

Reintroduction of Ventilation Components for Terrace Houses in Malaysia

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Abstract

The migration of rural population to cities in Malaysia caused the government and private agencies to built 1.8 millions units of house from 1976 to 1995. Most of the houses are built in rows called terrace houses with openings only on the front and back elevations. The lack of emphasis of local authorities to regulate sufficient ventilation, low outside wind velocity and building design disregard the need of cross ventilation have resulted houses having poor natural ventilation of less than 1.0 m/s air movement in the interior spaces. The ventilation quality could be improved by the introduction of perforated components use by many traditional houses and shophouses in the country. The components include top-hung of door and window, tall window with adjustable louvers, wall panels and gables. The introduction of these features in the terrace houses will improve the living comfort of urban housing, revitalizing the traditional craft to modern society, and harmonizing the urban dwellers in a multi-racial society by an architectural artifact. Utilization of the panel could boost the furniture and cottage industries which inline with the government policy.

Introduction

As a developing country, Malaysia is facing the problem to accommodate urban populace. Migrations of the rural population to towns are large since early 1970s. Since mid-1970 many governmental and private agencies built mass housing scheme to cater for the demand. Thus more than 1.8 million houses were built between 1976 to 1995 in the Third, Fourth and Fifth Malaysia Plans to reside the urban populace. The emphasis of the government in housing development program is to provide adequate, affordable and quality housing for all Malaysians, particularly the low-income group. In the Seventh Malaysia Plan (1996-2000) the demand for houses is expected to increase and a total of 800,000 units of houses will be required. The public were given with four categories of housing types to choose which include low-cost, low medium-cost, medium and high-cost units.

Most housing sites were planned in grid-iron layout to maximise the use of the land area. The land utilization is considerably high with land-use density of 26 to 41 units per hectare. To maximise the use of land, most of the houses were built as terrace

(link) houses; with opening of 22 to 24 feet and depth of 70 to 80 feet and constructed either one or two storey high. The building materials include masonry for floor and walls, and timber for roof structure. Architecturally, façade and form of the unit are similar, thus resulting to a homogenous, lack of variety and character in the urban housing landscape.

The mass housing programs also resulted in dwelling units which are not designed suitable for the warm-humid tropical climate of the country. Most designs ignored the importance of wind ventilation to cool the house. House features and components which can generate ventilation include air-well (Rajeh, 1994), doors and windows and their ventilation panels, and fenestration walls. The lack of emphasis on the ventilation features and components of the house cause discomfort to residents whose later resort to electric fan and air-conditioning to cool the interior environment.

Traditional buildings in Malaysia typically Malay houses and Chinese shophouses (built as linked building) are built in full response to the tropical climate. The Malay houses were built from timber and raised on stilts. The building is well ventilated by having doors and windows with perforated panels or adjustable louvers, and floor board with 1/4 inch gap to let the air to circulate in and out from beneath the building. Similarly, traditional Chinese shophouses in the towns strongly considered the need of natural ventilation to cool the interior spaces. Air-well and courtyard were incorporated in the building with fenestration components on windows, doors and walls. As a result the residents were able to feel comfortable with the presence of air movement in the building.

Ventilation components of traditional timber architecture include door, window, floor, perforated wall panel, top-hung of door or window and gable. All components except the floor are well carved from hardwood symbolizing cultural motives derived from flora, fauna and cosmic features or simply in geometric patterns. The motives are the design language which hold and link the architecture of the Malay Archipelago. Thus the ventilation panels of the house are significant components to indicate culture and belief of Malaysians and signage of tolerance in a multi-racial society.

Therefore, the purpose of this paper is to discuss the significance of ventilation components of a house to achieve the following objectives, namely; (i) to improve thermal performance in terraced house, (ii) to revitalize the cultural value of traditional craft in modern Malaysian society, and (iii) to harmonize multi-racial society through an architectural artifact.

