culture</td>
<td>The kitchen is separated from other spaces due to strong smell from cooking</td>
</tr>
<tr>
<td></td>
<td>Fung-shi affects important decision making</td>
</tr>
<tr>
<td></td>
<td>The need of privacy is low and residents have positive relationship with other neighbors</td>
</tr>
<tr>
<td>City</td>
<td>Tube houses are a general housing type</td>
</tr>
<tr>
<td></td>
<td>Preference of Villas are higher than apartment buildings</td>
</tr>
<tr>
<td></td>
<td>Most residents own motorcycles.</td>
</tr>
<tr>
<td>Society</td>
<td>Education facilities affect housing location</td>
</tr>
<tr>
<td>Economy</td>
<td>Prices of apartments are too high for most middle-class residents to afford</td>
</tr>
</tbody>
</table>
4. Developing a Prototype of High-Rise Apartment

4.1 Basic Concept of the Prototype

The basic concept of this prototype is to apply the overall spatial structure of the tube house and to improve housing environment. As confirmed through interviews with local residents, tube house was considered as the most familiar housing type to Vietnamese people and residents are used to this spatial structure. As the prototype considered the long and narrow shape of tube houses, it also achieved air circulation by planning openings on the long side of the house which maximizes ventilation for all rooms (Fig.5). This is more efficient compared to original tube houses which openings were very limited. In terms of spatial structure, rooms were planned around the corridor which follows the traditional space structure. The designed floor plan can provide familiar housing spaces to residents and also increase living comfort.

4.2 Flat-type

Flat-type plan is a type of building which units are arranged to form a linear building plan and corridors are connected to cores which are planned between units. This type has advantage in cross ventilation. Buildings are arranged to face south. This orientation affects efficient ventilation as temperature difference occurs between the south and north part of the building. This reflects the characteristics of the traditional houses in the rural areas of Vietnam. Vietnamese farmers arranged buildings to face southeast or south so that cool breeze can enter the house in the summer and that monsoon can be avoided in the winter. (Na, 2011) Flat-type housings can be considered as environmentally beneficial in hot and humid regions, like Vietnam. By adding the basic concept of the prototype, which was explained above, more efficient ventilation can be expected. Also, balconies can be planned to prevent solar radiation. Because solar altitude is high in Vietnam, short canopies are also expected to bring shading effect.

4.3 Courtyard Type

Courtyards in tube houses and traditional rural houses of Vietnam have an important role in cultural and environmental terms. In traditional rural houses, it was used as outdoor workspace, a place to dry grain, and also a space for big events such as funerals or weddings. It
also has environmental features like reflecting sun light into the house. Courtyards in tube houses were also used for outdoor activities. It also brings light into deep spaces and connects or separates other spaces. (Jeon, 2005)

By applying courtyards into apartment houses, living activities that happened in traditional houses are expected to take place and be reminded by residents. Also, courtyards can provide shade which will lower outdoor temperature. If the lower floors of the apartment buildings are open, this will cause stack effect and activate natural ventilation which will provide a much comfortable living environment.

The courtyard prototype is planned so that air can flow between units, and the unit plans were designed so that all spaces are naturally ventilated. Courtyards are installed every 4 floors to limit the total height of openings and to increase more outdoor spaces for residents. Louvers are designed on the façade of the building to reduce solar radiation which can control indoor temperature.

**CONCLUSION**

In this study, climate control methods and housing cultures were studied from vernacular architecture and were reflected on prototypes. Vernacular designs include lifestyles and designing techniques which consider local climate. Therefore, practical, economical, and environment-friendly designs can be expected from research of vernacular architecture. In this regard, the significance of this study is the re-interpretation of vernacular architecture and the application of researched elements to modern apartment buildings. This research is
also expected to bring new opportunities in the apartment market in Vietnam.

However, the limitation of this study is that further research is needed to test the environmental effects of the prototype. Through further research, tests of the two prototypes will be carried out through environment simulation. Results of the simulation will be compared, modified and re-tested through constant feedback.

ACKNOWLEDGEMENTS

This research was supported by a grant (12 High-Tech Urban C14) from High-Tech Urban Development Program funded by Ministry of Land, Transport and Maritime Affairs of Korean government.

REFERENCES


越南民居設計應用於高層公寓規劃研究

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（2013年11月01日投稿；2013年12月11日通過）

摘要

本研究根據越南的民居(vernacular dwelling)提出適用於越南的高層公寓原型。此區域的民居設計反映了越南傳統建築的獨特特徵和環境體系。透過對民居設計的研究，可用於高層住宅設計的具體設計方法遂而導出。而本研究則根據所導出的方法，對高層住宅自然通風系統的開發予以建議。此外，本系統還對“管狀式住房”(tube house)的文化及空間特徵進行了研究，並將之反映在所發展的越南高層公寓的原型中。透過研究，本文對越南所建造公寓之正面形象及解決越南城市地區的住房問題，提出了一項既環保又經濟的原型。

關鍵詞：高層公寓，自然通風，民居設計，越南住房，原型，熱帶氣候