

# Tectonics in Architecture of Tanean Lanjhang and Osing House: The Impact on the Growth of Space Area

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## Abstract

This research was initiated by an interest in vernacular architecture, which adapts to fit the changing demands of its inhabitants. Cultural variations and differing population demands can cause spatial planning patterns to vary even within a province or between nearby places. Tectonic formations are produced by the growth of vernacular houses. In addition to understanding the distinctive tectonic structures through the connections of elements in the expanded spaces, this study attempts to identify and classify the spatial arrangement patterns in the vernacular houses of Tanean Lanjhang and Osing. Tanean Lanjhang and Osing buildings are examples of vernacular architecture known as "growing houses," which have horizontal expansion as their principal growth criterion. The two kinds of houses, however, expand in different directions. This research uses qualitative techniques, such as literature reviews on Osing houses and on-site observations of Tanean Lanjhang houses. The results show that the Tanean Lanjhang houses show three orientations of spatial arrangement patterns: expansion in the middle, forward, and backward areas. Osing houses, on the other hand, extend from front to back. Both types of houses have connections built with or without gutters, despite the variations in the connections between each of the elements within them.

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## INTRODUCTION

The yearly intensification of urbanization poses substantial obstacles to the building of housing, including restricted land availability and limited budgets (Agusniansyah & Widiastuti, 2016). In addition, changes in family sizes and lifestyles need modifications to the amount of space needed as well as the way that dwelling's function (Raihan & Sulthan, 2020). As a result, homes frequently differ from their initial designs (Agusniansyah & Widiastuti, 2016). The concept of the evolving house emerges as a solution to accommodate diverse resident needs, rooted in vernacular architecture.

The needs and customs of the people who live there influence the evolution of vernacular architecture, which helps them to survive in their natural environments (Kusdiwanggo, 2018). This illustrates how dynamic and always adapting vernacular architecture is to changes. Extending already-existing structures also referred to as "growing houses," is a popular adaptation to accommodate rising space demands. With this method, homes can grow from a small area gradually without making significant changes to the initial design. Depending on spatial constraints, houses may expand horizontally, towards sides, front, and back, or vertically by adding floors (Agusniansyah & Widiastuti, 2016). Although vernacular architecture addresses similar problems, different regions have different traditions and socio-cultural contexts, hence their approaches differ (Mentayani, 2012).

A building's tectonic aspect indicates a community's unique approach to problem-solving with resources and methods that are specific to that culture. According to Kenneth Frampton, tectonics is the creative manifestation of structure that goes beyond simple utility by combining technical know-how and creative flare (Frampton, 2001). By using indigenous resources, it respects the environment and incorporates customs from the local cultural community (Frampton, 2001). Frampton states that the object, details, joints, material, construction, structure, and interaction are

all important tectonic variables that must be considered to build a coherent architectural language (Al-Alwan & Mahmood, 2020). The deliberate integration of these components gives spatial creations meaning, which is also known as the Poetic of Construction (Frampton, 2001).

A building's tectonic element shows how distinctive a community is in problem-solving with resources and methods that are specific to the area. Tectonics is the creative expression of construction, combining technical know-how with artistic abilities to produce something that goes beyond a simple, useful structure. (Frampton, 2001). The elements found in the environment and the customs of the local people are the sources of tectonics. Respecting the natural resource's locality is another aspect of tectonics. (Frampton, 2001). Spatial order involves psychological, social, and cultural aspects and plays a crucial role in the complex interaction between humans and their physical surroundings (Mentayani, 2012). Object, details, joint, material, construction, structure, interaction, and Frampton's division of tectonic factors into seven important components (Al-Alwan & Mahmood, 2020). Each is essential to creating an integrated architectural language. Understanding the more intricate aspects of joint building is necessary to embody correct construction. Understanding the properties of the material being used is necessary to choose the right kind of connection between building elements. Joints between well-planned components will create a structural system that works. The careful blending of these elements gives meaning to spatial creations; this process is known as the Poetic of Construction (Frampton, 2001).

This study focuses on tectonic factors, specifically details, joints, and structures, by comparing the expansion of space in Osing vernacular houses in Banyuwangi and Tanean Lanjhang vernacular houses in Madura. These architectural examples were selected for their analogous efforts in expanding space to meet familial needs. For instance, the original spatial arrangement of Tanean Lanjhang houses measured approximately 6.16 m x 7.61 m, comprising an *amper* (front porch) and *romah* (bedroom) (Figure 1). As space requirements evolved, the spatial layout of Tanean Lanjhang houses expanded horizontally in multiple directions, forward, backward, and sideways, as classified.



Fig. 1. Plan and Perspective of Single Bangsal Building (Source: author)

The four primary spatial components of Tanean Lanjhang are the *tanean* (gathering yard) and the following: *romah* (home), *langgar/kobung* (house of worship), *kandhang* (cage), and *dapor* (kitchen) (Salamat, 2022). The *bangsal* type and the *pegun* type are the two forms of traditional Tanean Lanjhang houses, distinguished by where the major columns are located (Tulistyantoro, 2005). The *bangsal* variety has decapitated ends and a *nok* ridge that resembles a dragon tail or horn, giving it an appearance similar to a Javanese Joglo. Its four principal columns are arranged in a square shape in the center. The *pegun* type, on the other hand, has four columns arranged in a rectangular pattern close to the walls, like a pyramid with ridges at the front and back (see Figure 2) (Tulistyantoro, 2005).