Thermal Performance in Terraced Houses

The Malaysian Uniform Building By Law 1984 defined a terraced house as single dwelling unit and forming part of a row or terrace of not less than three such residential buildings. These houses are constructed in reinforced concrete and bricks and supplied with water and electricity. Each unit is of rectangular shape sited on a 6m x 25m plot fronting a 12m to 15m in width road. The gross floor area for a typical terraced house ranges from 112m² to 185m². Most are laid in grid-iron layout to maximise the use of the land area and arranged side-by-side in rows. Generally, the house are of single or double storey. But the high demand since 1991 saw a new two and a half storey to three storey units. The form is obviously identical but the original form gradually change once the owner resides and renovates the building.

Since 1981 several researches have determined that the terraced houses are poorly ventilated. The cause is simply because of insufficient openings in the building to allow for cross ventilation and other criteria are the climatic factors (see Figures 1 and 3). Openings are mainly from doors and windows were limited to front and back of the building. Many of the house types utilised solid timber door and glass window either louvered or leaf. Sometimes the door and window are accompanied with top-hung, small openings on top of them. Furthermore, roofs of most house are hip types which lack of gables, or if available, the gables are sealed without perforation. Perforated gables directly allows the hot air collected in the pitch to move outside the house.

The buildings are not designed in response to the country's incliment climate which characterised by three main features; seasonal uniformity, low wind velocities ranging in average of 1m/s to 1.2 m/s and small diurnal temperature range (Takahashi, 1981) and high humidity and high DB temperature in the afternoon. Malaysia and other parts of South-East Asia are under the influence of eight or nine major air streams which have their source in the North-east and Central Siberia, North India, the North Pacific, Australia, the South Indian Ocean and the South Pacific. The wind velocities in Malaysia are generally low except occuring locally only during thunderstorms where strong winds prevail.

The insufficient openings and low wind velocity have caused the air velocity in the terraced houses to be less than 1.0m/s. Rajeh (1994) has recommended that an air movement of 1.0 m/s would provide a satisfactory relief for most of the time. The air velocity helps to increase the efficiency of sweat evaporation, and thus avoid discomfort due to moisture on the skin. Climatic analysis for Kuala Lumpur have suggested openings between 50% to 80% of the walls to facilitate ventilation comfort (Rajeh, 1994). Thus many residents resort to mechanical ventilation using fan and air-conditioning to bring comfort in the houses. Therefore, there is a need to evaluate the

current design of terraced house particularly in amount and form of openings to increase the natural ventilation in the warm-humid and low-wind velocity climate of Malaysia.

Ventilation Components

The ventilation components of the traditional Malay house and Chinese shophouse are elemental features which include door, window, wall and gable. The door leaf is sometimes perforated and accompanied with perforated top-hung whereas window is usually tall and constructed with adjustable louvers and also incorporated with carved, perforated top-hung. All these openings help to improve the air movement in and out of the house. In addition, walls of the Malay house are patterned with perforated panels. The panels are intricately carved with motives of flora, fauna, cosmic feature and geometry. The gables are also perforated or vented to allow the external breeze to flow in the house and allow warm air to flow out of the roof. Not only the ventilation components promote natural ventilation, they also allow day light to come in to lit the interior spaces and become aesthetic features in enhancing the house. In association with some structural elements and detailings including post, rafter, stringer of staircase, fascia board, gable end, railing, and bracing, the ventilation components bring an authentic character of a house responding to tropical climate and cultural value of the people. Furthermore, the aesthetic beauty transcend into the darkness of night when light from the house passes through the perforated panels which distinctly outline the silhouette of the carvings. This form resembled the shadow play practiced by the Malays for several centuries.

The carvings also illustrated adaptation of the native Malay architecture by Chinese immigrants in the construction of the shophouses in the cities. Tall window with adjustable louvers and carved, perforated top-hungs on door and window resemble the native architecture. Although the general pattern followed a similar language, the choice of motive is quite different. The Malay carvings mostly illustrated in flora motives with all curvilinear lines whereas the Chinese used both flora and fauna motives with some straight lines. The modification is a gradual and progressive change in the local architecture which signifies the cultural values and belief of the people in Malaysia. Intrinsicly, the architectural components showed the tolerance and pluralism of the old society in Malaysia before the 1970s.

