

Build Back Better: Rehabilitation And Reconstruction After The Cianjur Earthquake Disaster

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Abstract – Geographically, Indonesia is located in an area with a tropical climate, making Indonesia a country prone to disasters. Located within the Pacific Ring of Fire (volcanic arc), 76 out of 147 volcanoes in Indonesia have active status making this country the most disaster-prone place in the world. In recent years, various earthquake activities have been recorded in Indonesia, one of which occurred in Cianjur on November 21, 2022. The Cianjur earthquake was caused by active fault activity of the Eurasian plate with a shear fault type, a shallow crustal earthquake which caused the damage so big. This study aims to identify the development of earthquake resistant houses with RISHA technology (Simple Healthy Instant Houses) for sustainable development. This study used a qualitative approach with documentation data collection methods and data analysis using descriptive methods. The results of this study are sustainable post-disaster management in accordance with what is stated in the 2015-2030 Sendai Framework, namely build back better. Construction of permanent housing in Cianjur using RISHA earthquake resistant housing technology as a form of mitigation or preventing the occurrence of new disaster risks and reducing existing disaster risks while still paying attention to the living conditions and livelihoods of the local community.

Keywords – Build Back Better; Rehabilitation and Reconstruction; Earthquake

I. INTRODUCTION

Indonesia is known as an archipelagic country, on the other hand Indonesia is quite vulnerable to the possibility of disasters. Geographically, Indonesia is located in a tropical climate, making Indonesia a country that is prone to disasters such as hydrometeorological disasters. Floods, landslides, forest fires and droughts. Many countries are faced with one of these disasters at one time or another. However, Indonesia often faces that threat. Located within the Pacific Ring of Fire (volcanic arc), 76 of the 147 volcanoes in Indonesia have active status [1], making this country one of the most disaster-prone places in the world.

Based on the definition of Law Number 24 of 2007 concerning Disaster Management, a disaster is defined as "an event or series of events that threaten and disrupt the lives and livelihoods of the community caused by both natural and/or non-natural factors and human factors resulting in casualties, environmental damage, property losses and psychological impacts" in this case disasters referred to in Law Number 24 of 2007 includes natural, non-natural and social disasters.

In recent years, various earthquake activities have been recorded in Indonesia, one of which occurred in Cianjur on November 21, 2022. The Cianjur earthquake was caused by active fault activity of the Eurasian plate with a sliding fault type, a shallow crustal earthquake caused damage caused so much [2]. The earthquake with a magnitude of 5.6 and accompanied by aftershocks as many as 297 times with the largest magnitude M4.2 and the smallest M1.0.

By considering the location of the epicenter and the depth of the hypocenter, the earthquake that occurred was a type of shallow earthquake due to Cimandiri fault activity. The results of the source mechanism analysis show that the earthquake has a strike-slip mechanism [3] The earthquake has caused shaking in several areas with intensities between I to VIII on the Mercalli Modified Intensity (MMI) scale from damaging earthquake survey information. As a result of the earthquake that occurred on Monday, November 21, 2022, it resulted in considerable shaking in the area around the epicenter of the earthquake.

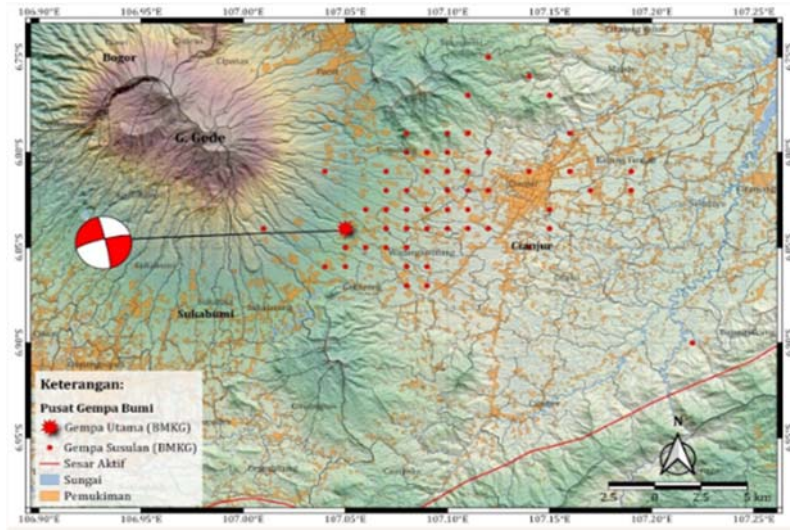


Fig 1. The epicenter of the Cianjur earthquake includes both major earthquakes and aftershocks [4]

