

Ethnomathematics in The Gayo Traditional House (Case Study of *Umah Kantur*, Kung Village, Pegasing District, Aceh Tengah)

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INFORMASI ARTIKEL

Abstract: *Umah kantur* is a traditional house in the form of a house on stilts built in 1925. *Umah kantur* was built under the influence of the development of traditional houses such as *umah pitu ruang* and *rumoh Aceh*. The typology of geometric shapes in *umah kantur* has similarities with the types of traditional houses. Like traditional houses, the construction of *umah kantur* is carried out using ethnomathematics methods. This study aims to identify the typology of elements in the *umah kantur* and determine the measurement system in the *umah kantur*. The research method is descriptive qualitative with data collection techniques through collecting primary data, secondary data, and computing. After data collection and computation, the results show that *umah kantur* adapts the characteristics of *umah pitu ruang* and *rumoh Aceh* with the building measurement method using *sara jengkal* (span) and *sara pungu* (cubit) of the selected people.

Keywords: *Gayo traditional house, umah kantur, typology, geometry, ethnomathematics*

Abstrak: *Umah kantur* merupakan sebuah rumah tradisional yang berbentuk rumah panggung yang dibangun pada tahun 1925. *Umah kantur* dibangun di bawah pengaruh perkembangan rumah tradisional pada saat itu seperti *umah pitu ruang* dan *rumoh aceh*. Tipologi bentuk geometri pada *umah kantur* mempunyai kemiripan dengan kedua jenis rumah tradisional tersebut. Sebagaimana rumah tradisional pada umumnya, pembangunan *umah kantur* dilakukan dengan metode etnomatematika. Tujuan penelitian ini untuk mengidentifikasi tipologi elemen pada *umah kantur* dan mengetahui sistem pengukuran pada *umah kantur*. Metode penelitian pada penelitian ini berjenis deskriptif kualitatif dengan teknik pengumpulan data melalui tahap pengumpulan data primer, data sekunder, dan komputasi. Setelah dilakukan pendataan dan perhitungan, diperoleh hasil bahwa *umah kantur* mengadaptasi karakteristik *umah pitu ruang* dan *rumoh Aceh* dengan metode pengukuran bangunan menggunakan *sara jengkal* (span) dan *sara pungu* (hast) orang terpilih.

Kata Kunci: rumah tradisional Gayo, *umah kantur*, tipologi, geometri, etnomatematika

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INTRODUCTION

The Gayo tribe is a tribe originating from Aceh Tengah, Aceh Province. One of the Gayo cultural heritage we can still find today is the traditional house building that characterizes the customs or traditions of that time and traces of past history. The Gayo tribe has a traditional house known as *umah pitu ruang*. One of the *umah pitu ruang*, whose physical form is still visible today, is located in the village of Kung., Pegasing, Aceh Tengah. This house widely known as *umah kantur*. More than 50 years ago, *umah kantur* was built by

a *reje* or government leader. It was not only a place to live. It was also the centre of government and culture in its time.

Partiwi et al (2022) argue that Gayo traditional houses are one of the works of art that reflect the culture of the Gayo tribe. Culture in society plays a big role in influencing the construction of houses. Rosita (2019), in the culture of traditional houses there is ethnomathematics which is implemented by the community in their daily life. Without realizing it, the value of ethnomathematics in society is the basis of mathematics in the local area. Same as traditional houses in general, during the construction of *umah kantor*, they still used ethnomathematics or the methods used by the cultural group in counting, measuring, and designing activities such as using body parts as measuring tools. *Umah kantor* has peculiarities where from the construction until now, only a few changes have occurred in the formation of the house elements.