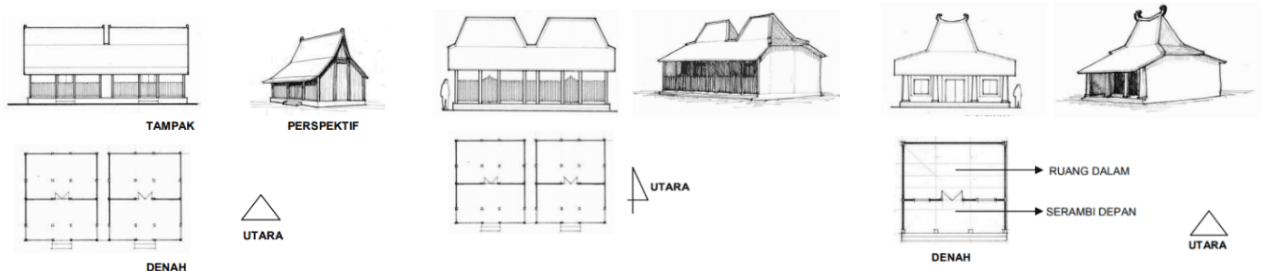
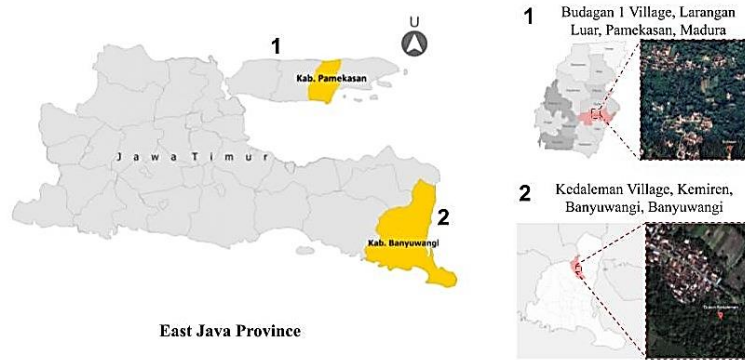


Fig. 2. Tanean Lanjhang Typology by Roof Type (from left to right: *trompesan*, *pegun*, *pacenan*) (Source: Tulistyantoro, 2005)

The three primary areas of an Osing house's spatial layout are the *bale*, *jrumah*, and *pawon*. Furthermore, certain homes have additional spaces like the *ampok* (side terraces) and *amper* (front terrace) (see Figure 3; Noor et



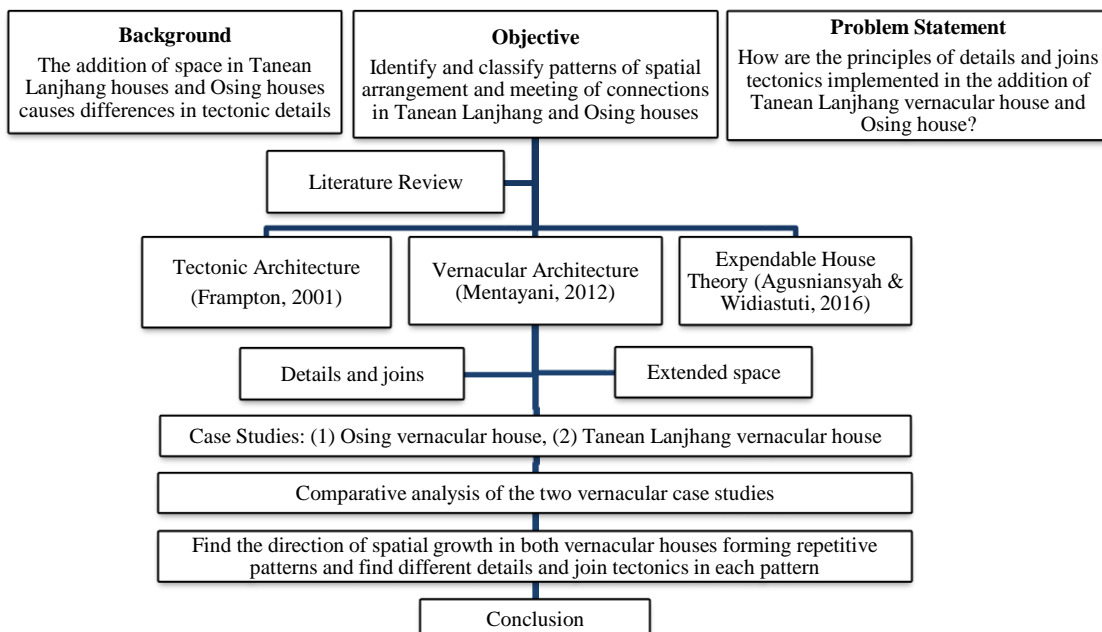
1, Larangan Luar District, Pamekasan, Madura, and Osing in Kedaleman, Kemiren District, Banyuwangi was the first step in the research procedure (see Figure 6). Field observations were done at Budagan 1, Larangan Luar Village, Pamekasan, Madura. These observations included documentation, measurements, and interviews to identify the purposes of spaces and the names of building elements. Finding the houses' structural components, their connections, and the tectonics of the construction were the main priorities. For additional observation, the researchers intentionally selected houses with various kinds of additions (see Figure 7). Meanwhile, in Osing House, observations were done using google map's street view and photosphere. In order to identify different additions and tectonic details in the architectural elements of Tanean Lanjhang and Osing homes, the analysis included processing the data that was already available. The pattern of space extension and the specifics of the connections in Tanean Lanjhang and Osing houses were then identified by comparing the two types (refer to Figure 8).



