

## Tsunami Response in Batu Bengkung Beach Tourism, Gajahrejo Village, Malang Regency

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### KEYWORDS

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### ABSTRACT

Batu Bengkung Beach in Malang Regency has excellent potential as a natural tourist destination. However, the natural condition which is an area prone to tsunami disasters also cannot be ignored. Safety considerations and minimizing casualties are the main reasons this tour aims to make adjustments to aspects of tsunami disaster mitigation. Likewise for the sustainability of tourism in the future. The method carried out is through qualitative and quantitative data research. Direct observation at the location is also needed to determine exactly the existing conditions, as well as interviews with several resource persons as data reinforcement. The result is the application of aspects of tsunami disaster mitigation that are relevant to existing natural conditions. Aspects of tsunami disaster mitigation that can be applied are, first, the determination or determination of evacuation locations and evacuation routes. By utilizing natural conditions surrounded by hills, these conditions can be an ideal evacuation location. The second early warning is in the form of an alarm or siren warning of a tsunami. Aims to notify of the tsunami disaster and is expected to evacuate immediately. The third erected vertical evacuation buildings in the form of tsunami shelters that met FEMA guideline standards. And finally regular disaster mitigation simulation training.

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### Introduction

Tourism is the act of a person temporarily visiting a specific location outside the territory of his residence and work, with diverse purposes involving tourist activities. Another opinion states that tourism is an organizational structure that involves parties, both from government agencies and the private sector, involved in the process of developing, producing, and marketing product services to meet the needs of individuals who are traveling. (Pendit, 1994) (Kusdianto, 1996)

Tourism has a significant role in efforts to increase income, and has great potential to be developed. Indonesian. With its charm of natural beauty and cultural diversity, it has great potential to boost the tourism sector. The increase in the tourism sector in Indonesia is expected to make a significant contribution to national economic development.

Malang Regency is part of East Java Province. Known for its city branding "The Heart of East Java," it is actively developing its tourism potential. According to the Regional Spatial Plan (RTRW) of Malang Regency Year 2010-2030, tourism in this region is divided into three groups based on Tourism Objects and Destinations (ODTW). The division includes natural, cultural, and artificial tourism.

Batu Bengkung Beach is one form of natural tourism in Malang Regency. Precisely located in Gedangan District, namely Gajahrejo Village. This beach has a very interesting natural charm, especially in its physical form which has a cape with a cliff in the middle. Gedangan District is included in the Tsunami Disaster Potential Area. Batu Bengkung Beach is no exception, which has a high risk of the threat of tsunami waves. Tsunamis are generally associated with earthquake events. An earthquake is an event where there is a vibration on the ground surface that arises as a result of the propagation of elastic waves through the mass of the earth. These waves can be triggered by major events such as volcanic eruptions, volcanic activity, landslides, or the movement of the earth's plates called tectonic earthquakes. Other opinions also say tsunamis are large waves that arise due to the occurrence of earthquakes on the ocean floor, volcanic eruptions, and avalanches of rock masses around the ocean basin area. While stated by the Center for Volcanology and Geological Disaster Mitigation or PVMBG (2006) tsunami is a form of natural event in the form of sea wave disasters that arise due to earthquakes on the seabed and have a speed of propagation up to 900 km / hour. So to increase the attractiveness and safety of Batu Bengkung Beach tourism, it is necessary to analyze science in the form of aspects that are responsive to the potential for tsunami disasters. These measures need to be implemented to maintain the sustainability of tourism and at the same time increase preparedness to face potential natural disasters. (Setyonegoro, 2011) (Djunire, 2009) (Kurniasih et al., 2020).

Based on the explanation that has been described about the tourism potential of Batu Bengkung Beach and the threat of tsunami disaster in the area. The problem that will be discussed is, How to analyze aspects of Tsunami disaster response values on Batu Bengkung Beach tourism. Thus, this study aims to analyze Batu Bengkung Beach tourism which has aspects of Tsunami disaster response values. With the hope that it can attract more tourists to visit and increase the safety factor for its users.

## **Research Methods**

This study adopts a mixed approach, combining qualitative and quantitative data to provide a holistic understanding of the tsunami response aspects at Batu Bengkung Beach Tourism Facilities. In conducting research, observations were made to gain deep insight into the tourist sites of Batu Bengkung Beach. This observation is carried out to find out and obtain the data needed in the form of what facilities are already available, and whether there are elements of disaster mitigation that have been implemented. Interviews were also conducted by researchers on several resource persons. The study interview population includes local communities such as tour managers, stall traders, and tourists visiting Batu Bengkung beach. This interview aims to determine the perception

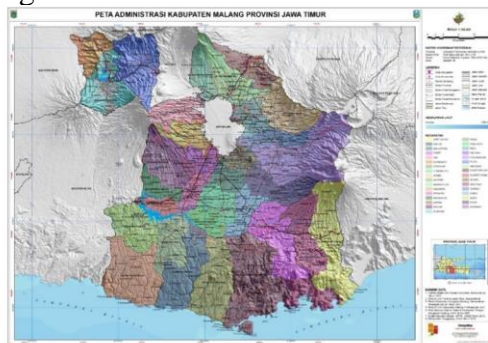
of tourism actors on tourism conditions, the threat of disasters that arise and the needs needed, especially in dealing with tsunami disaster situations. Research ethics are maintained by obtaining permission, consent from sources, and maintaining data confidentiality. The collected data will later be used to be able to formulate aspects of tsunami disaster response that can be applied to Batu Bengkung Beach tourism.