The Cianjur earthquake affected 16 villages out of a total of 32 villages and as many as 180 villages affected from 360 villages. The earthquake that occurred in Cianjur caused damage to buildings and infrastructure, based on data obtained from BPBD Cianjur related to the infographic of the Cianjur Regency earthquake on December 29, 2022, there were 59,889 damaged houses with a classification of 28,110 lightly damaged, 17,198 moderately damaged, 14,581 severely damaged, plus 18 health facilities damaged, 281 places of worship damaged, 701 educational facilities were damaged, 18 offices and buildings were damaged. Damage to building structures in addition to being affected by shallow earthquakes is also influenced by building structures that do not meet earthquake resistance standards, such as using standard reinforcing iron or cement in buildings instead of standard foundations to withstand earthquakes.

Rehabilitation is an effort to restore or improve the area/area to restore it to its pre-disaster state or function and the reconstruction stage is an activity to rebuild the entire infrastructure including community houses [5]. Post-disaster reconstruction consists of repairing physical damage caused by a disaster, but Kennedy et al [6] show that rebuilding environmental buildings and infrastructure exactly as they were before a disaster often recreates vulnerabilities that existed before. If returned to pre-disaster standards, disaster-affected communities will face the same difficulties if faced with other catastrophic events in the future. This study aims to identify the development of earthquake-resistant houses with Simple Healthy Instant Home (Risha) technology after rehabilitation and reconstruction due to earthquakes in Cianjur in the number of earthquake disaster mitigation efforts in the future.

II. MATERIAL AND METHOD

This research uses a qualitative approach with a method of collecting documentation data in the form of records of past events such as records in books, writings, pictures, or monumental works of a person [7]. Data analysis is carried out by descriptive method. This method is in the form of theories or arguments derived from observations, literature studies from various document sources such as books, articles, and magazines. Analyze without using numerical calculations. Study conclusions are also categorized by description. This research includes a type of literature review research by looking for theoretical references that are relevant to the case or problem found. states that a literature review is a written summary of articles from journals, books, and other documents that describe theories and information both past and present organizing the library into topics and documents needed [8]. The type of data used by the authors in this study is data obtained from literature studies. Literature study is a way

used to collect data or sources related to the topic raised in a study. The data that has been obtained is then analyzed by descriptive analysis methods. The descriptive analysis method is carried out by describing facts which are then followed by analysis, not only elaborating, but also providing sufficient understanding and explanation.

III. RESULT AND DISCUSSION

The West Java region has many landscape straightness which is the result of fault processes. Path The fault path is generally west-east, north-south, northeast-southwest and northwest-southeast Regionally the northeast-southwest fault structure is grouped as the Meratus Pattern, the north-south fault is grouped as the Sunda Pattern and the west-east fault is grouped as the Java Pattern. Fault structures with a west-east direction are generally ascending fault types, while fault structures with other directions are horizontal faults. Normal faults are common in varying directions [9]

Of the many fault structures that developed in West Java, there are three regional structures that play an important role, namely the Cimandiri Fault, Baribis Fault and Lembang Fault. The three faults were first introduced by van Bemmelen (1949) and allegedly all three are still active today. The Cimandiri fault is the oldest fault (Cretaceous age), stretching along 100 km starting from Pelabuhan Ratu Bay, Sukabumi continuously to the east through the Cimandiri Valley, Cipatat-Rajamandala, Mount Tangkubanprahu-Burangrang and allegedly continuing northeast to Subang. Overall, this fault path is in a northeast-southwest direction with horizontal to oblique (oblique) fault types. By Martodjojo and Pulunggono (1986), this fault is classified as the Meratus Pattern.