**Fig. 6.** Research Location  
(Source: modified from Google Map)



**Fig. 7.** Observed Sample House; (a) House of Case 1 (Double *pegun* type with additional terrace), (b) House of Case 2 (Double *bangsal* type with additional terrace and kitchen), (c) House of Case 3 (Double *bangsal* type with additional kitchen & cowshed)  
(Source: author)



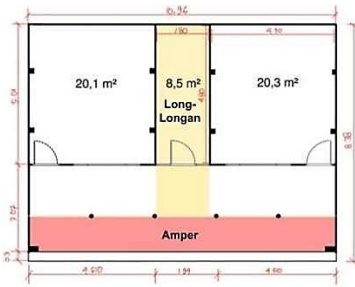
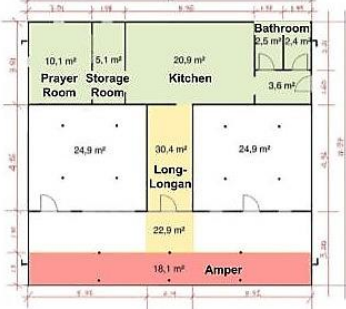
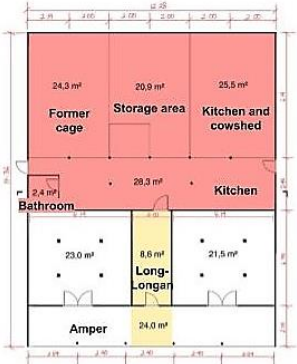


**Fig. 8.** Research Steps  
(Source: author)

## RESULTS AND DISCUSSION

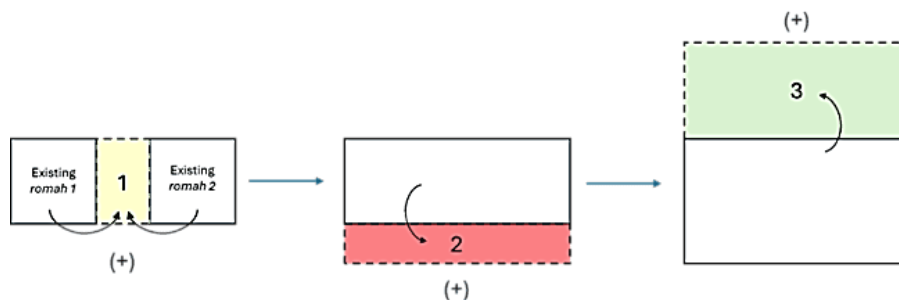
Both types of houses experience horizontal expansion, according to field observations on Tanean Lanjhang houses in Pamekasan Larangan Luar Village and the literature study on Osing houses in Kemiren Village Banyuwangi. However, the directions of development differ between them. Three categories of space expansion are distinguished in Tanean Lanjhang: (1) Middle Area Expansion: This refers to the expansion of the front terrace and the *long-longan* area as a result of the merger of two *bangsal* houses (see Table 1, House 1). (2) Middle and Back Area Expansion: This involves integrating kitchen features into the current house (see Table 1, House 3). (3) Expansion in the Middle, Forward, and Backward Directions: This involves growth in all three directions at the same time (see Table 1, House 2).

**Table 1.** Stages of Adding Tanean Lanjhang Space

	House 1	House 2	House 3
	Pegun Type	Bangsals Type	
Form that occurs due to increasing space			
Description:			

Source: author

Tanean Lanjhang's direction of space expansion is repetitive in all three houses. At first, more space is added in the center to fill in the gaps between the existing structures. This space is frequently used for a family room, bedroom, or storage area. The room then opens up to the front, where the terrace is usually utilized as a gathering place or a place to relax. Lastly, additional space is built at the back, typically for cooking areas and barns/cowsheds (see Figure 9). The Tanean Lanjhang complex's existing buildings' spatial functions are being transferred, resulting in the need for more space, especially at the back of the home. For instance, the second and third examples include additions at the back, whereas the first case does not have any. The reason for the differences is that the Tanean Lanjhang complex in the first example still has all its buildings, *kobhung*, *dapor*, *kandhang*, and *romah*, complete and active. In other situations, the Tanean Lanjhang complex is lacking in some functions, resulting in their addition to the house. Kinship connections and the need for additional room in the home as a result of one of the Tanean's functions being lost have an impact on the addition of space.



**Fig. 9.** Space Addition Pattern of the house case 1, 2, 3 in Tanean Lanjhang (Source: author)

The pattern of space increase in the Tanean Lanjhang home is always from the front (*amper*) to the back (*pawon*). However, in the Osing house, the amount of space added depends on the residents' lifestyle, number, and kind of activity (see Figure 10). The Osing tribe has a linear settlement pattern made up of *pawon*, *jrumah*, and *bale*, which are functions that proceed from front to back and are created from symmetrical and parallel spatial patterns (Noor et al., 2021). Consequently, Figure 11 illustrates the Osing house's pattern of space increase.

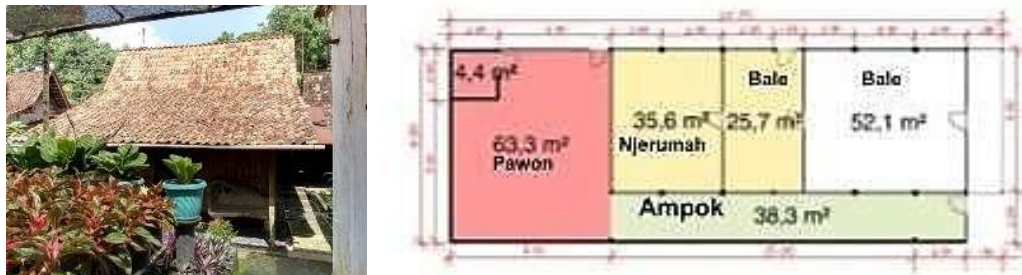


Fig. 10. Stages of Adding Osing House Space  
(Source: author, Google Map)

With a *tikel balung* roof style, the existing house operates as a *bale* (living room). Following it, there was a back extension with the same *tikel balung* roof that included a *bale* and *njerumah* (private family room). There's also an additional extension in the back that makes use of a *cerocogan* roof, used as a *pawon* (kitchen). In this particular Osing house, the *ampok* area acts as an enclosed space adjacent to the main room, increasing the total area of the building. Unlike in other Osing houses, where *ampok* is usually not a separate room, it adds to functional expansion rather than creating completely new functions. These additions to the Osing house were caused by the need for more space and the accommodation of additional family members.