Nowaday, *umah kantor* is one of five *umah pitu ruang* buildings. Among the five *umah pitu ruang* that still exist, four of them are replica *umah pitu ruang* buildings built by the government. The rest are non-replica houses, one of them is *umah kantor*. The five houses are not used as dwellings, but as objects of history and research. Gayo people today are rarely built *umah pitu ruang* as a dwelling house due to several factors. According to Hikmah (2022), the negative impact of the decline of this house is the disappearance of Gayo tribe characteristics contained in the traditional Gayo dwelling/house form. In line with that, Hikmah (2022) added that the reduction of Gayo traditional houses can result in the reduction of Gayo people's knowledge of their own culture. According to Wanabuliandari (2017), the reduction of people's knowledge of culture can be helped by studying ethnomathematics in traditional houses. Ethnomathematics can be a means of developing cultural values and introducing culture to the community. Yustinaningrum et al (2018), *umah pitu ruang* is one of the cultural works that contains ethnomathematics value in it. From previous research, studies about ethnomathematics in traditional Gayo houses, especially *umah kantor*, have not been found. *Umah kantor* is a research priority because this house is an *umah pitu ruang* which has a high authenticity value of *umah pitu ruang*. In research on *umah pitu ruang*, it is very rare to use research related with ethnomathematics to see history and culture. Therefore, researchers are interested in studying the classification of types of elements with ethnomathematical studies in the *umah kantor*. This research aims to identify the typology and to know the measurement system of the *umah kantor*.

RESEARCH METHOD

This research is a qualitative descriptive type with descriptive analysis techniques to produce descriptive data with written words (Putra et al., 2021).

Secondary Data Collection

In research, data collection is important to complete information related to the research object. The data collected becomes supporting data, references, and comparisons from data found in the field—secondary data is used in the form of literature from several journals and books.

Primary Data Collection

Primary data was obtained by direct observation of the object of research. Activities undertaken to obtain primary data are:

- a. Make direct observations of the object of research, *umah kantor*. This observation

aims to determine the physical state of the research object.

- b. Conduct interviews with parties related to the object, such as homeowners and historians. Interviews can produce data, direct explanations about the object, and the history of the object.
- c. Documentation is carried out as a complement to the data obtained in the form of photographs. This documentation aims to clarify the physical form of the research object.

Computing

After collecting primary and secondary data, the data is processed in the form of digital modelling using the SketchUp Pro 2022 software. Modelling aims to visualize the research object.

Data Analysis

It analysed and reviewed the data associated with typological theory, arranged in categories and groupings and displayed in descriptions, tables and figures. The discussion uses a theoretical framework as a reference in preparing the report to obtain the aims and objectives of the research.

Research Site

The research location is in Kung Village, Pegasing District, Aceh Tengah which is part of Aceh Province (Indonesia) where Pegasing District is an extension of Bebesen District.

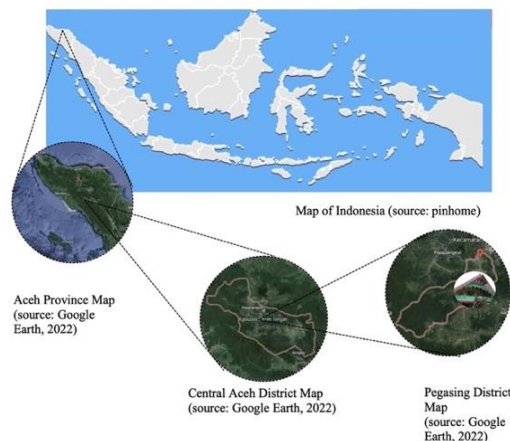


Figure 1. Research Location

Source: pngwing and Google Earth, 2022

DISCUSSION AND RESULTS

Gayo Culture

Gayo first appeared in the Malay literature of the Hikayat Raja-Raja Pasai (Arfiansyah, 2020). The saga contains stories about the kings of Aceh from 1280 to 1400. According to the saga, a group refused to be converted to Islam by envoys from Mecca. The group then ran with the Peusangan River flow upstream and was called Gayo. The word "Gayo" is believed to be a modification of the word from the Acehnese ethnicity, which comes from the word "ka yo", which means fear. Meanwhile, according to Ibrahim in Husaini (2020), the Gayo Nation came from the Old Malay people who came and lived in the Jamboe

Ayee, Tamiang River and Peureulak River areas. Then the Malays followed the river until they arrived in the central part of Aceh and developed in the Linge area and Gayo Lues.