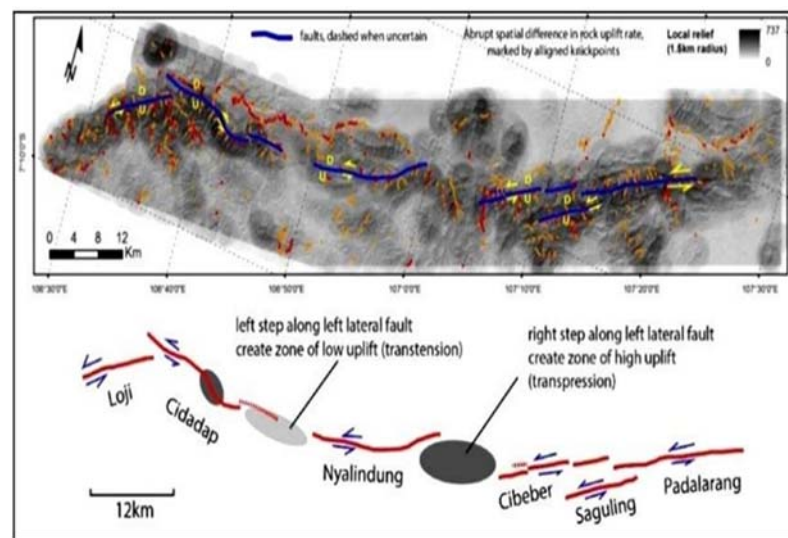


Fig 2. Map of Cimandiri active fault segment [10]

According to historical records, major earthquakes have occurred along this fault in 1699, 1834 and 1900 (Visser, 1922; Wichmann, 1918). Based on geodesy studies, Abidin et al. (2008, 2009) estimated the slip rate of the Lembang fault at 3-14 mm / th with sinistral shear movements. And the earthquake that occurred in 2022 caused a new active fault shift called the cugenang fault. The new fault crosses 9 villages in two districts with a trajectory heading northwest southeast.

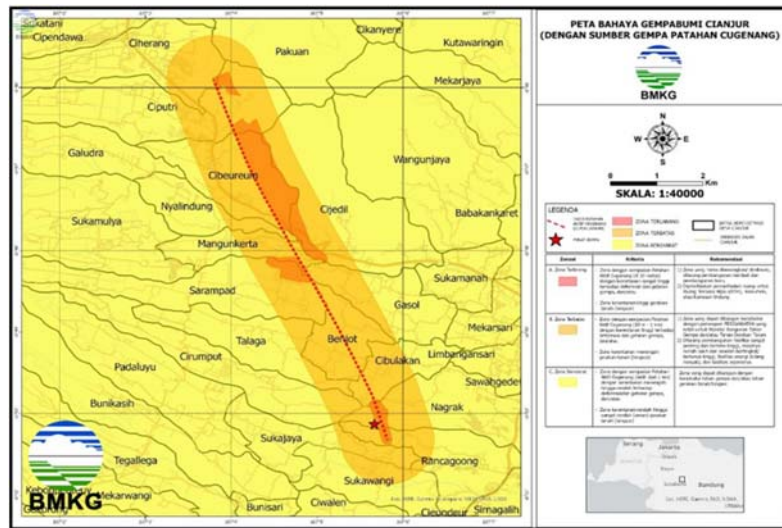


Fig 3. Cugenang fault hazard map [11]

From the results of verification carried out by BMKG, 3 earthquake danger zones were produced, namely the Forbidden Zone (Red), Restricted Zone (Orange) and Conditional Zone (Yellow). The Forbidden Zone (Red) has the criteria of a Zone with a "border" of the Cugenang Active Fault 0 - 10 meters to the right and left perpendicular to the fault, which is a zone of very high vulnerability due to earthquake deformation and vibration, and/or is a zone of high vulnerability to ground movement (landslides). BMKG also recommends not to build buildings in this location and must be relocated and build better buildings than before as a mitigation effort if at any time the same disaster comes back.