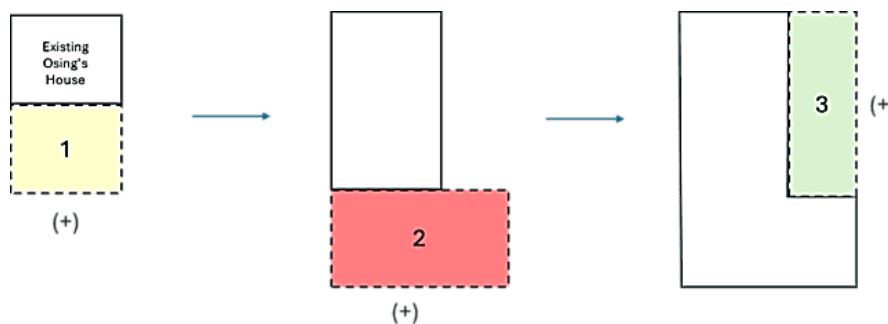


Fig. 11. Space Addition Pattern in Osing House  
(Source: author)

## Tectonics: Detail of Connections

### Tanean Lanjhang

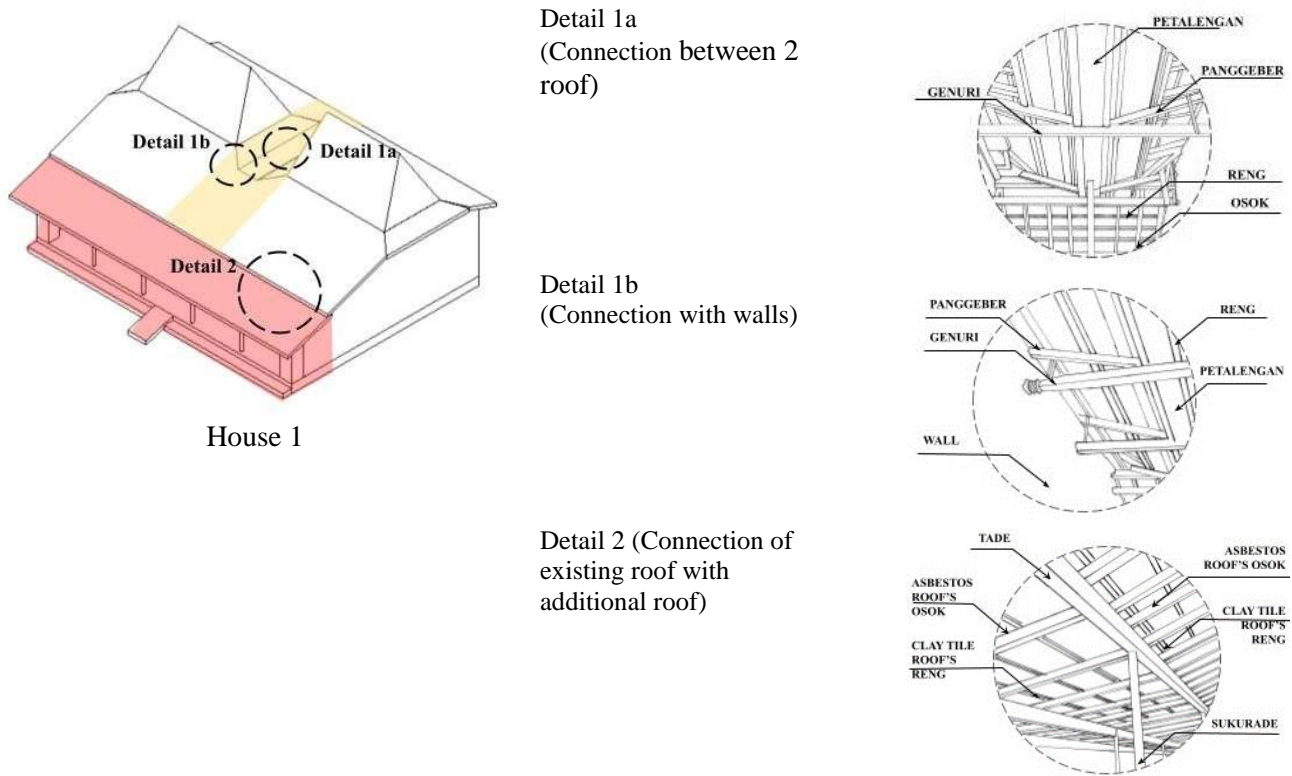
The traditional houses of Tanean Lanjhang have a connection between their old and modern room roofs. In the case of House 1, *pegun* type, connections occur between the two roofs of the *long-longan* room (between two sleeping areas) and on the terrace roof. A *petalengan*, or *gutter*, with two *reng* on either side is placed in the middle of the *long-longan* room at the connection of the two roofs to stop leaks (see Figure 12, detail 1a). With the *genuri* and *penggeber* positioned on the wall (see Figure 12, detail 1b), which support the overhang of these roofs, the wall in this house functions as a load-bearing wall. This part of structure is well-constructed and exposed to showcase/highlight the building process.

