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## Material Module Technology in Amartapura Apartment, Lippo Karawaci

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### ABSTRACT

Amartapura Apartment was one of the tallest and luxury apartments in 1987. The building consists of 2 towers with each floor: Tower A consists of 41 floors, and Tower B consists of 51 floors. Located in the elite area of Lippo Village Karawaci Tangerang-Banten, this apartment was developed by Lippo Developer Hyundai Development, which is a Joint Operation company between Lippo Land Development and Hyundai Corporation. This research intends to reveal the application of material module technology from the planning phase to the construction phase to be efficient in construction costs. The quantitative method through literature studies and virtual media, coupled with the personal experience of researchers who are directly involved in the project. Based on what is obtained from the results of research and field conditions, in the planning phase, the planner team did not discuss the use and application of material modules. So in the construction phase required very intense studies, simulations and adjustments related to the material module. To anticipate material waste that will directly affect project costs. This could happen because the number of apartments reached 700 units of bays (for two towers). For example, suppose that in an apartment unit, a ceramic tile is cut, so as a whole, there will be a huge "waste" (700 pieces of the remaining pieces will be discarded). Efficiency in the use of architectural materials (floor materials, walls, work aids/cutting tools) should have been planned and predicted from the beginning ever since the planning phase. So that in the construction phase, things like this will not result in wasteful costs. Considering Amartapura Apartments were built in large numbers.

**Key words:** material, module, apartment, Lippo, Karawaci

### 1. Introduction

Housing needs are the basic needs of every human being as a shelter and a means of fostering family. The area of Lippo Karawaci and its surroundings is an independent city development area located west Jakarta. It is one of the choices for residential locations in the form of apartments and landed housing.

Various problems in construction projects can result in material waste. Some problems occur because they do not consider deeply the use of industrial fabrication materials that have limitations in terms of size. The availability of skilled labor, poor coordination between the parties involved, mistakes in the selection of construction methods used and the weakness of project planning and control are also among the problems. Prevention of the occurrence of residual waste of building materials is essential to be considered involved by all parties. Material use planning must start from the planning phase, the estimation phase to the construction phase. Thus it can anticipate the uncontrolled residual material waste and ultimately can save construction costs. The purpose of this study is to determine the extent of the application of material module technology and how the implications for construction cost efficiency.

### 2. Method

This research uses descriptive quantitative research methods. Data obtained through a literature study. Data collection through the internet media and the experience of researchers directly involved in the project from the planning phase, the construction phase to the unit handover phase. The overall findings are presented descriptively, then analyzed by the theory to make the final results in the form of conclusions.



### 3. Literature Review

A modular system is a method of carrying out development by utilizing fabrication materials or components that are made outside the project site or inside the project site. However, it needs to be integrated in advance between the components (erection) where they should be or the position of the component [1].

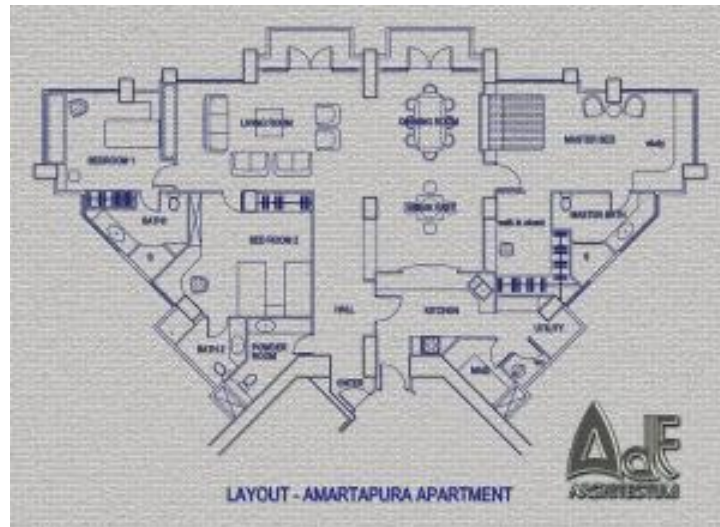
Modular construction refers more to the volumetric space, not as a part of the room, such as walls, roofs, or floors, but as a unit of space. An average modular has been completed 60% -90% off-site, i.e., inside the factory and then transported and assembled on the site of a project [2]. Material is one of the main elements in constructing a building that influences the quality of buildings produced, located in the strength and durability of the construction. The types of material can be divided into three categories [3]:

