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Pre-fabricated Material for Modular House

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Abstract. This research identifies pre-fabricated materials which aim to save time and cost of making a modular house. The purpose of this study is to provide the best solution for the entire Indonesian population especially to the government and entrepreneurs who have a project about housing that there is an appropriate solution to reduce development costs, reduce development time and reduce the inefficiency of a typical residential house which is certainly more expensive than modular. Modular housing has a unique system and is certainly fast in the development process, usually a technology that is paid at a high price, but innovation is not always expensive. There are various types of modular home systems, but not all systems are compatible or compatible with climate conditions in Indonesia, but most modular systems are widely used in Indonesia. This research used descriptive analysis methods to explain the people growth in Indonesia, that increasingly very fast, so they need more house very fast too, and the next stage is to explain the prefabrication of materials that are appropriate to the climate in Indonesia. Besides, this study aims to obtain information on the types of pre-fabricated materials that can be used in the manufacture of modular houses and specifications from pre-fabricated. The results of this study explain that there is a prefabricated material module system in the form of single and double modules which are used in making modular houses, depending on the size and type of house. Therefore, this research is useful for architect and developer in choosing modular materials.

1. Introduction

The era that continues to grow is accompanied by Indonesia's population growth which is increasing significantly so that there are many needs, especially the need for housing. Finding a cheap house or shelter is certainly the right choice for housing, and when building it uses the concept of a modular house or prefabricated house. The modular or prefabricated house is a house building whose components are ready in the form of finished goods produced by the factory. Unlike conventional buildings whose walls are made of cemented cement, then painted, the prefab house just plugs in. In terms of price is certainly cheaper when compared to conventional homes, and modular homes have structure modules that have been set up so that they are ready for a partner and will cut the time of building a house.

There is a lot of research or development on this modular home system, almost all of the research results say that modular homes are the right solution for making environmentally friendly housing, price-friendly and work-friendly, here are some research results on the modular home concept system [1]. Research conducted by Edwin Randall Harris (USA) modular homes has a well-organized system. A rectangular module consisting of two panels tied to an internal webbing creates a basic building block where a united and bonded modular building can be erected [2]. The bonded building survives from Stresses' extreme and can be built from kit assembly. Thus, it is the main objective of this invention to provide a planned Structural Modular Unit. It is another object of the present invention to provide a Structural Modular Unit which is engineered for the construction of a



building. Each of the four inner corner posts is connected to an angled pillar to work together with the inside of the wall, thus forming an annular inner wall unit, such that the angular pillars and rails are located between the inside and outside wall unit. The outer wall unit has two opposite sidewalls, each of which has a tapered end so that the V-shaped roof is inverted against the wall. So modular homes have several separate systems according to the modular concept that is applied or used. Another study by Judd Zebersky (USA) examined the modular system of a house. The object of the present invention is to provide a modular housing which overcomes the disadvantages mentioned hereinabove from a previously known device of this general type and which provides a modular and inexpensive Structural house [3] this same study discusses modular toy [4]. With previous and other objects, provided, in accordance with this invention, modular homes include fixed Support structures that have Solid floors, Solid ceilings, Solid back walls that connect the floor to the ceiling, and open arches connecting the floor to the sky – sky. Another study conducted by Seymour L. Schwart (USA) which examined modular homes with a green building approach. The aim of the present invention is to provide modular building construction which eliminates the need for special tools and can be quickly and easily assembled [4]. This discovery provides modular greenhouse construction using universal beam structures for prefabricated panels. Universal light or mullion has a spline receiver channel to attach screening or transparent material to the frame and ribbed channels on the opposite surface to allow joining other members without pre-drilling. On the other side of the beam has a C-shaped slot which, when closed, allows the panel to be connected to form walls and ceilings by inserting a H. Member capping-shaped insert gliding over the outer edge of the frame to allow the formation of angles or sloping or pointed roofs. Another study conducted by Paulo Tiamani (USA) which examined prefabricated modular homes. This need and others are met by disclosed discoveries that provide prefabricated houses that have two or more modules; each module has one or more collapsible walls [5]. Foldable walls have one or more multi-frame openings that can be converted to doors, windows or other openings. Thus, individual modules are structured to join multi-frame openings in more than one configuration. For example, if each module is rectangular and includes a multi-frame opening at the midpoint of each wall, modules can be combined along adjacent longitudinal walls to form, generally, a square layout, or, the module can be combined with a paired longitudinal wall with a lateral wall, so that it forms, generally, a T-shaped layout.