In this case, the process of the post-disaster handling process is an important stage, in accordance with what is stated in the 2015-2030 Sendai Framework that build back better after disasters as a form of mitigation efforts or prevent the occurrence of new disaster risks and reduce existing disaster risks. One of the priorities in Sendai Framework is the term "build back better". Various research results have recognized the opportunity to reorganize disaster-affected communities or regions [12],[13].

The Sendai Framework for Disaster Risk Reduction emphasizes the need for requirements or conditions that support the creation of better post-disaster recovery and do not result in new risks or disasters in the future. According to Wisner [7] all these requirements can be grouped into six aspects which include governance, economy, ecology, settlement, social protection and basic services, as well as vulnerable groups. In the post-disaster recovery process, especially in the provision of housing, the construction site must be ensured to be safe from disaster risks. Similarly, the location of the new settlement must be ensured that it is not in the danger zone. To achieve this, collaboration and coordination between various parties such as the government, non-governmental organizations, academics, the private sector, and the community are needed. The involvement of various parties can maximize success in the post-disaster recovery process [14], [15], [16]

The implementation of post-disaster rehabilitation and reconstruction is carried out based on BNPB Perka No. 06 of 2017. Recovery after disasters that aims to strengthen the sustainability of the nation and society through disaster risk reduction actions integrated into efforts to improve physical and social infrastructure, as well as refresh livelihood, economic, and environmental systems, can be defined as "Build back better" [17], [18]. Opportunities to reduce disaster risk, especially vulnerability to disasters, can be found in the post-disaster recovery process. Rehabilitation and reconstruction programs can also pay attention to improving the welfare of the population.

In relation to the Cianjur earthquake disaster, the government has made efforts to carry out post-disaster rehabilitation and reconstruction, in this case the government determines the insitu area and the area that must be relocated by coordinating directly with BMKG related to zones that have a level of vulnerability to earthquakes (19). People who live in vulnerable areas or areas that have a potential risk of earthquakes will be relocated and people who live in areas that have a potential risk level of safety from earthquakes can rebuild in the same location / area.



Fig 4. Simple Healthy Instant Home [20]

Heavily damaged or relocated residential houses are built using earthquake-resistant house structure technology such as Simple Healthy Instant Home. This technology was developed by the Balitbang Housing and Settlement of the Ministry of PUPR in Bandung. This technology uses a knock down system, with each module consisting of three component structural panels and node panels that are very flexible and efficient in the use of raw materials. RISHA technology allows the construction of houses in stages, where the time needed to build each module measuring 3x3 meters only takes 24 hours involving three workers [20].

The implementation of rehabilitation and reconstruction to build back better was carried out in Sirnagalih Village, Cilaku District and Murnisari Village, Mande District.



Fig 5. Development of permanent housing Sirnagalih Village [21]

The construction of permanent housing is carried out using earthquake-resistant house technology, namely Simple Healthy Instant Home (RISHA) and this is done to reduce the impact caused if at any time the same disaster occurs again. The construction of permanent housing in Sirnagalih Village as many as 200 units on an area of 2.5 hectares went smoothly, then further construction in Murnisari Village as many as 151 units on an area of 1.9 hectares. The permanent residence is built with a type of 36 m² and a plot area of 72 m² using RISHA earthquake-resistant house technology and still paying attention to the living and livelihood conditions of the local community.

Build back better is a strategy to improve and rebuild environments, infrastructure, and communities after a disaster. The aim is to make recovery better than previous conditions by considering the problems and challenges that have been identified during

the rehabilitation and reconstruction process. In the rehabilitation and reconstruction process, the "build back better" strategy can be applied to increase resilience and preparedness for disasters that may occur in the future, the application of this strategy in the rehabilitation and reconstruction process is expected to produce environments, infrastructure, and communities that are more resilient to future disasters and better than the conditions before they occurred disaster. Rehabilitation and reconstruction after the Cianjur earthquake disaster carried out in Sirnagalih Village and Murnisari Village using earthquake-resistant house technology, namely Simple Healthy Instant Home (RISHA) which is designed to be resistant to earthquakes, This house uses strong structures and materials, such as lightweight steel walls and roofs, which are able to withstand shocks during an earthquake.

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