- a. Engineered materials, which are products that are made specifically based on planning and technical calculations. This material is explained explicitly in the drawings used during the implementation of the project. If there is a delay, it can affect the project completion schedule.
- b. Bulk materials, which are products made based on specific industry standards. This type of material is often difficult to estimate because of its various types, such as cables and pipes.
- c. Fabricated materials, which are products that are assembled outside the project site, such as sills and steel frames.

Several construction materials often cause waste, like bricks, sand, wood, iron, ceramics and cement [4]. Concrete iron, cement, sand, broken stone, brick and ceramic [5]. Formwork wood, reinforcing iron, brick, ceramic and gypsum/*kalsiboard* [6]. Cement, formwork wood, ceramics and gypsum board [7]. The residual construction material can be caused by a combination of several sources and causes [8]. Distinguishes from the remaining sources of construction materials in six categories; (1) design; (2) material procurement; (3) material handling; (4) implementation; (5) residuals; (6) and others.

### 4. Results and Discussion

Data obtained through literature study, internet and researcher experience, Amartapura apartments consist of: type 1 Bed Room consisting of 140 units = 20% (@ 36m<sup>2</sup>). Type 2 Bed Room consists of 322 units = 46% (@ 72 m<sup>2</sup>). Type three-bedrooms consist of 210 units = 30% (@ 144 m<sup>2</sup>) and Penthouses consist of 32 units = 4% (@ 216 m<sup>2</sup>). On one floor, there are 8-10 units of apartment bay. Floor to Floor building height is 300 cm (3m). The height of the floor to ceiling is 280cm (2.8m). The dividing wall between units is made of lightweight brick with a plastered + aci finish. While the wall between the rooms inside the apartment unit as a whole is made of gypsum board partition material 12mm thick (Drywall partition). The partition frame uses a metal stud, the gypsum board panel is mounted on two faces, and the inside of the wall is filled with rock wool. The standard apartment unit floor uses 40x40 cm of ceramic material. (there is an option to upgrade with marble or other floor materials, base on customer wants). Whereas for the ceiling in all rooms generally without a ceiling (the floor is not smooth and ready to paint), except in the bathroom and kitchen area where dirty water pipes and sewage pipes are installed with cement board ceiling.



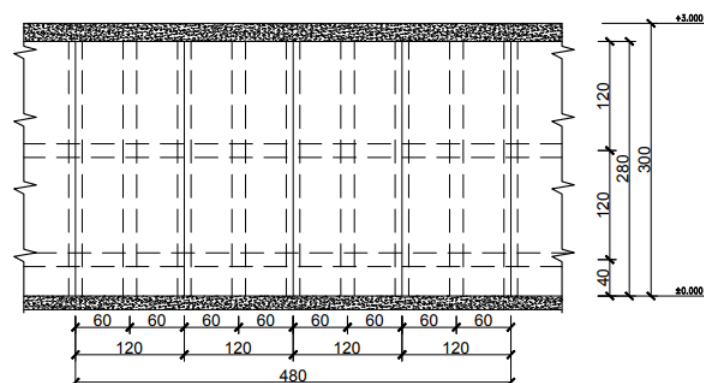
**Figure 1** Layout Unit three-bedrooms of the Amartapura Apartment  
Source: <https://adearchitectum.wordpress.com/about-us-2/>, 2020.

This research will focus on the application of fabrication material module technology, which uses Gypsum board + metal stud walls frame material and the use of ceramic flooring materials in unit type three-bedrooms.