So, from some references that become the benchmark of this paper, the author gets some views on this modular home system, of course, the purpose of this paper is obtained after seeing or referring to the reference papers relating to modular homes [6,7]. The purpose of this study is to provide the best solution for the entire Indonesian population especially to the government and entrepreneurs who have a project about housing that there is an appropriate solution to reduce development costs, reduce development time and reduce the inefficiency of a typical residential house which is certainly more expensive than modular. The type of research used in making this paper is qualitative research. Qualitative research is research used to examine the condition of natural objects, where researchers are key instruments. The difference with quantitative research is that this research departs from the data, utilizes existing theory as explanatory material and ends with a theory, and the research method used is descriptive research method which aims to make a systematic, factual, and accurate description of the facts and nature of the population or certain areas.

2. Method

This research used descriptive methods to explain the data, utilizing existing theories as explanatory material and ending with a theory, and make a systematic, factual, and accurate description of the facts and nature of the population or region certain.

3. Results and Discussion

From year to year the development of a country will be very rapid especially from the population growth sector. Indonesia is one of the countries with the largest population in the world. The development of the population or population of Indonesia has increased significantly, but there have been very few decreases in several years. Following in Figure 1, a graph of population growth in Indonesia.

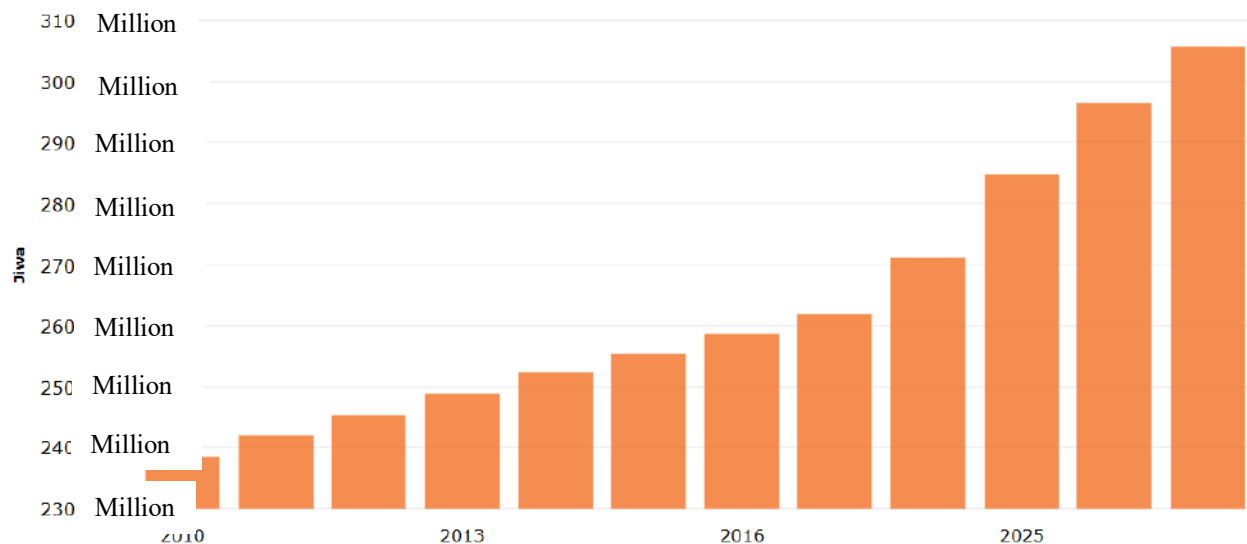


Figure 1. Indonesia people growth

Judging from the growth chart of the Indonesian population, of course it will increase, so it will make the need for housing to increase. Of course, with the large population, the competition in working is getting tighter, so low-cost housing will be very much in demand, especially cheap houses with a well-integrated system and have a clear system. The provision of housing is an important part of the progress of a country. The house is a pillar of family growth which is good in terms of welfare, health and social aspects. The Ministry of Public Works and Housing through the Directorate General of Housing Finance estimates that by 2025 the number of housing needs in Indonesia will reach 30 million units.