Traditional architecture is a form of invaluable cultural heritage and is a deposition of phenomena from time to time that takes place coherently and evolutionarily (Ramadan, Umar, and Kadir, 2021). For areas with many relics of traditional buildings, it is very helpful to get various types of traditional houses that have existed (Salwin and A, 2019). Traditional houses are a cultural asset and identity of the Acehnese people and are symbols of the embodiment of technological, social and cultural systems for traditional Acehnese communities. Traditional architecture is the architecture and systems that are built that grow and develop in a traditional community that still influences the behaviour and values of life collectively (Sahputra and Edytia, 2021).

According to a traditional Gayo house is a design built jointly by the community and used for deliberation and traditional activities (Pinan, 1998). The traditional Gayo house is on stilts and has a facade typology that is not much different from rumoh Aceh. The Gayo traditional house is not an ordinary stilt house like traditional houses in other Aceh regions. The Gayo traditional house is a stilt house with seven rooms (*umah pitu ruang*). There are four bedrooms (*umah rinung*), a men’s veranda (*serami rawan*), a women’s veranda (*serami banan*), and a terrace (*lepo*) on the front of the house (Beruh, 2018).

Typology

Aisy and Anisa (2020), typology concerns the type of building in a particular situation in the city. Typology refers to concepts and consistency that can make it easier for people to recognize parts of architecture. Typology is a science or study activity to find types and classify an object (Lang, 2017). It must be based on related variables that can explain the phenomenon of an object in this context, namely its architectural object. According to Moneo in (Faisal and Ikaputra, 2022), typology studies various types. Typology in architecture can be interpreted as an attempt to find or trace the origins and origins of the formation of an architectural design. Typology is a science and knowledge that focuses on identifying types and characteristics and classifying or grouping an object, or can also be called taxonomy (Faisal and Roychansyah, 2014).

Geometry (Ethnomathematics)

Mathematical concepts in traditional houses are seen from ethnomathematics. It can be found, namely, flat shapes, spatial shapes, number patterns, and one-dimensional geometry, as well as implementing ethnomathematical forms found in society. Ethnomathematics in traditional houses is related to measuring, designing buildings, and some mathematics learning and implementing learning (Saputra et al., 2022). According to Krisnawati in (Yuningsih, Nursupriana, and Manfaat, 2021), ethnomathematics is the rational use of mathematical concepts and ideas in the cultural living space of society if studied more deeply, mathematics results from historical and cultural processes that develop along with the contribution of society and culture.

Tabel 1. Elements classification of Umah Edet Reje Baluntara

Size Name	Dimension
Hasta	±45 cm
Depa	±180 cm
Satu ruas jari	±2,5 cm
Jengkal	±21 cm

Size Name	Dimension
Satu telapak tangan	±20 cm
Satu jari	±10 cm
Satu telapak kaki	±25 cm
Satu langkah	±100 cm

Source: personal documentation, 2022

History of Umah Kantur

Umah Kantur is a traditional Gayo house in Kung Village, Pegasing District, built from 1925 to 1933. *Umah kantur* was built by Reje Nyak Ali or known as Reje Wekes, the leader of the pegasing area at that time. Reje Nyak Ali has three daughters and one son; the shape and number of rooms at the beginning of the construction of the *umah kantur* were adjusted to the number of residents. Based on the results of an interview with Abdullah (4th descendant of Reje Nyak Ali), the typology of *umah kantur* was influenced by the typology of other traditional houses that were developing at that time. In 1940, Japan converted the house into an office. Therefore, until now, this house is known as *umah kantur* (office house in Gayo). There was no significant change in the *umah kantur*. Changes occur in roofing materials, floor materials, and the transfer of space functions.



