Traditional Construction of Javanese Vernacular Buildings

Case study: Rural Housing in Yogyakarta Special Region

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Abstract

Located on the tropical region of latitude ranged from of 6° North down to 11° South, Indonesia has general characteristics of wet and humid climate on most of the large islands. In addition to the earthquake region, the environmental condition, and the influence of the local culture applied in the community, it generates certain characteristics to its vernacular buildings. Java at the central part of Indonesia has the described characteristics, which is reflected on the form and arrangement of spaces, choice of structural design and construction materials on the local buildings. As Yogyakarta is located at the central part of Java, the main subject of this paper is a study of vernacular buildings on the rural housing of Yogyakarta Region.

Keywords: Javanese vernacular building, Rural housing, Traditional construction

1. Environmental Aspects

Yogyakarta Region, known as the Province of Yogyakarta Special Region (YSR), is divided into four *Kabupatens* (Regencies) and one *Kotamadya* (Municipality), which the *Kotamadya* is surrounded by all *Kabupatens*: Sleman at north, Kulon Progo at west, Bantul at south-west, and Gunung Kidul at south-east. Yogyakarta is the capital of *Kotamadya* Yogyakarta that is also the capital of YSR Province. The town of Sleman is the capital for *Kabupaten* Sleman, Wates for *Kabupaten* Kulon Progo, Bantul for *Kabupaten* Bantul and Wonosari for *Kabupaten* Gunung Kidul. These towns are classified as middle-size cities of the Province.

Yogyakarta is a unique city located in central Java, surrounded by some interesting places; it is also nationaly known as the centre of culture and education. Borobudur temple, the largest Buddhist temple in the country, is located at north-west of YSR, that is about 30 km of Yogyakarta city. Kaliurang, a small town of Mount Merapi sloping higher land at far north of YSR, it provides vacation facilities such as villas, amusement parks, and recreational tropical rain-forest, etc that represents the beauty of volcanic nature.

The climatic condition of YSR presents the average annual rainfall of 2,000 – 3,000 mm with average local temperature of 28^0-32^0 Celcius (Anonymous, 2002). In addition to the lengthy and relatively constant tropical sunrays through the years, the high rates of rainfall will require a specific design on the local buildings. The characteristics of building design that includes the local building structures should cover and protect the indoor spaces harmoniously.

Larger proportion of the YSR land use is exploited for agriculture activities, therefore limited land is provided for conservation purposes. Such case is shown, that the forestry conservation of YSR is less than 10 % of the region's land coverage.

2. Cultural Issues

YSR has several types of traditional house buildings, which are the royal buildings and the vernacular houses for common people. The houses found mostly in the rural areas can be classified as common houses; most of the royal houses and buildings are in the urban center of Yogyakarta, which are usually owned and used by the Sultanate Family.

Through cultural development in the community of YSR, it influences the architectural development of the local buildings and houses. Through natural process from time to time, the development of local houses experience some changes and improvements on its form as well as function. The building form exchanges of local houses are merely caused by several factors; however, the main issues are caused by the limited supply of houses available for the fast growing community. Such common issues related to the local housing is the extremely high demand of houses needed to meet the expanded household numbers that is not responded by adequate supply of affordable houses. The main problems seem to be the unbalance economic situation for the lower income households. In addition to the limited available land and building materials, the significance presence of larger proportion of local population with limited and low-income level creates harder situation in respect of the housing problems. Low production of inexpensive and sustainable building materials of locally made products is in high demand to provide affordable houses in the region.

The common form of vernacular building in the region can be identify by its roof types, which various roof of the traditional buildings of Yogyakarta's type are classified into grouped of: (1) *Panggang-Pe*, (2) *Kampung* or *Pelana*, (3) *Limasan*, (4) *Joglo*, and (5) *Tajug*. From each group of roof forms are also developed into some variations, however, the basic form can be clearly notified. The example of Joglo roof variation is *Tajug* roof form, as its four sides of roof form are similarly developed (Hamzuri, 1978).

Earlier prior to 1950s, the implementation of roof form with traditional style of Java, especially to the community in Yogyakarta, the choice of roof shape used for any building usually based on both the owner's status in the community and

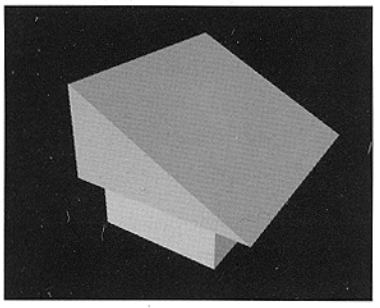
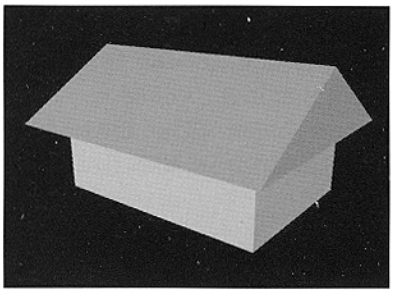


Figure 1.
Panggang-Pe roof form

The simplest roof form. It has one direction of sloping surface into one roof end only; at the other end of the roof side, and a vertical plane ends it. At the other two ends, two triangles of vertical planes end the roof shape.

