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Analysis of Earthquake Resistant House Characteristics as Optimization of Earthquake Victims

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Abstract. An earthquake is a natural disaster that is often found in the world, this is triggered by the movement of plates or the effects of volcanic eruptions. Indonesia is one country that has a high level of earthquake vulnerability because Indonesia is flanked by two of the world's great oceans (Indian and Pacific oceans), Indonesia is at the confluence of the world's three main plates (Indo-Australian plate, Eurasian plate, and Pacific plate), and very diverse Indonesian surface conditions (relief). Efforts to mitigate disasters have been carried out for how to minimize casualties and physical losses that have fallen, one of them is by making houses earthquake resistant. This article aims to analyze the characteristics of earthquake resistant homes with the aim of minimizing the impact of an earthquake.

1. Introduction

Disaster is something we cannot avoid because, no one can predict when the earthquake will occur. But over time we can find out which areas are prone to disasters from the data, especially in the form of data on geographical conditions. Earthquake resistant house building is an alternative to be able to reduce casualties and physical damage to house buildings if at any time an earthquake occurs. In most designers the structure of the building used rarely includes the calculation of earthquake resistance in planning a building, even though the calculation of earthquake resistance must also be considered because each region has geological conditions that are prone to earthquakes. Designers only rely on structures that have been used by the community in building, specific buildings that are mostly used, among others [1].

1. The column design is flat with walls, the thickness of the structure is only 13 cm.
2. Foundation using river stone foundation
3. For non-storied dwellings, the quality of concrete is not clearly characterized.
4. The roof frame uses wood and mild steel.
5. The roof cover uses ground tiles, concrete tiles, and metal tiles
6. The walls are made of red bricks, hebel brick or celcon and brick making.
7. The walls are plastered and some are not plastered.

From the specific balance above many buildings that cannot withstand earthquakes, because when building or structures are used only based on estimates, without the proper calculation of structures to withstand earthquakes. The character of the house is possible to be very dangerous for the local



population / community, for that there is a need for further action to minimize casualties and physical damage to the community.

2. Literature Review

2.1 Characteristics of Earthquake Resistant Buildings

Building a building that can withstand earthquake loads is not economical. Therefore, the main priority in building earthquake resistant buildings is the creation of a building that can prevent the occurrence of victims, and reduce property losses. From this point the notion of earthquake resistant buildings is [2]:

- If there is a mild earthquake, the building cannot cause damage to both non-structural components and structural components.
- In the event of a moderate earthquake, buildings can damage the non-structural components (ceiling collapsed, walls crack) but structural components (columns, beams, sloof) cannot be damaged.
- If there is a large earthquake, the building can cause damage to both non-structural components and components, but damage to the occupants of the building remains safe, it cannot be done before the building collapses, there is still enough time for the occupants of the building to exit.

One of the long-term mitigations is to prepare themselves by building houses that follow earthquake resistant rules. With predictions that are difficult for an earthquake to come, the earthquake resistant house is an alternative to reduce the negative impact of an earthquake, where for small earthquakes and moderate earthquake resistant houses still provide security, while for large earthquakes still provide opportunities for residents to save themselves by getting out of the house, and the house can still with the damage that is not severe. There have been many studies and manuals on earthquake resistant houses, all of which aim to reduce the impact of losses caused by earthquakes, especially to reduce loss of life and material losses. Some principles and research of earthquake resistant buildings are as follows;

According to [3] in CEEDS UII, in the construction of simple residential houses must meet the principles of earthquake resistance as follows,

- a. If there is a minor earthquake, the building will not be damaged.
- b. In the event of a moderate earthquake, technical buildings may experience damage to non-structural elements, but should not be damaged in the structural elements while simple buildings may experience damage to the walls.
- c. In the event of a large earthquake, technical buildings may experience damage to non-technical elements and structures. Fixed buildings may not collapse, while simple buildings may experience wall damage and practical reinforcement. Damages that occur can still be repaired Buildings that are resistant to large earthquakes are ductile buildings (tough, tough). Ductile building is the ability of a building to experience a change in shape but can still accept the burden.