Figure 2. Umah Kantur

Source: personal documentation, 2022

Development of the Typology of Umah Kantur



Figure 3. Lisplank (belbes)

Source: personal documentation, 2022



Figure 4. Ventilation (*pepir*) and ornaments on the top of the exterior

Source: personal documentation, 2022



Figure 5. Carving on the top of the *lepo*

Source: personal documentation, 2022



Figure 6. Ornaments on the facade columns

Source: personal documentation, 2022

Umah kantur is a house on stilts that is dominated by wood. A ladder (*kite*) is at the front of the main entrance. The stair in the *umah kantur* has six rungs. The walls of the *umah kantur* use wooden boards arranged vertically. *Umah kantur* also has many windows on the house's front and sides. The windows in the *umah kantur* have various sizes. In contrast, the shape of the roof used in the *umah kantur* is a saddle shape. Gayo ornaments are rare in *umah kantur*. Ornaments can be found on the lisplank (*belbes*), ventilation (*pepir*), the top on the exterior, the top of the *lepo* (terrace), and the columns on the front facade. In general, the condition of the house is still livable. However, some parts of the house are starting to get damaged due to age and lack of maintenance. The front of the house is in better condition than the back.

Changes in floor elements from bamboo slats to wooden planks occurred in 1979. The material was different because the wooden planks were more robust than the previous material. The ornaments found in the *umah kantur* have not changed; only damage has occurred. In the roof, elements changes occur in the top covering material. The *serule* leaf material is replaced with zinc material because the *serule* leaf is hard to find and requires high maintenance costs. The wood material replaced the roof structure.

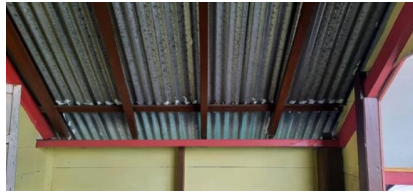


Figure 7. Roof Material

Source: personal documentation, 2022

Changes also occur in the typology of space. These changes include the transfer of the function of the bili (room) into a foyer. The door on the room's wall adjacent to the living room is removed. Then, there is the addition of stairs in the house's interior that connects the house on stilts to the landed house below. Changes are influenced by the needs of the house's occupants for the new function.

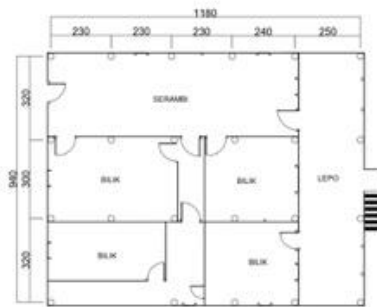


Figure 8. the oldest version of *umah kantur* plan (result of interview with Mrs. Mariam)

Source: personal documentation, 2022

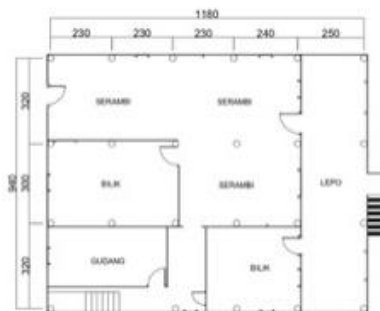


Figure 9. Current plan of *umah kantur* in 2022

Source: personal documentation, 2022

Geometry Concept

Umah kantur's facade has a different appearance from other traditional Gayo houses. The addition of the arch form to the facade is a direct idea from Reje Wekes the owner of the house. The height of the walls on the right and left of the *umah kantur* is shorter than the other traditional Gayo houses. At the front, there is a larger window than the other windows on the other sides. The difference in the form of the house is believed to be because Reje Wekes wants to look different; he doesn't want to have the same house as the others.

Umah kantur is divided into three parts: the lower, the body, and the upper. The column under the *umah kantur* is an 8-sided, or in Gayo language, it is called a waluh side.