Figure 2.
Kampung or *Pelana* roof form

A simple but relatively popular roof form in the region, which it has two sloping direction planes that ended at both sides, and at the other two ends both are ended by two triangle vertical planes.



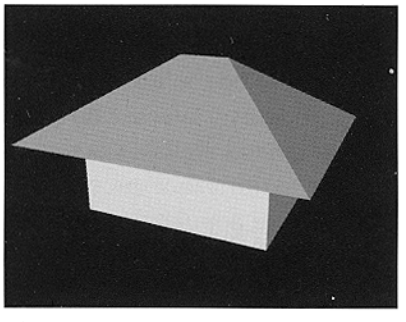
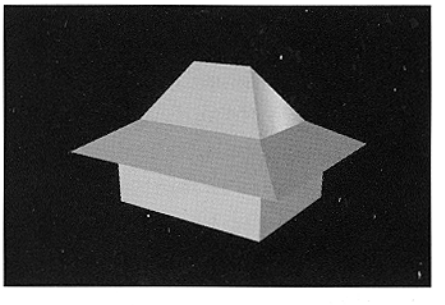


Figure 3.
Limasan roof form

A more complicated roof form of pyramidal shape, which each of the four ends has individual sloping directions and formed by the four roof planes. The lower edges of the outer roof planes, accordingly, are the lowest elevations.

Figure 4.
Joglo roof form

A complicated roof shape, which has four slopings of four directions. It has four roof planes, however, another four roof planes are extended and developed as the lower continuing roofs.



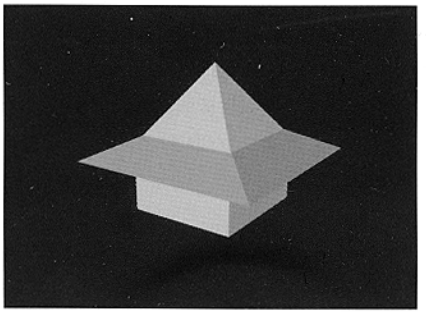


Figure 5.
Tajug roof form

It is a complicated and developed form based on the *Joglo* roof form. It has four sloping directions and planes of pyramidal shape of piled roofs, that the roof tips are met at the very top point of the roof planes.

the economy situation. The more complicated roof form is available for the higher position and status of building owner in the community; therefore, a community member without any position in the village community will consider building the private house by the implement of simplest roof shape. According to the roof form and status of house owners, a *Limasan* roof is considered as a complicated form.

A village leader or higher position of community member can build the house with *Joglo* roof form. This roof form is usually applied for the main building of houses in Java with its function as *Pendopo* or main meeting room, a public area of a private house. Following this functional part of *Pendopo* of the house, not all member of the community will have the competent to build a private house with *Joglo* roof form.

The orientation of the traditional building in Java, especially of the YSR, almost always directed to the south or north, that is due to the basic conceptual for most buildings. The exception is made to the Sultan's Palace and Mosques, which building orientation can be built directed to the east.

The traditional buildings of rural areas built prior to the 1950s have certain characteristics such as the use of set of wooden main columns called *Saka Guru*, and the use of bamboo or wooden walls for most façades or partitions. The burnt bricks for use as wall enclosures at the time were in limited supply; however, in the development of the local buildings in Java the use of building bricks is more popular, since there is also limited supply of local timber that is suitable for the tropical condition.

It is noted that the local community of indigenous origins involve in the Governmental sector at the time were limited to Village Leader known as *Kepala Desa*, or slightly higher position, such as Sub-District Leader known as *Penewu* or *Camat* at present. The position of *Bupati* or Regent at the time is mostly hold by the Dutch people who occupied Indonesia. Therefore, the traditional buildings of Yogyakarta Special Region that were built during the early time or before the National Independence 1945 should consider and adjust the local culture and

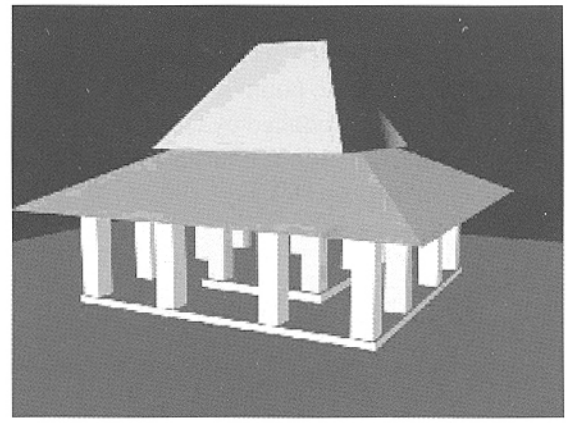


Figure 6: *The form of Joglo roof of Pendapa building*

position of the building owners regarding the social status in the community (Ronald, 1992). After the 1950s, further developments on buildings of rural areas were experienced due to the influenced of urban culture. During the progress of development, there was more direct freedom to build the private houses, which the conceptual of *Saka Guru* of traditional building were replaced by the concept of modern buildings, such as the use modern truss system for wooden roof structures.