Modular home systems have various types so that it will affect the concepts used in their homes [8]. The author gets several modular systems that can be applied in Indonesia because not all modular home systems can be applied in Indonesia because there are differences in climate and weather, it is very influential on the durability of buildings from natural disasters or the effects of unstable natural conditions. The initial objective of this paper is to provide solutions to the many shortcomings that are obtained from conventional homes and more towards introducing this system to the general public to gain a new understanding of low-cost housing development. Here is the concept of a modular home: Rumah Modular Prefab

The prefab modular house is one of the few modular home concepts. The Prefab modular house has an integrated and more efficient structural pattern in all respects. Prefab modular homes focus more on the use of building materials, both structural, architectural, interior materials and other things related to development. The material in question is prefabricated.

Material Prefab

Industrialization of the construction method in which the components are produced in a mass assembled in buildings with the help of cranes and other lifting and handling equipment. Prefabricated Structural Components are made from concrete through precast units / precast numbers or precast

elements (molded units) depending on the alternative use, controlled printing is given time to harden and reach the desired strength before being lifted and carried to the site real construction for development. Construction methods made using prefabricated components are collectively referred to as "prefabricated construction"[9]. Prefabricated construction can be in the form of the main building activity sector: industrial architecture, General Engineering and Civil Engineering Material

Of course, a concept or innovation has its drawbacks, here are some prefabricated material problems:

1. Manufacturing capability through mechanical methods (default load and closed components).
2. Simultaneously the possibility for the implementation of its function due to the default load and limited space for movement

Qualification of material criteria

1. Insulating heat, waterproof and anti-decay
2. Fireproof and can be printed in volume
3. Can be nailed and sawed so
4. allows for changes
5. Does not need much maintenance (maintenance
6. Has high strength.

Following this Figure 2.



Single Panel

Figure 2. Single Panels Prefabrication. This figure was taken on Nov 3, 2018

Prefab wall panels that are ready to install and ready to be used as wall elements in a building. The wall panel, which of course has the size of the module that has been set, the Module will be adjusted according to a modular plan. This prefab Dinging has earthquake-resistant technology because the material is lightweight and not rigid, and the thickness of the wall can be custom so that it will adjust to the load caused by the building. There are 2 types of Prefab walls; there are single panels (Figure 3).



Double Panel

Figure 3. Single Panels Prefabrication. This figure was taken on Nov 3, 2018

And the other one is double panel. Single panels can function as structural walls, partition walls and others, while double panel walls focus more on structural functions. Prefab wall which has 2 panels (Double panel). This wall is purely structural because it has a wall. Like the picture in Figure 3.

Thickness that is twice as large as a single panel, and has more concrete density when compared to a single panel, reinforced structural elements. This wall is full of technology in it, so this is the result of the process of solving problems in development. Following in Figure 4.



Stair Module

Figure 4. Stair Module Prefabrication. This figure was taken on Nov 3, 2018

There is also a ladder module which is prefabricated, the ladder will not be made in the project but the ladder has been made in the form of a ladder completely and just plugs in, of course, it greatly cuts the time of a development work, that is the purpose of this research, to find a solution to the development problem.

Prefab floor plate which has a stretch that fits the modular building. Usually, the floor plate is cast in place, and it often happens damage or cracking, and work that is not neat, and requires time to wait for casting is felt strong to the next stage [10]. This is certainly a problem that must be resolved, the solution is to use prefabricated deck panels that are ready to install and assemble, this will greatly reduce the time and efficiency of the property and time, as well as neat and safe work of course. Like the picture in Figure 5.



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Figure 5. Deck concrete prefabrication. This figure was taken on Nov 3, 2018

4. Conclusion

From some research results and concepts applied to modular homes, it is evident that modular homes have a unique system and are certainly fast in the development process, usually a technology that is paid at a high price but an innovation is not always expensive, for example, modular homes, cheap houses with a well-ordered system, and fast working time, it is a strong consideration that modular homes are the right solution. There are various types of modular home systems, but not all systems are compatible or compatible with climate conditions in Indonesia, but most modular systems are widely used in Indonesia.

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