The 8-sided column is the hallmark of the Gayo traditional house building. However, the columns in the *umah kantur* are round, like the *rumoh Aceh*. *Umah kantur*'s body comes from a rectangular shape combined with the triangular shape of the roof. The triangular roof on the *umah kantur* is the same as the houses in other tropical areas.

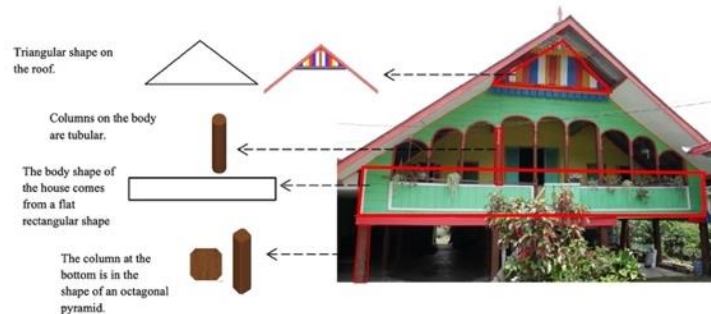


Figure 10. Geometry in *umah kantur*

Source: personal documentation, 2022

Gayo traditional houses are known for the splendour of the ornaments on the elements of the house. Ornaments are commonly found on the lower pillars and rucksack cover boards. However, in the *umah kantur*, no ornaments are found in the two parts. There are very few ornaments in the *umah kantur*.

Traditional Measuring Tools

The manufacture of traditional Gayo houses in ancient times did not use modern measuring tools such as meters. Measurements were carried out using the yarn measurement method. The yarn is made by spinning the *serule* leaf, where the length of the yarn follows the size of the most significant person's hand at that time. *Sara jengkal* (span) and *sara pungu* (cubit) are the main benchmarks for yarn size. At the same time, fingers are used for smaller sizes, such as the size of window frames.

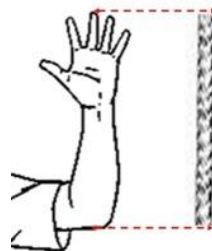







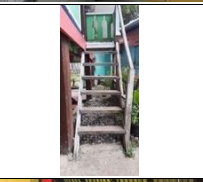

Figure 11. Illustration of yarn measurement

Source: compose by the author, 2022

The size of the house space is adjusted to the user's functions and activities. In one *bili*, there's a *sara olang* (one family) consisting of a wife, husband, and children. *Serami rawan* functions as a place to eat, discuss, and perform arts or for women's daily activities at home, such as weaving mats and making baskets. *Serami banan* is used as a place to cook. In comparison, *lepo* is where girls gather to do handwork and chat. *Lepo* is used as an area that is synonymous with the depiction of girls.



Elements Classification of *Umah Kantor*


Tabel 2. Original elements of *Umah Kantor*

Name	Original Elements
Pole (<i>Suyen</i>)	
Opening	
Ornament	
Joint	
Wall	
Ladder	
Roof Structure	

Source: personal documentation, 2022




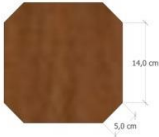

Tabel 3. Replaced elements of *Umah Kantor*



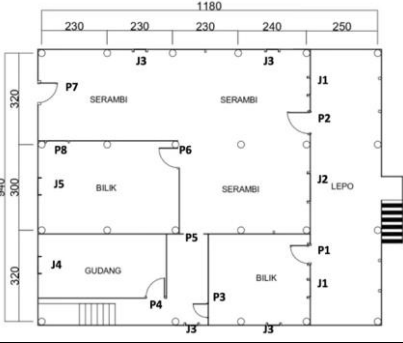
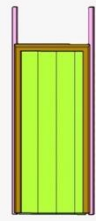
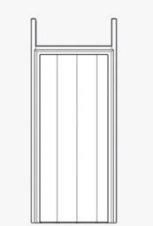
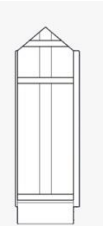
Name	Original Elements
Roof Covering	
Floor	