Since mid-1970s, the booming housing sector had forgotten or ignored the importance of the ventilation components for both thermal comfort features and cultural-valued features. The features to provide ventilation to the terrace house include

air-well, high ceiling with vented wall, vent opening in the roof's ridge or overlapping roof, fenestrated top-hung on door or window, and tall and louvered window leaf (see Figures 2, 4 and 5). The air-well, a common feature in the old shophouse, is an opening within the roof that connects the internal space to the open sky. Its function is to provide both natural lighting and ventilation to the internal spaces of a terrace house. The existence of the air-wells in terrace house had created problems of security to the occupant, whereby burglars gain access into the house via the open air-well. As a precaution against these incident, almost all air-wells were either sealed or modified into variety of shapes and forms. Due to this, the basic requirement and function of an air-well is ignored and abandoned. Thus to improve the thermal performance in the terrace house, door, window, wall and their perforated panels are to be installed in the building.

Revival of the Ventilation Components

Introducing the ventilation components into the terrace houses is essential to improve the thermal performance inside the buildings. The suggested components can be categorized into two types; movable and fixed. Door and window with tall leaf and adjustable louvers are the fixed components. Fixed components include perforated top-hungs on door and window, perforated wall panels and gables and ventilation holes at foot of wall. Installation of the features should cover minimum of 50% the area of front facade and back elevation of the house. The internal walls separating the rooms should be fixed with perforated panels to allow the air movement to cross from the front wall through the internal walls and exit to the back wall or visa versa (see figures 4 and 5).

These features could be manufactured from hardwood timber, clay or concrete. Making of perforated top-hungs and wall panels could be done by craftsmen whom run the cottage industry in their communities. Apparently, there are few remaining wood carving workshops in the state of Terengganu and Kelantan. At present, most of their works concentrate in the making of carved components for resort buildings, museum, and luxury homes. Certainly, the demand which might derive from the terrace houses would boost the small-scale wood carving industry. This industry should manufacture only intricate carving components symbolizing traditional motive of flora and fauna. The traditional motive must correspond to the ethnic values of the people. Thus the carving for the Malays could symbolized the common flora motives of *Getamguri*, *Ketumbit* and *Bakawali* (see insert in figure 4) whereas the Chinese may prefer the motives of pomegranate and fauna motive especially birds. The perforated components must be minimum 1.0 inch thick which is strong enough to restrain intruders entering the house. Craftmen could get assistance from Universiti Teknologi Malaysia to refer

the collection of wood carving motives. The university has done thorough architectural documentation of old buildings in the country. The compiled information is called measured drawings and are kept in the Center of Malay Architecture at Faculty of Built Environment.

On the other hand, simple geometric patterns can be mass produced in the furniture factories. These patterns are rather universal which could fit to all ethnic groups in Malaysia. Swastika and *pagar musang* are the example of such pattern which could be used in the making of top-hungs and wall panels. Typical motive of *Lontar* (a palm) palmate frond is suitable in the manufacturing of the gable. Consequently, it is the role of Malaysia Timber Industry Board to promote the wood industry to uptake the manufacturing of the ventilation components. Forest Research Institute of Malaysia could assist the furniture industry to educate the manufacturers in using machinery to mass produce the components.

The success of utilizing the ventilation features could be secured by installing galvanized wire or polyethylene netting to stop mosquitoes and other nocturnal insects entering the house. Although the netting reduce the amount of opening and thus retard air movement, the netting will certainly draw resident's confidence to use the ventilation components.

Conclusion

The consideration to design terrace house responding to tropical climate of Malaysia is essential to attain satisfactory comfort level in the building. Architect, local authority and developer should work together to revive the use of ventilation components in the new design. The revival would certainly accentuate the front and back elevation of the house. Monotonous and repetitive building outlook is broken by the introduction of gables, tall windows with carved top-hungs and adjustable louvers, doors with carved top-hungs, and even the concrete walls with perforated panels. Thus each house owner can choose to install ventilation components with patterns and motives to his preference which may indicate their ethnic beliefs. Pluralism in the multi-racial society is demonstrated by the architectural artifacts. Furthermore, the resident can add different finishes including paint or wood stain on the features to accentuate the character and establish identity to his house. It is hope that the introduction of the ventilation components could increase the cross ventilation to more than 1.0 m/s especially during the mid-day. Obviously, the dependence on fan or air-condition should not be put aside totally after the introduction of the features.

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