## Results and Discussions

The word Tourism comes from a combination of the words "Pari" and "Wisata". The word "Pari" can be interpreted as many times or in circles. While "Tourism" refers to travel. In simple terms, tourism can be defined as a trip that is carried out repeatedly from one place to another. According to the Great Dictionary of Indonesian, tourism includes all activities related to leisure travel, travelers, and tourism. When talking about tourism, it is very closely related to facilities. According to what is one of the important things to develop an object or tourist spot is through facilities. Not a few tourists who visit a place or area because they are attracted by the facilities and conveniences offered. So problems in the form of facilities and safety aspects that are not met can be the cause of lack of tourist interest (Yoeti, 1996) (Heryati, 2019) (Sammeng, 2001).

Tsunami is a large sea wave that leads towards land because of an earthquake on the seabed. These disasters often result in large casualties compared to other disasters. Sea waves due to earthquakes or submarine volcanic eruptions, pose a serious threat to Indonesia located on the Pacific Ring of Fire. Indonesia is vulnerable due to its geographical location at the confluence of tectonic plates and the presence of many volcanoes along the seafront. One of the biggest tragedies was the tsunami of 2004, triggered by a magnitude 9.1 earthquake off the coast of Sumatra, causing severe damage in Aceh and neighboring countries. Coastal areas in East Java also face tsunami risk although they are not as well-known as Aceh. Factors such as underwater volcanic eruptions and earthquakes can trigger such threats. Between the earthquake and tsunami there will usually be a time lag that can be used to provide early warning, and can be used by the community to evacuate immediately. However, this is often overlooked and not done due to lack of knowledge, as well as the absence of tsunami early warning tools (Pé niquel et al., 2006) (Kurniawan et al., 2020) (Widana, 2022).

Batu Bengkung Beach Tourism is administratively a natural tourism located in Gajahrejo Village, Gedangan District, Malang Regency. This beach is located in the southern region of Java, so it leads directly to the ocean off the Indian Ocean which is famous for its high waves and waves (Muhaling & Ismail, 2023). The location can be seen in the following image:



**Figure 1**  
**Map Image of Malang Regency**  
Source: Thematic Map of Indonesia, 2015

High waves and waves cause fears of the emergence of potential disasters in the form of tsunamis. Gedangan District is included in the category of Tsunami Disaster Potential Areas (PERDA Malang Regency Number 14 of 2018). Based on this, Batu Bengkung Beach Tourism which is one of the coastal areas in Gedangan District, has a high risk of the threat of tsunami waves (Malang, 2019). An explanation of the potential tsunami area is shown in the following figure:

3. Wilayah Potensi Bencana Alam Gempa Bumi, meliputi Kecamatan Gedangan, Kecamatan Sumbermanjing Wetan, Kecamatan Dampit, Kecamatan Tirtoyudo dan Kecamatan Ampelgading.
4. Wilayah Potensi Bencana Alam Tsunami, meliputi **Kecamatan Gedangan**, Kecamatan Sumbermanjing Wetan, Kecamatan Tirtoyudo, Kecamatan Ampelgading, Kecamatan Donomulyo dan Kecamatan Bantur.
5. Potensi Bencana Alam Angin Puting Beliung, mencakup wilayah Kecamatan Pagak, Kecamatan Karangploso, Kecamatan Jabung, Kecamatan Wagir, Kecamatan Kromengan, Kecamatan Pakis dan Kecamatan Poncokusumo.

### Figure 2

#### Picture of Gedangan sub-district entering the potential for tsunami.

Source: PERDA Kabupaten Malang Number 14, 2018

The same information was also obtained from an interview with the manager of Batu Bengkung Beach Tourism who conveyed the lack of tourist interest due to the issue that this tour is an area that is potentially prone to tsunami disasters. Stalls traders also said that their lack of income was due to the lack of visitors on this tsunami-prone beach tour. And according to some visitors conveyed the fear of traveling to Batu Bengkung beach because they knew the news of a potential tsunami. This condition certainly poses problems for the continuation of tourism.