The new asbestos roof, supported by rounded *sukurade* poles and columns, replaces the building's old clay tile roof on the terrace. The spacing between *reng* and *osok* placement varies as a result; on tile roofs, the spacing is less than on asbestos roofs (see Figure 12, detail 2). Choosing to use asbestos for roofing may depend in part on installation ease and cost. To enable a smooth transition between the two roofs, the new terrace roof overlaps beneath the old roof. One side of the *sukurade*, which is made of round iron pipes, needs to be cut and attached to the *tade* in order to be connected securely.

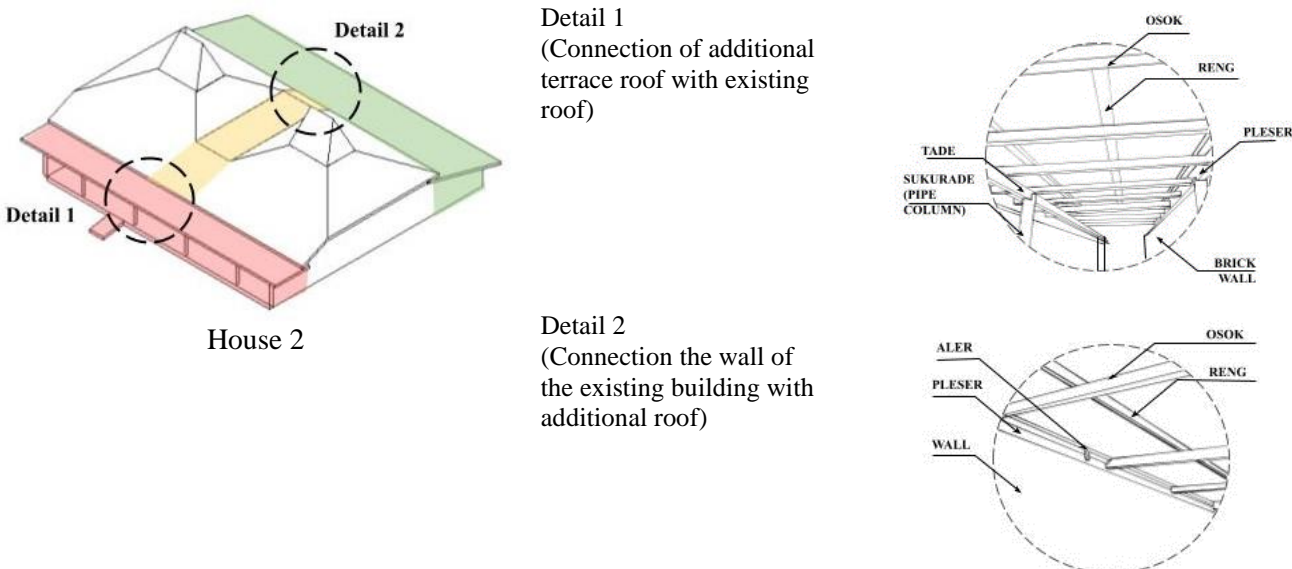
The types of *bangsal* in House 2 are connected by the roof of the current building with the terrace, by additional space at the back, and by the intersection of two roofs in the *long-longan* room. The pattern of roof construction and

expansion is identical to that of House 1 at the connection of the existing roof and the terrace extension (see Figure 13, detail 1). There are variations in the application and relationship between the *tade* and the *sukurade*. The *sukurade* used in House 2 is bigger in diameter than the ones used at House 1. The difference is due to House 2's bigger span and spacing between columns as opposed to House 1's usage of larger-dimension columns at the terrace's end.

The *sukurade*'s installation is another difference. The diameter of the huge *sukurade* is greater than that of the *tade*'s surface. As a result, to support and lock the *tade* during installation, a hole must be pierced through the *sukurade*. To increase rigidity, the *tade* is then fastened with nails. The expansion at the back of the home has an additional roof that overlaps the current roof where it meets the existing one to ensure a more organized meeting between the two and to avoid leaks from rain. This is clear from the extra roof structure that supports the extra *aler* on the *pleser* and the *osok* above it on the existing wall. This suggests that the new roof is supported by an existing (old) frame (see Figure 13, detail 2).



**Fig. 12.** House 1 Connection Details  
(Source: author)



**Fig. 13.** House 2 Connection Details  
(Source: author)

House 3's case differs significantly from the previous two. The terrace is not expanded in this house, as seen by the width, which is achieved with a single-column module. The back of the house has a large extension, though. The *pleser* portion of the wall is supported by a wooden structure on the roof at the back (see Figure 14, detail 1). The main distinction between this and the back addition in House 2 (see Figure 13, detail 2) is the type of roofing material chosen. Clay is the new roofing material added to House 3, matching the roof's current composition.

The type of *bangsai* in House 3 has a special relationship that is uncommon in other houses. The connection is made between the addition of a *trompesan*-style roof over the kitchen and cowshed and the main roof extension (see Figure 14, detail 2). Thin bamboo *tades* and *sukurades* made from small-dimensional bamboo support the connection. Because there is additional support for the structure on both the left and right sides of the connection, this is possible. The low distance between the floor and the roof structure is probably the reason for the usage of thin beam components. On a bamboo *tade*, the *osok* from the *trompesan* roof and the current roof overhang converge and are nailed together. There is a *petalengan* with two *reng* on either side above the *osok* arrangement. Although both connect two sides of a sloping roof, this form of connection is very different from the one above the *long-longan* area. At the *long-longan* roof connection, the *osok* does not meet and instead halt at the *reng* flanking the *petalengan*. Even though it does not seem like this meeting was scheduled in advance, this arrangement organizes the look of the *osok*. On the other hand, the *reng* meet and are situated below the *petalengan* at this point of connection.