3. Structural Design

The structural design of the traditional building of rural areas in YSR built during the Dutch colony, before the 1950s, was mostly based on wooden frame structures. The wooden frame structures in the form of *Saka Guru* were common in the region. The setting of *Saka Guru* is the main structure of traditional buildings in Java, which it stands on four main columns. From which the set is tied by set of wooden beams composition known as *Tumpangsari* beams. The structural weight produced by the *Tumpangsari* beams composition is relatively limited to the roof weight. Structural weight of the enclosure walls is relatively insignificant since the wall is often built of wood or bamboo. In the case of burnt bricks for use on the enclosure walls, the wall structures are built split from the main structure of *Saka Guru* set.

Certain guidance is needed for the design of the traditional structure form of the region, which is known as *Pamidangan*. The *Pamidangan* directs the traditional building of Java regarding

its structural proportion, such as the proportion and dimension of height and length of columns, roof height, and othe components. It is stated that the buildings produced by the *Pamidangan* concept will result building forms that meet the Javanese aesthetics (Dakung, 1982).

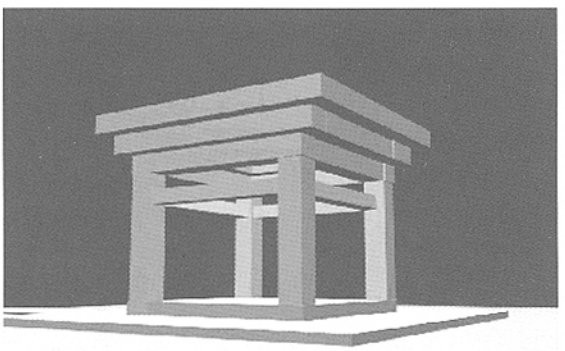


Figure 7: *Soko guru dan balok tumpangsari*

In the consideration of building components' load, it is proven that the structural design of the Javanese traditional building of *Saka Guru* are able to support various loads such as wind, statical, earthquake, climatic, etc. The composition of columns and beams connection of *Saka Guru* employs some wooden wedges known as *Pasak*, to lock the wooden connections. The stiffness factor of *Saka Guru* frame is produced by the set of *Tumpangsari* beams composition. The *Tumpangsari* beams are usually composed of 3 to 5 layers of inter-connected beams, which the use of layers is always odd numbers. Based on the Javanese believes, the odd numbers is best to use, therefore, it is always used in most calculation, especially in the proportion form of construction. Metric method is not used for the unit size of building components, instead, the size of body part of the building owners are used, such as *Kilan* or length of hand, *Depa* or length of arm, *Jangkah* or length of foot step, etc.

There is transformation process of house building in rural areas after the 1950s that is due to the exchange of political condition in the Government from the Dutch colony to the Republic of Indonesia. The concensus of certain building form based on the owner status in the community is no longer popular, since the signage to present social status in the village political position is transformed into economical status. This freedom, therefore, anyone of financial capacity can build own private houses as they wish.

4. Construction Materials

Timber as building materials are commonly used for main structure in housing construction of rural areas prior to the 1950s. In this case, timber is always used for Saka Guru, which at the time Teakwood is suitable for use as timber for the tropical buildings. The Teakwood is the best material based on its durability towards the climatic condition and best performance for load capacity on the building's main structure. Up to the present, timber is popularly used as the main building materials in the rural areas. Since limited supply of Teakwood is experienced in most areas, therefore, the price of Teak is considered very expensive and almost not affordable for some. Some exchanges are made regarding the use of timber for the rural houses, such as *Bangkirai*, *Nangka* from Jackfruit tree, etc since they are able to perform the requirement and load capacity for components of main structure for the rural houses.

To build the traditional structure using the Soko Guru method, some qualitative requirements of timber are described as:

- Timber type must have durability towards climatic condition, such as high heat of the tropical sunrays and the high humidity or wet condition of monsoon.
- Timber characteristics must have relatively moderate state of swell and shrink.
- Timber that highly durable towards termite attacks, since termite is the main problems on the timber construction.
- Timber with good strength capacity towards pressure and pulling loads, therefore any timber with possible cracking following the layers of fibre will be unrecommended for use in the main structure.
- The timber must meet the requirement and criteria following the Javanese culture, such prohibition is: timber from a collapse tree before it is purposely harvested (Dakung, 1982).