#### a. Gypsum board material

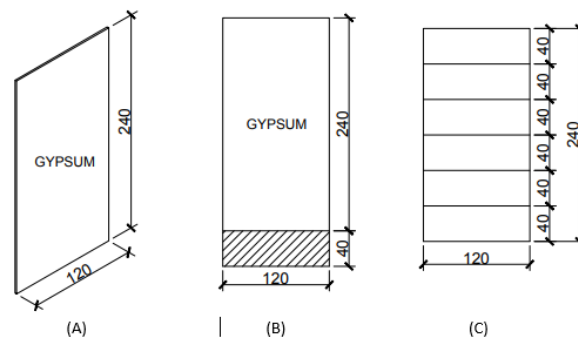
The Factory-standard module size per sheet is 122 cm x 244 cm. If applied to a wall of insulation between rooms in an apartment unit with a high Floor to Ceiling 280 cm, cutting will occur in addition to the less, like 40 cm on each sheet of gypsum on the front and back. This will result in cutting gypsum in huge quantities. As a result, the volume of work in the field will increase (cutting gypsum, Compound work, and extra screws at each connection). On the other hand, there is a possibility of damage during cutting. When storage is huge, considering the gypsum board material is vulnerable to damage on the former scavenging side.

As an example, the case will be discussed based on a plan type three-bedrooms. In one Unit Apartment type three-bedrooms, there are 128 m<sup>2</sup> partition walls (double side). This means that it takes 256 m<sup>2</sup> of gypsum board or equivalent to 91.5 sheets of standard module size gypsum board, 122x244cm. Also, it takes effort to cut the gypsum connection as many as 46 pieces to size @ 40 x 122 cm. Furthermore, if the number of type three-bedrooms is (30% of 700 by units) or equivalent to 210 units, there will be a cut of 46 x 210 gypsum, equal to 9,666 Gypsum Board.



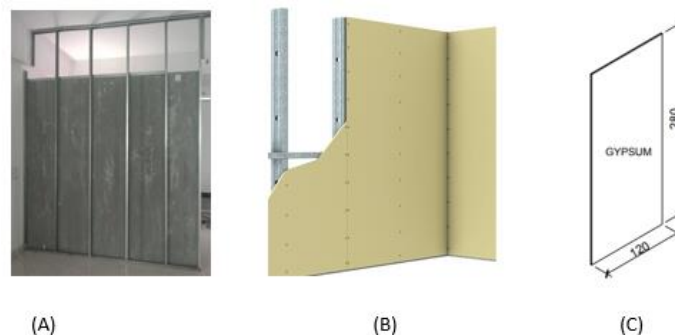
**Figure 2** Floor to Floor High of the Amartapura Apartment.

Source: Wiraguna, 2020.



**Figure 3** (A), Gypsum standard size, (B), Gypsum installation with one sheet intact and additional 40cm (welds), (C), Gypsum Cutting Pattern for adding 40cm as (welds) as many as 9666 sheets.  
Source: Wiraguna, 2020.

With the above conditions, it turns out that it is not predicted and no study of the use of the material in the planning phase. In the construction phase, a thorough discussion must be carried out, including re-study, whether it is possible to use *cut to size* measurements. Then what are the obstacles when using size 122x280 cm? Is there a factory that can and can produce this size?



**Figure 4** (A) Gypsum board installation uses standard factory sizes available on the market, so it is necessary to add 40 cm as a weld. Figure (B) and Figure (C) Gypsum material size cut to special size requirements to the factory, according to the needs of the field, height 2.8 m (280 cm) and installation.  
Source: <https://www.rondo.com.au/products/walls/>, 2020