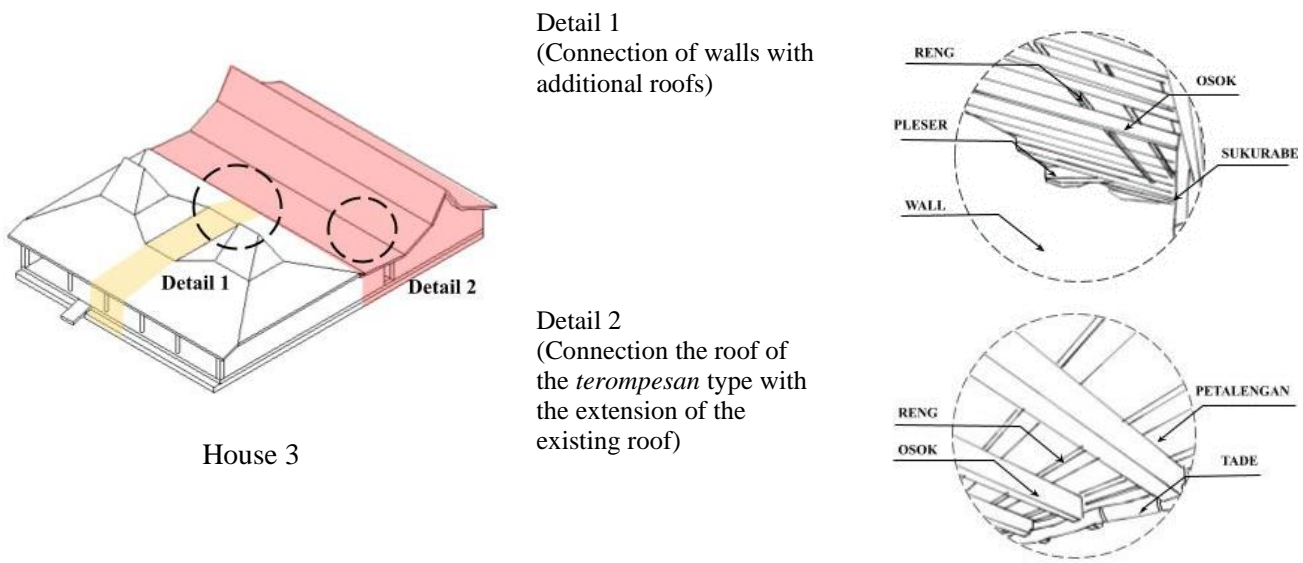


Fig. 14. House 3 Connection Details (Source: author)

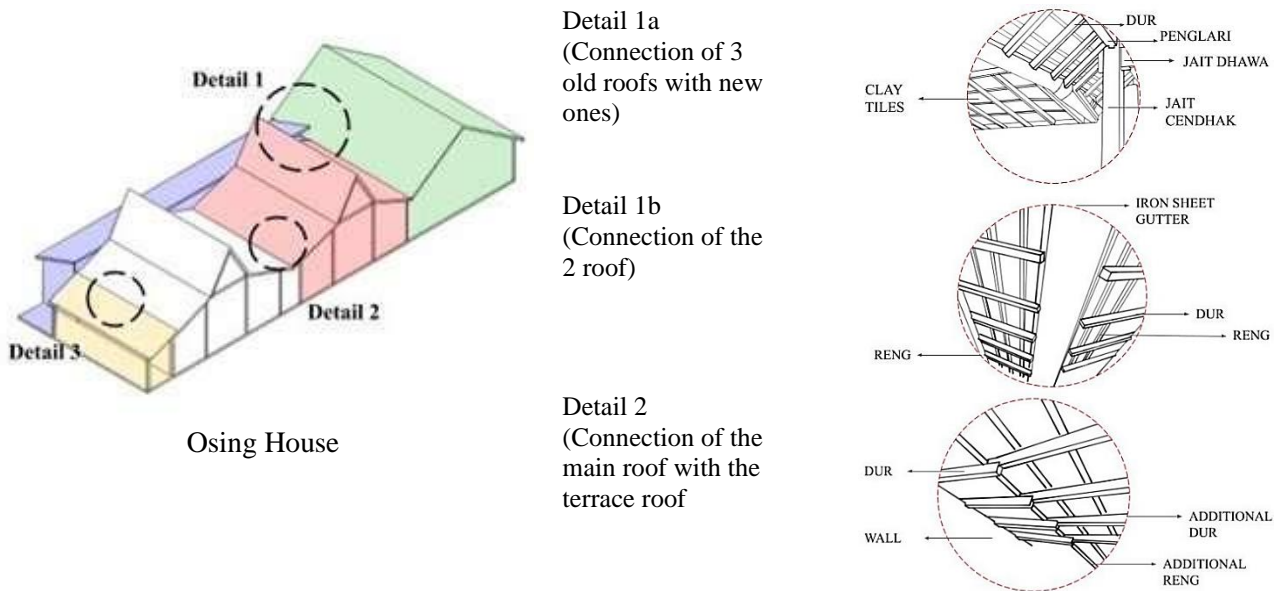
Four different types of tectonics are present at the connection details, based on three cases in Tanean Lanjhang: The first form, which uses *petalengan* supported by *genuri*, is located at the meeting point of the roof above the *long longan*. The second kind is located where the *reng* of the two overlapping roofs is connected and the *petalengan* is supported by *tade*, at the meeting point of the *trompesan*-type roof and the sloping roof extension. The third kind is seen in the terrace area, where two metal roofs overlap each other without the need for a *talang*, with the new roof sitting beneath the old. The fourth variety is positioned in the rear of the home, where the newly installed roof structure is situated and rests against the wall beneath the existing roof.