Buildings that are resistant to large earthquakes are ductile (tough, tough) buildings. Ductile building is the ability of a building to experience a change in shape but can still accept the burden. From the results of field observations conducted by the Research and Development Agency of the Ministry of Public Works and Public Housing, one of the earthquakes that rocked Lombok, West Nusa Tenggara, 29 July 2018 and 5 August 2018, found that damage to buildings was caused by the lack of application of building principles. earthquake resistance in the field. A common mistake is related to ignoring the importance of the existence of Sloof, practical columns and beam rings. From the incident identified the need for the implementation of earthquake resistant building technology principles in accordance with applicable standards, in general there are three things that must be considered for the application of earthquake resistant buildings, namely the suitability of the design, the suitability of the types of building materials and the suitability of the implementation method itself (Center Research and Development of Housing and Balitbang Settlements Ministry of PUPR RI 2018). The following is

a general description of the principle of earthquake-resistant buildings for the allocation of one-story houses based on PUPR Regulation No. 5 of 2016.

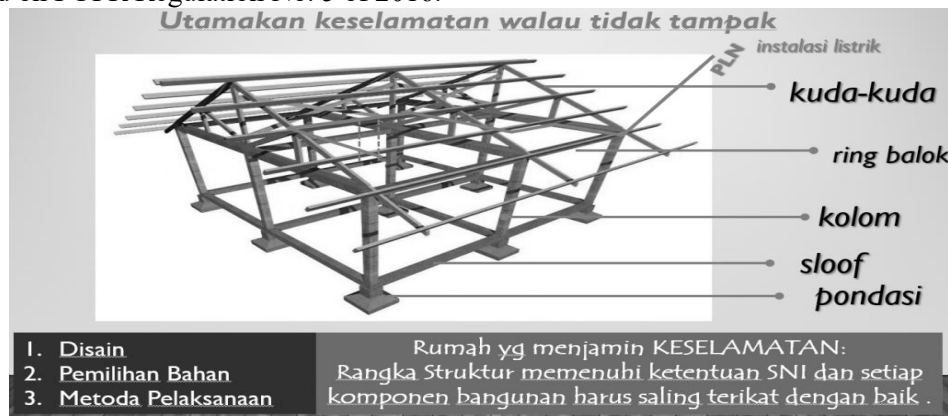


Figure 1: <http://puskim.pu.go.id/prinsip-prinsip-bangunan-tahan-gempa/>

2.1.1 Optimization of Earthquake Victims

Minimizing the risks arising from earthquake disasters includes several things, namely predicting earthquakes, actions before events, actions when events and actions after an event [4].

Predicting Earthquakes

Earthquake is a disaster that cannot be prevented, occurs suddenly and surprisingly and cannot be accurately estimated at its central location, its timing and strength are precise and accurate, but earthquakes can be predicted for the possible timeframe to occur. There are 2 (two) methods for predicting earthquakes, namely:

1. Short-range prediction. This prediction requires a relatively short time and includes:
 - Predict the time period between fore shock and playing shock or major shock or major earthquake.
 - From the historical experience of earthquakes in Japan, America, China and Russia this time varies, some are 24 hours, some are more than 1 month.
 - The reality is that many don't succeed.
2. Long time prediction.
This prediction requires a relatively long time and includes:
 - Study the interval of major earthquake disasters in the past (cycle).
 - It turns out that this cycle is not exactly the same as the Republic of Indonesia's Independence Day or someone's birthday that is clearly the time.

Before Genesis

Before the earthquake disaster needs to be prepared and knowledge about disaster. This is intended to foster understanding and preparedness in dealing with disasters so that losses and casualties are expected to be reduced

Moment of incident

When the earthquake disaster needs to be taken steps that aim to save themselves. This is very important in order to reduce casualties due to disasters.

3. Conclusion

Characteristics of earthquake resistant house building are very important to be studied in order to minimize earthquake victims both fatalities and physical damage. One of the long-term mitigations is to prepare themselves by building houses that follow earthquake resistant rules.

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