ABILA PRECAST CONCRETE CONSTRUCTION METHOD FOR SIMPLE HOUSING

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Abstract
The purpose of this research is to arrange the stages of implementation of the ABILA precast concrete construction method to be applied to housing construction so that it can be used as a reference for future development. While the purpose of this research is to arrange the stages of housing construction with ABILA precast panels starting from the precast concrete production stage, transportation or mobilization of materials to the installation process and final completion. Precast concrete can speed up processing time, save costs, and minimize waste for formwork and scaffolding. In the world of construction, any waste of construction material must be reduced or even eliminated. The application of Precast Concrete is very easy, considering its plug and play nature. Besides being easy, precast concrete has quite a lot of applications, especially the Abila Panel which has a function as a building structure, it can also be used as fences, floors and drainage channels. The level of the implementation method for the development of precast concrete technology is divided into several levels between prefabrication, preassembly, and module. The implementation method of building a house with ABILA precast concrete takes 14 days in the field, starting from panel installation to finishing. The construction method includes prefabrication in the workshop, mobilization of panels to the job site, assembly of structural elements, installation of brick walls, installation of roof structures and roof coverings, electrical and mechanical floor work, installation of ventilation doors and windows and paint finishing.

1. Introduction
Precast concrete is starting to be widely used by housing developers in the process of building simple residential houses for the lower middle class. The precast concrete is used as a structural component in the form of sloof, beams and columns before being assembled into buildings. In 2017, during a working visit to Padang, West Sumatra, the Minister of PUPR Basuki Hadimuljono supported the development of the national precast concrete industry when he visited PT. Kunangi Jantan, a local company from West Sumatra that produces precast concrete building components, steel structures, iron poles, cinder blocks and concrete blocks as well as galvanized pipes.

In its application in the housing sector, the Ministry of PUPR has developed a precast technology called RISHA (Simple Healthy Instant House) which is a knock down construction technology that can be built quickly using reinforced concrete in the main structure. Adopting RISHA technology, PT. Jusuf Salam is a housing developer domiciled in Singkawang City that develops precast concrete which can be used for structural elements of single or multiple residential buildings.

According to Ervianto (2006), it is possible for the precast system method to be applied to various types of construction project implementation, such as the construction of high-rise buildings, bridges, industrial buildings, housing, ports and so on. The use of precast concrete is expected to be able to answer the challenges of industrialization which demands effective, efficient, quality and economical work results (Khakim 2011).

The purpose of this research is to compile the stages of implementing the ABILA precast concrete construction method which is relatively new to be applied to the residential construction so that it can be used as a reference for widespread development. While the purpose of this research is to arrange the stages of residential house construction with ABILA precast panels starting from the precast concrete production stage, transportation or mobilization of materials to the installation process and final completion.

2. Materials and Method
Almost all aspects of construction work use concrete, including the construction of residential houses. Tri
Mulyono (2004) suggests that all structures in civil engineering will use concrete, at least in foundation work. Precast concrete is an example of innovation that is now widely used in construction processes such as buildings and bridges, this is because precast concrete can speed up the processing time, save costs, and minimize waste for formwork and scaffolding. In the world of construction, the remaining construction material (waste) must be reduced or even eliminated (Adiasa, et al. 2015)

This research was conducted by direct observation of the construction process of the Abila Housing in Singkawang City, starting from the process of preparing the panel material printing to the process of implementing the construction on the provided house footprint. According to Tommy et al (2015), Precast systems are divided into 2 categories, namely as a structural component where precast system technology is not only used for buildings, but can also be used in other building structures such as piles, sheet piles and diaphragm walls, bridge girders and flyovers, sheet piles, slabs, precast floors, precast concrete blocks, wall panels, precast stairs and more. Then the second system is a structural system where precast system technology is developing quite rapidly and innovating into various structural systems categorized into 36 precast systems by the IAPPI (Indonesian Association of Precast and Prestressing Experts).

2.1. Abila Panel Components

Abila panel, is a precast concrete that has iron as the main reinforcement and cast concrete with a composition of sand, cement and gravel. See Figure 1.

![Figure 1. Abila Panel Components](image)

There is also the size of the Abila Panel that can be adjusted to the needs of its use, namely; 1.2 m, 1.5, 2.3 m and 3 m. This allows the panels to be mobilized and assembled easily. See Figure 2.

![Figure 2. Abila Panel Size](image)

2.2. The Application of Abila Panel

The application of Precast Concrete is very easy, considering its plug and play nature. Besides being easy, precast concrete has quite a lot of applications, especially the Abila Panel which has a function as a building structure, it can also be used as fences, floors and drainage channels. See Figure 3 and Figure 4.

![Figure 3. Abila Panels as Structures](image)

![Figure 4. Abila Panel as the floors and drainage system](image)

In buildings, Abila panels function as structural elements that can be combined with wall coverings, such as; brick, red brick, press brick, hebel, interlock brick, composite panel and so on. See Figure 5.

![Figure 5. Combination of Abila Panel and walls](image)

3. Discussion and Result

3.1 Simple House Construction Implementation Methods with Abila Panels

The level of the implementation method for the development of precast concrete technology is divided into several levels between prefabrication, namely the manufacturing process carried out using special tools where various types of materials are combined to form part of a building. Then preassembly, which is the process of unifying the fabricated components in a place that is not in the position where the component is located. Next is the module, which is the result of the unification process of manufacturing components, usually requiring a large enough transportation mode to move it to its proper position (Ervianto & Suryantoro, 2006).
3.1.1 Abila Abila Panel Production Stage

The Abila Panel production process begins with printing panels using iron plate modules of varying sizes. In the production process, the main reinforcement is assembled with 8mm diameter iron arranged in parallel following the cavity in the iron plate module, then filling the module with cast concrete. The time required for the production of 1 Abila Panel is 10 hours. See Figure 6.