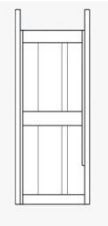
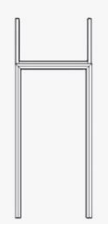
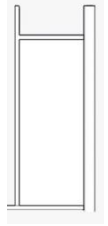

Name	Original Elements
Foundation	

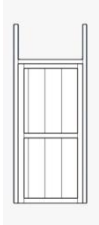


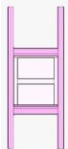



Source: personal documentation, 2022




Tabel 4. Elements of Umah Kantur

Name	Picture	Location	Characteristics
Wall		Located on most of the walls of the house.	wood board material
			Rectangular flat shape
Wall		Located in several parts of the wall as in the room. Plywood is used to coat wooden walls.	Shaped like a block room
			Wood thickness 2-2.5 cm
Floor		The whole room.	The width of one span of wood is arranged horizontally up.
			Wood plank material.
Column		Column at the bottom of the house.	Rectangular flat shape
			Shaped like a block room
Column		Top column	Wood thickness 2.5 cm
			One inch wide
			Shaped octagon / pyramid
			The diameter of one adult hug
			Circular/tube
			The diameter of one adult hug

Name	Picture	Location	Characteristics
		Practical column on the front view of the building.	Circular/tube Diameter of adult arms.
		Practical column on the body of the building.	Beam shaped.
			Have a frame
Door		P1	Door size 4 cubits x 2 cubits (assuming cubit length: $\pm 48\text{cm}$) Consists of 4 boards with a thickness of 2.5 cm The shape is rectangular
Door		P2	Door size 4 cubits x 2 cubits (assuming cubit length: $\pm 48\text{cm}$) Consists of 4 boards with a thickness of 2.5 cm The shape is rectangular
Door		P3	Has a right and left frame, but the top does not have a frame. The top of the door is triangular.

Name	Picture	Location	Characteristics
		P4	<p>Consists of 3 boards with a thickness of 1.8 cm.</p> <p>18 cm from the floor.</p> <p>Has no jamb</p> <p>Door size 4 cubits x 1.5 cubits (assuming cubit length: ± 48cm)</p> <p>The thickness of the door is 2 cm.</p> <p>The practical column doubles as a door frame.</p>
		P5	<p>Does not have a door.</p> <p>Just a frame.</p> <p>Size 4 cubits x 1.5 cubits (assuming cubit length: ± 48cm)</p> <p>Incomplete jamb.</p>
		P6	<p>The door leaf was covered with a tarp.</p> <p>Columns are used as frames.</p> <p>The door measures 4 cubits x 1.5 cubits. (assuming cubit length: ± 48cm)</p> <p>The thickness of the door is 2.5 cm.</p> <p>There is a beam under the door.</p>
		P7	<p>The door measures 5 cubits x 2 cubits. (assuming cubit length: ± 48cm)</p> <p>The thickness of the door is 3.5 cm.</p>

Name	Picture	Location	Characteristics
Window		P8	<p>There is a plywood connected to the door. Size 3.5 cubits x 1.5 cubits. (assuming cubit length: $\pm 48\text{cm}$)</p> <p>The thickness of the door is 3.5 cm.</p> <p>Consists of four wooden planks.</p>
		J1	<p>Window size 1 cubit x 1 cubit (assuming cubit length: $\pm 48\text{cm}$)</p> <p>Have 2 shutters</p>
		J2	<p>The window size is 3 cubits x 2 cubits. (assuming cubit length: $\pm 48\text{cm}$)</p> <p>Have 2 shutters</p>
		J3	<p>The window size is 1 cubit x 1 cubit. (assuming cubit length: $\pm 48\text{cm}$)</p> <p>Number of shutters 1</p>
		J4	<p>Window size 2 cubits x 1.5 cubits. (assuming cubit length: $\pm 48\text{cm}$)</p> <p>Number of shutters 2</p>
Ornaments		Lisplank (<i>belbes</i>)	<p>Carved ornaments are located on the lisplank on the left and right of the house.</p>
		Repel the wind (<i>pepir</i>) and ornaments on the exterior	<p>The ornament on the top of the exterior is an ornament of bamboo shoots.</p> <p>In the form of a sticky</p>