**Osing House**

In Osing buildings, the transition between the new and old roofs is connected by an unusual gutter at the intersection of the three roofs, which is formed of an iron plate in the shape of a U (see Figure 15 detail 1). This gutter's unique shape ensures that its incline fits with the nearby roofs by matching the form and slope of the roofs. Installing the iron plate gutters at various angles allows them to connect perfectly and stop leaks. To protect the building from potential damage, the three gutters that are nearest to the edge of the roof are additionally reinforced to withstand the weight of rainfall.

A similar model is used when connecting two roofs, either *tikel balung* roof to *tikel balung* roof or *tikel balung* roof to *cerocogan* (see Figure 15 detail 2). Here, the iron plates serve as gutters, held in place with nails and flanked by *reng*. The building technique and specifics of the connections between two or three roofs are the same; the primary differences are in their slopes. During construction, the terrace roof is integrated on their own which makes it different from the main and new roofs. It is stabilized utilizing the half-lap technique and supported by the main building's roof.





**Fig. 15.** Osing House Connection Details  
(Source: author)

**Table 2.** Comparison Table of *Talang* Support Construction and Terrace Roof Connection Structure in Tanean Lanjhang and Osing House

House Type	Tectonics	
Tanean Lanjhang		
	<p><i>Long-longan</i> on house 1, 2, and 3</p>	<p>Terrace in house 1 and house 2</p>
	<p>Connection between existing roof and extension at the back of the house 3</p>	<p>Extension of the roof of the house 2</p>
Osing House		
	<p>The connection of two sloping roofs</p>	<p>Terrace</p>

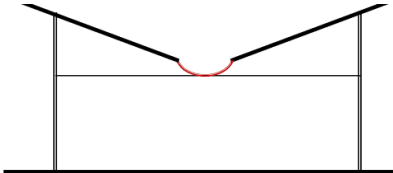

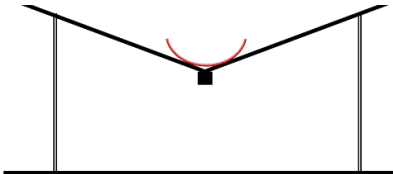

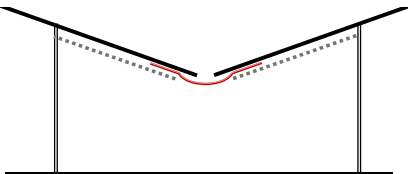
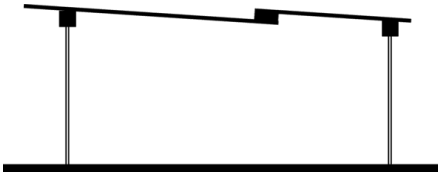
Source: author

Two distinctive classifications can be identified by looking at the construction methods used in Osing houses. First, there are connections between the main roofs. Rigid iron sheets are secured to the roof's *reng* and nailed in an arch shape to secure the connection of two roofs. The roofs in this instance are not joined directly. The second type can be found at the connection of the terrace roof and the main roof. The second type of connection happens on the *osok*, where the half-lap joint is used to support the terrace's roof on top of the main building. Table 2 illustrates how the tectonic method used by the local artisans during the construction of Tanean Lanjhang and Osing vernacular houses is highlighted by these structural characteristics.

The connections created by additional rooms in Tanean Lanjhang and Osing houses indicate the craftsmanship and expertise of the locals in construction. Despite the essential similarities between these structures, they use distinct features that highlight their uniqueness and character. Their techniques are simple and make use of easily accessible material, cost-effective, and easy-to-install components. Local resources like *Sukarno* wood are widely utilized in Tanean Lanjhang for wall and structural construction. On the other hand, Osing homes usually make use of *bendo* wood and bamboo, both of which are common. Tanean Lanjhang connections frequently use additional connectors, such as nails, and rely on the walls for structural support. However, in Osing houses, some elements use basic wooden joints because Osing houses were meant to be disassembled and reconstructed (knock-down technique). Both types of houses show off their raw construction while also emphasizing the special qualities of the added parts. They do this by displaying the beauty of the construction and the local expertise.

Two main tectonic focuses are revealed through studying structural components at the connection of Tanean Lanjhang and Osing houses: vernacular houses with gutters (*talang*) and those without gutters. There are specific differences in gutter placement amongst traditional houses with gutters, detailed in Table 3.

**Table 3.** Comparison Table of Gutter Support Structure and Terrace Roof Connection Structure in Tanean Lanjhang and Osing House

House Type	Tectonics	
Tanean Lanjhang	 <p data-bbox="403 1144 762 1173">Long-longan on house 1, 2, and 3</p>	 <p data-bbox="959 1144 1394 1173">Extension of the rear roof of the house 2</p>
	<p data-bbox="435 1218 738 1247"><i>Talang</i> supported by <i>genuri</i></p>	<p data-bbox="871 1205 1481 1265">There are no gutter (<i>talang</i>) at the back of the house. <i>Osok</i> rests on <i>pleser</i> and <i>pleser</i> supported by brick walls</p>
	 <p data-bbox="323 1464 847 1525">Meeting between the existing roof and extension at the back of the house 3</p>	 <p data-bbox="1038 1473 1310 1509">Terrace in house 1 and 2</p>
	<p data-bbox="339 1570 834 1630">The gutter (<i>talang</i>) rest on the <i>osok</i>, while the <i>osok</i> is supported by the <i>tade</i></p>	<p data-bbox="874 1554 1477 1644">The meeting between the existing and new roofs lies in the <i>tade</i> element. The tile roof's <i>osok</i> (existing) rests on the <i>tade</i>, while the asbestos roof's <i>osok</i> meet on the <i>tade</i>.</p>
Osing House	 <p data-bbox="403 1845 769 1877">The meeting of two sloping roofs</p>	 <p data-bbox="1134 1845 1214 1877">Terrace</p>
	<p data-bbox="323 1921 852 2011">Gutter is made of iron sheets, not a pipe. There is no pedestal as a buffer for gutters from below. Most likely, the iron sheet nailed to battens</p>	<p data-bbox="874 1906 1477 2024">There are no gutters on the terrace. The insufficient length of <i>dur</i> may cause the meeting between the roofs, so it can be seen from the old <i>dur</i> structure stacked by the new <i>dur</i> structure</p>