From a number of basic requirements, some types of timber that are met the requirement is described as follows: Teakwood, Bangkirai timber, Jackfruit timber, etc. Due to the limited supply of quality timber and increased price caused by high demand for Teakwood; it is understood as the best and excellent material for material construction of main structure on the rural houses. The use of timber is then replaced by reinforced concrete; therefore, this material performs an increase demand in the rural areas. The substitution of reinforced concrete into quality timber has caused an exchanged of cultural value on the traditional architecture of the region, especially in regard of the main structure of the local houses, which it is experienced significantly since the 1960s. Due to the limited timber supply required for *Saka Guru*, which earlier was the main structure concept for building in the region, the transformation into frame structure of modern building employs reinforced concrete material for components such as floor slab and beams, columns, lintels and beams, etc

5. Discussion

The improvement of rural housing in the YSR since the National Independence or after the 1950s presents some development on its orientation especially due to the problem of limited supply on local material such as quality timber: Teakwood. Teakwood was the primary building timber for *Saka Guru* of traditional buildings in Java prior to the 1950s, especially of Yogyakarta region. The problem of limited suplly on Teakwood introduces some types of timber as substitute of the high quality timber, therefore, timber of Jackfruit tree, Bangkirai, Coconut trunk are then used as timber for *Saka Guru* on the traditional houses. There are significant exchanges of local materials for rural houses since the introduction and available supply of modern materials such as reinforced concrete and steel.

Part of the exchange use of material for the main structure of the rural houses, there is also transformation on the architectural concept of traditional houses in Java, especially of YSR. The former house building orientation of rural houses into north or south is then no longer becoming a strictly concept due to the pressure of limited land and building materials; therefore there is a common exchange of rural house orientation not limited into north and south only, but east and west orientation as well.

Some strong concepts of traditional architecture in Java that is formerly always used by the rural community on house building, at the present has transformed into more freedom concept of houses such as the interior and spaces composition of the house, and the use of ornaments and detailing. The transformation developments of architecture for rural houses in YSR are shown as follows.



Figure 8: *An example of a rural house with south orientation, although the site has a west entrance.*

Based on field observation, it is concluded that part of the unstrict application of the Javanese concept on traditional architecture for rural house building of YSR, there is also a slight exchange of life style by the rural community due to the influences of modern and urban styles. The transformation consequences, however, are not fully anticipated by the rural community. Although the value of modern life style is expanded to the rural areas in YSR, however, not all of the rural buildings replaced the traditional concept of Javanese architecture. There are some new house buildings built in the basis of traditional architecture of Java culture, for example by the use of north or south orientation.

Table 1: Transformation architectural concept of rural houses in the YSR

Architectural concept	The era prior to 1950s	The era after 1950s
• **Environment**	Front and backyard of houses are relatively larger therefore more plants and trees are available to add shading areas and comforts.	Limited available areas for front or backyard of houses due to repetition of land distribution.
• **Interior spaces**	Employing traditional concept for spatial design in Java houses thoroughly.	The design of houses are based on spatial needs, therefore the traditional concept of Java is no longer strictly used.
• **Main structure**	Saka Guru is used as basic concept of the main structure on traditional building in Java.	The orientation of main structure is based on the use of modern structural concept such as truss system.
• **Construction materials**	The main structure always employs quality timber based on the concept of *Saka Guru*.	The main structure concept has an exchange into closed framing concept based on the reinforced concrete.
• **Architectural detailing**	Building architectural detailing has adjusted the social status of building owners in the rural community; the higher level of position, the more architectural details are made.	The detailing of architectural design adjusts economy capacity of the building owners. There is none influence made by the social status of building owners in the rural community.

Source: Observation and analysis, 2004

6. Conclusions

From the description above, some conclusions are made with the relation to the architecture building of houses in the rural areas of YSR as follows:

a. Before the 1950s, the roof form with Javanese culture, especially the YSR vernacular buildings, employs the traditional houses based on the owners' social status in the community and economy capacity.

b. During the period after 1950s, there is transformation process in architecture concept of house design in the rural areas. The concept of Javanese traditional buildings that based on the *Saka Guru* concept is replaced by the modern building concept such as the wooden truss system.

c. Some concepts of Javanese traditional architecture that always used by the community for building the local houses are finally experienced some design transformation such as spatial arrangement and function of the rural houses, and also, the use of ornaments and detailings.

d. Although the value of modern life style influences the nearby rural areas of YSR, not all the local houses follow the Javanese architectural concept. However, there are some new buildings in the region, which are designed and built, based on the concept of traditional Javanese architecture.

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