Figure 6. Abila Panel Production

In simple terms, concrete is formed by hardening a mixture of cement, water, fine aggregate (sand), and coarse aggregate (crushed stone or gravel). Sometimes, a mixture of other ingredients (admixture) is added to improve the quality of the concrete. Several principles are believed to provide more benefits from this precast concrete technology, including those related to time, cost, quality, predictability, reliability, productivity, health, safety, environment, coordination, innovation, reusability, and relocability. (M. Abduh 2007).

3.1.2 Construction Stage on Building

Construction Phase of Abila Panels are mobilized to the construction site or Abila Panels can be produced directly at the construction site. The foundation footprint is prepared as a panel holder, then the panels are arranged as sloof, columns and beams with connections using 22 cm and 32 cm bolts with locks, see Figure 7. The panel requirements for 1 (one) type 36 housing unit are approximately 48 panels of type size 1.5 meters. The workforce required for sloof, column and reverse structure work is 6 people for 1.5 working days.

Figure 7. Building Structure

The next construction process is building wall work using bricks/brick, floor casting work and building roof work. See Figure 8.

Figure 8. Wall and Roof Works

3.1.3 Finishes the Building

The finishing stage is the final stage in the construction of a simple house such as closing, coating and beautifying the building. See Figure 9.

Figure 9. Work Finishing

3.2 Construction Execution Time

The duration of the structural work using the conventional method is 30 days or 5 weeks and for the analysis of the duration of the structural work with RISHA precast technology is 5 days or 1 week (Salim, 2022). In general, the construction time using ABILA precast concrete as a structural element is estimated to be faster than the conventional method. The duration of work for each work item in the field can be seen in Table 1 below.

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Time (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing 48 Abila Panel</td>
<td>5</td>
</tr>
<tr>
<td>Site foundation</td>
<td>5</td>
</tr>
<tr>
<td>Panel Mobilization</td>
<td>1</td>
</tr>
<tr>
<td>Structural Construction (Sloof, Beam and Column)</td>
<td>2</td>
</tr>
<tr>
<td>Bricking and plastering the walls</td>
<td>5</td>
</tr>
<tr>
<td>Light Steel Roofing and Roof Covering</td>
<td>3</td>
</tr>
<tr>
<td>Floor Casting</td>
<td>2</td>
</tr>
<tr>
<td>GRC, PVJ and Electrical Ceiling</td>
<td>4</td>
</tr>
<tr>
<td>Sanitary (Tools and Pipelines)</td>
<td>5</td>
</tr>
<tr>
<td>Ceramic Floor Finishing</td>
<td>4</td>
</tr>
<tr>
<td>Paint Finishing</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1. Construction Period
3.2.1 Production Work 48 Panels Abila
For one housing unit type 36 requires 48 concrete panels measuring 1.5 meters. The number of needs includes sloof, column and beam components. The process of ironing and casting in iron moulding takes 5 days before the panels are mobilized to the work site. The total number of workers involved in the ironing process is 2 people, 2 people are found in the casting process and 1 person is in charge of opening the panel molds.

3.2.2 Tread Foundation Work
The parallel process of tread foundation work coincides with the panel production process so that when the precast concrete panels are ready to be mobilized, the condition of the structure is ready for use and direct assembly of structural components in the field is carried out. The process of excavating the tread foundation, ironing for formwork and casting takes 5 days with a total of 5 workers.

3.2.3 Panel Mobilization
The parallel process of tread foundation work coincides with the panel production process so that when the precast concrete panels are ready to be mobilized, the structural conditions are ready for use and direct assembly of structural components in the field is carried out.

3.2.4 Wall and Plastering the Wall
Wall work using adobe walls and in conjunction with backfilling sand for the floor. Wall work and plastering of the outer walls of the building are carried out by 4 workers with a period of 5 working days.

3.2.5 Roofing and Flooring Works
The roof structure material uses mild steel and zincalum roof covering material. The work is carried out by 4 workers with 3 working days. Simultaneously with the roof work, floor casting work was also carried out which involved 3 workers (mixture of cement and casting).

3.2.6 GRC, PVJ and Electrical Ceiling Works
The GRC ceiling work is carried out for 4 working days with a total of 3 workers. During the execution of the ceiling work, door, window and ventilation installations were also carried out as well as the installation of electrical networks throughout the building.

3.2.7 Sanitary Work
Sanitary work includes the installation of sanitary equipment such as faucets and toilets. This work also prepares clean water and dirty water pipelines as well as clean water wells and septic tank excavations. 2 people involved in the installation of sanitary equipment and pipelines and 2 people digging wells and septic tanks.

3.2.8 Ceramic Floor Finishing Works
Ceramic floor finishing work measuring 40 x 40 cm for the room and 25 x 25 for the bathroom. This work involves 4 workers where 1 person prepares the cement mortar, 1 person installs the ceramics for the main room, 1 person installs the ceramic tile for the room and 1 person installs the ceramic.

3.2.9 Paint Finishing Job
The exterior and interior paint finishing work involved 6 workers for 5 days of implementation. When the building paint finishing work is carried out cleaning the building area so that the building can be occupied immediately.

4. Conclusion
The implementation method of building a house with ABILA precast concrete takes 14 days in the field, starting from panel installation to finishing. The construction method includes prefabrication in the workshop, mobilization of panels to the job site, assembly of structural elements, installation of brick walls, installation of roof structures and roof coverings, electrical and mechanical floor work, installation of ventilation doors and windows and paint finishing.

5. Acknowledgement
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6. References