Source: author

## CONCLUSION

The Tanean Lanjhang and Osing houses have different patterns of horizontal growth in their room layouts. Tanean Lanjhang houses increase their capacity in several methods, including by joining two rooms in the middle (called *long-longan*), adding two *romah* (right-left), and growing the front (terrace) and back (*dapor*) sections of the building. Osing houses, on the other hand, grow symmetrically and linearly from the front to the back. The characteristic tectonic aspects of Tanean Lanjhang and Osing houses are a result of these unique expansion techniques, and they may be recognized by several types of recognizable patterns. Tectonic characteristics specific to Tanean Lanjhang include roof-gutter connections supported by *genuri*, roof-gutter connections resting on *osok*, roof connections without gutters using *tade* elements, and roof connections without gutters on the terrace. Similarly, Osing houses feature two main tectonic patterns: roof-gutter connections between primary roofs and roof connections without gutters on the terrace.

## REFERENCES

- Agusniansyah, N., & Widiastuti, K. (2016). Konsep pengolahan desain rumah tumbuh. *MODUL*, *16*(1), 1–12. <https://doi.org/10.14710/mdl.16.1.2016.1-12>
- Al-Alwan, H., & Mahmood, Y. B. (2020). The connotation of tectonics in architectural theory. *IOP Conference Series: Materials Science and Engineering*, *745*(1), 012161. <https://doi.org/10.1088/1757-899X/745/1/012161>
- Asmarani, I. K., Antariksa, A., & Ridjal, A. M. (2016). Tipologi elemen arsitektur rumah bangsal di Desa Larangan Luar Pamekasan Madura. *Tesa Arsitektur*, *14*(1), Article 1. <https://doi.org/10.24167/tesa.v14i1.514>
- Frampton, K. (2001). *Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture*. MIT Press. Retrieved from <https://www.ardhindie.com/get-ebook/file.php?id=j2dL02m1AMEC&t=studies-in-tectonic-culture&a=kenneth-frampton&p=MIT%20Press&h=452&d=2001-08-24&i=0262561492>
- Kusdiwanggo, S. (2018). Disiplin keilmuan arsitektur nusantara riwayatmu nanti. *Jurnal Lingkungan Binaan Indonesia*, *7*(3), Article 3. <https://doi.org/10.32315/jlbi.7.4.235>
- Maharani, A. C., Nugroho, R., & Marlina, A. (2021). Penerapan arsitektur neo-vernakular pada galeri seni pertunjukan di Banyuwangi. *Senthong*, *4*(2), Article 2. <https://jurnal.ft.uns.ac.id/index.php/senthong/article/view/1353>
- Mentayani, I. (2012). Menggali makna arsitektur vernakular: Ranah, unsur, dan aspek-aspek vernakularitas. *LANTING Journal of Architecture*, *1*(2), 68–82.
- Noor, I. M. K., Siwalatri, N. K. A., & Widiastuti. (2021). Konsep arsitektur rumah adat Suku Osing di Desa Kemiren, Banyuwangi. *RUANG: Jurnal Lingkungan Binaan (SPACE: Journal of the Built Environment)*, *8*(2), 95–110. <https://doi.org/10.24843/JRS.2021.v08.i02.p02>
- Putrawan, I. M. D., Agusintadewi, N. K., & Widiastuti, W. (2021). How the communal buildings created? socio-spatial transformation of the Osing in Kemiren Village towards social sustainability. *Local Wisdom : Jurnal Ilmiah Kajian Kearifan Lokal*, *13*(2), Article 2. <https://doi.org/10.26905/lw.v13i2.5184>
- Raihan, M., & Sulthan, F. (2020). Penerapan konsep rumah tumbuh pada teknologi struktur RISHA (Rumah Instan Sederhana Sehat). *Applicable Innovation of Engineering and Science Research (AVoER)*, 355–362.
- Rizka, H., Defiana, I., & Noerwasito, V. T. (2023). The thermal performance of Osing Houses in the Banyuwangi as humid tropical references. *IOP Conference Series: Earth and Environmental Science*, *1157*. <https://doi.org/10.1088/1755-1315/1157/1/012006>
- Salamat. (2022). Etika masyarakat Madura dalam tradisi Tanean Lanjhang. *Arete: Jurnal Filsafat*, *8*(2), Article 2. <https://doi.org/10.33508/arete.v8i2.4014>
- Sari, A. K., Budiarto, M. T., & Ekawati, R. (2022). Ethnomathematics study: Cultural values and geometric concepts in the traditional “Tanean-Lanjang” house in Madura – Indonesia. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *7*(1), Article 1. <https://doi.org/10.23917/jramathedu.v7i1.15660>
- Tulistyantoro, L. (2005). Makna ruang pada Tanean Lanjang di Madura. *Dimensi Interior*, *3*(2), Article 2. <https://doi.org/10.9744/interior.3.2>
- Wijaya, P. Y., & Purwanto, S. A. (2017). Studi rumah adat Suku Osing Banyuwangi Jawa Timur. *Buku Prosiding Simposium Nasional Rekayasa Aplikasi dan Perancangan Industri (RAPI) XVI Tahun 2017*. <http://publikasiilmiah.ums.ac.id/handle/11617/9522>