### b. Metal Stud Material

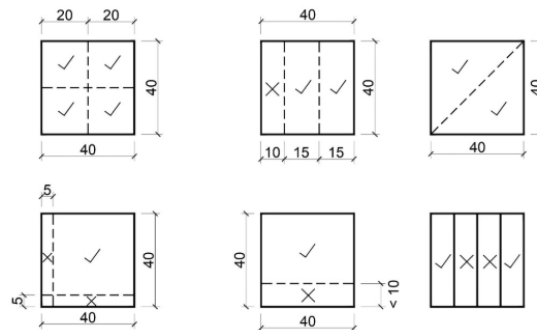
The sizes available in the market are the standard Module size length of 6 m (600 cm) per rod. Whereas what is needed for site conditions is a multiple of 2.8 m (280 cm) for the Vertical frame, and multiples of a length of 60 cm for the horizontal divider frame (in certain parts). So if you use a standard size Metal stud material, there will be 40 cm waste on each rod. Therefore, a Cut to Size metal stud is needed according to the size of the field's primary needs, like length 280 cm (2.8 m) for the Vertical frame. The length of 60 cm is for the horizontal divider frame, while the special extra dimensions can be anticipated from the factory standard size.

As a case in point, the researcher will discuss based on plan type 3 Bedroom. Each apartment unit type 3 Bedroom, partition wall area: 128 m<sup>2</sup>, each 1 m<sup>2</sup> partition wall requires an average of 3.3 m 'metal stud length. For a unit type 3 Bed room required 422 m 'length of the metal stud (for Vertical frames), or the equivalent of 70.33 rods of standard size 6 m long metal stud. Suppose each stem will be cut/thrown as much as 40cm (because what is needed is 280 cm x 2 = 560 cm). Then in every one-unit type 3 Bedroom apartment, there will be a waste of 70 x 40 cm = 2,800 cm (equivalent to 2.8 m). For the whole apartment type, 3 Bedroom waste will occur 2.8 m x 210 units = 588 rods of length 6 m.

### c. Floor Materials

Flooring materials used in Amartapura apartments for all types are 40x40 cm ceramic tiles. Except for units that the owner has upgraded to use materials other than ceramics, this can be done after the unit has been handed over. So all units in the construction stage are installed with ceramic floors. In this case, the room layout should pay attention to the size of the ceramic material module at the planning stage to minimize waste. The reality of this is not discussed in the planning phase so that in the construction phase, it becomes quite crucial and requires extra energy, time for adjustment.

With the design of the layout unit of the apartment unit that has diagonal wall lines, it will naturally become a very inherent part of cutting ceramic, not to mention if the size of the room is not a multiple of 40 cm. Ceramic cutting must be considered to minimize waste. The remaining pieces should be used as much as possible. For example: if the ceramic is cut into two equal parts, then all parts must be used, but if there is a cut that leaves less than 10 cm, then it will definitely be a waste material, and finally, in-efficiency.



Note: x sign = waste. The ✓ = can be used

**Figure 5** Ceramic cutting pattern schemes which can be reused and which cannot be used (become waste). (A) and (B) can all be used, (C) only two pieces can be used, and the rest discarded. (D) and (E) the rest is wasted. (F) Half of the ceramic is wasted.

Source: Wiraguna, 2020.

Based on the explanation above, the proposal is essential to consider and involve the size of the material module from the Planning phase, Estimation phase to the construction phase. To the best of researchers' knowledge, architectural planning consultants rarely discuss this in detail in the planning phase. Even if there was a thing that appeared and was initiated by the owner engineer team, in this case, researchers are very fortunate because they are on the Hyundai Development (Korea) team, so this has become a necessity for all project teams, especially researchers. All of this is aimed at tightening and saving construction costs. Control the quality of work and control of time and support environmentally friendly development is to minimize the remaining material.

### 5. Conclusion

Indeed, architectural planning does not only talk about artistic design and architectural interest but must produce an excellent comprehensive design from all related fields by the designation of the project.

Based on the analysis and discussion of the gypsum board, ceramics and metal stud are some materials that produce the most waste material. This happens in high rise building construction projects, especially apartments. Aside from a large number of pieces, the damage is also caused by damage, breaking during the transportation process from the warehouse to the installation site. The main effort to minimize material waste is to avoid cutting work on site. An in-depth and complete study is needed starting from the planning phase, the estimation phase and the construction phase. The application of effectiveness and efficient construction methods were done and the result was increased estimation accuracy. This can be realized effectively and continuously if supported by the

commitment of all parties involved, like the field supervisory team, quality control team, implementing the contracting team.

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