Name	Picture	Location	Characteristics
		Front facade	ornament. Part of the wall is attached to the front column. The ornaments on each column are different.
		Top of <i>lepo</i>	The form of geometric carvings. Combination of rectangles and regular hexagons
		stair railing	form of geometric carvings.

Source: personal documentation, 2022

Although it has undergone some changes, *umah kantur*, which has been standing for 90 years, still maintains the physical form of the house. According to Winandari (2017), maintaining the physical form of the house is one of the conservation efforts to maintain cultural continuity and sustainability. According to Triatmoko in (Darmawan, 2019), studies conducted on buildings with historical value are important to add insight about local history. Cheris and Rosetia (2022), community wisdom in managing and integrate with nature to fulfill their daily needs is a meaningful lesson for the current generation. The study of *umah kantur* as a cultural place will enrich knowledge about the history of Gayo society many years ago.

Modelling Umah Kantur



Figure 12. Front elevation

Source: personal documentation, 2022

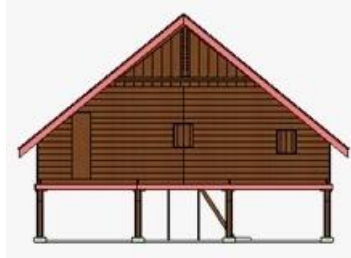


Figure 13. Back elevation

Source: personal documentation, 2022



Figure 14. Left elevation

Source: personal documentation, 2022



Figure 15. Right elevation

Source: personal documentation, 2022



Figure 18. Perspective

Source: personal documentation, 2022

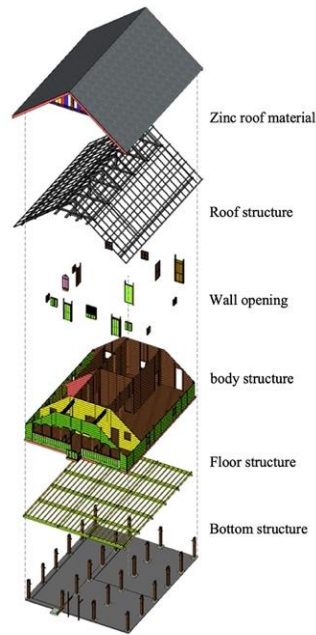


Figure 19. Exploded isometric
Source: personal documentation, 2022

CONCLUSION

Traditional house of the Gayo tribe is *umah pitu ruang*. *Umah kantur* is a traditional Gayo house that adapts the shape of the *umah pitu ruang*. Same as traditional houses in general, during the construction of *Umah kantur*, they still used ethnomathematics or the methods used by the cultural group in counting, measuring, and designing activities such as using body parts as measuring tools. This research aims to identify the typology and to know the measurement system of the *Umah kantur*. The methodology that this research used are collect primary and secondary data, digitalize the modelling using the SketchUp 2022, and analyze the founded data with typological theory. In general, the condition of *umah kantur* is still livable. However, some parts of the house are changed to mantain the condition. Changes occur in the paint of the house that right now use colours, roof cover material change from *serule* leaf to zinc material, and floor material change from bamboo to wooden planks. Changes also occur in the typology of space. These changes include the transfer of the function of the bili (room) into a foyer. The door on the room's wall adjacent to the living room is removed. Then, there is the addition of stairs in the house's interior that connects the house on stilts to the landed house below. Changes are influenced by the needs of the house's occupants for the new function.

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