Therefore, disaster mitigation and emergency response planning are key. Prevention efforts, such as early warning systems, public awareness raising, and evacuation simulations, are carried out by the government and related institutions to minimize human and property losses and prepare communities for potential tsunami disasters. Determination of safe zones and evacuation routes is crucial in beach tourism. Public facilities and beach tourist accommodation are placed in areas that are safe from potential tsunamis. Analyze evacuation routes to ensure visitors and local residents have quick and safe access to evacuation zones. Analysing tsunami early warning systems, such as the installation of warning sirens and evacuation information boards along the coast, will be the next step. The system will allow visitors and local residents to respond quickly to the tsunami threat and take necessary evacuation measures (Edyanto, 2015) (Imani et al., 2020). (See in image)



**Figure 3**  
**Image of Jatimalang evacuation route marker**

Sumber: BNPB, 2022

In the building aspect, creating vertical evacuation is the answer to generating shelter. This principle has an adjustment to the criteria for tsunami response buildings. According to the United States Federal Disaster Management Agency (FEMA) mentioned several Structural Design Guidelines for Vertical Evacuation buildings from tsunamis. The first is to make buildings made of concrete. Actually, some experts and architects from Japan revealed that wood material is better because of its flexible nature. So it will be safer in the event of an earthquake. But this actually makes the building vulnerable in the event of a tsunami. FEMA suggests vertical buildings made of reinforced concrete or steel frames are recommended. These powerful vertical evacuation buildings create a protection area for humans when evacuation out of the tsunami impact zone is not possible. Concrete structure in the following figure: (Repadi et al., 2016)(Parisi, 2013)



**Figure 4 Pictures Reinforced concrete structures**

Sumber: Indojava Readymix, 2023

The second criterion is a very solid foundation. The foundation with a very deep construction with a strong footing is expected to be able to withstand the load and shock to the building during a tsunami. This is because strong tsunami waves are able to knock down concrete structures if the foundation is not suitable. The structure of the foundation in the (Samsunan & Febrianti, 2018) following figure:



**Figure 5**

**Pictures of reinforced concrete foundations**

Source: Sabute Global Indonesia, 2022

The importance of beach support facilities, such as breakwater structures, as wave protection and beach protection, demands an effective layout. Breakwater layouts must consider the significant impact on ocean waves from multiple directions, with effective mileage calculations. Determining the location of an offshore breakwater involves the initial step of establishing a wave fault line and the location of the breakwater in the planning stages (Ichsan & Suleman, 2018).

It is important to understand the causes of coastal erosion in order to determine how to overcome it. Some approaches that are usually carried out involve the creation of coastal protection buildings with the following functions:

1. Reinforce/Protect the Beach from Wave Attacks: This step aims to increase the resistance of the beach to wave attacks.
2. Changing the Speed of Sediment Transport along the Coast: This approach involves modifying the speed of movement of sediments along the coastline.
3. Reducing the Energy of Waves Reaching the Shore: An attempt to reduce the impact of wave energy reaching the shore.
4. Reclamation by Increasing Sediment Supply to the Coast or Other Means: This process includes adding sediment supply to the coast or other methods to reclaim the area

Based on their function, beach buildings can be grouped into three main categories:

1. Beachfront Parallel Construction: Buildings such as revetments and beach walls are built along the shoreline.
2. Coastal Straight Construction: An example is the groin, which is built about perpendicular to the coast and connects to the coast.
3. Offshore Construction: Such as offshore breakwaters built offshore and parallel to the coastline, as well as coastal joint breakwaters jutting into the sea.

In this context, it is important that the position of the offshore breakwater is placed closer to shore than the position of the wave fault line. It is necessary to conduct previous research on the location of the breakwater so that the development process can be carried out more efficiently and effectively, considering the various aspects involved. Tetrapot (wave break construction) with the application of break water in the following figure: (Ichsan & Suleman, 2018)



**Figure 6**

**Tetrapot (wave break construction) drawing**

Source: Hiri Anchorage breakwater, 2021

Based on the results of the analysis conducted to respond to the tsunami disaster on Batu Bengkung beach tourism, the author designed a tour using Tetrapot to break waves from two directions because in the middle of the beach there is a stone cape that is used for tourist activities so that the cape has become a protector or natural breakwater but still needed a Tetrapot arrangement to break the waves so that tourists are safe in buildings that have been designed for Tsunami disaster response. The following is the application of break water in the following figure:



**Figure 6 Break water images**

Source: Personal design, 2023

The fourth is to create a design that allows water to flow underneath. Make the shape of a multi-storey building with the first floor that is much open like a stage building. This design aims so that tsunami currents can flow easily, and there is not much structural damage. The stage design structure in the following figure: (Edyanto, 2015)



**Figure 7**

**Pictures of Batu Bengkung Beach Tourist Inn**

Source: Personal design, 2023

Fifth, the shape of the building column is recommended to use a circular column shape. This shape aims to produce a lower thrust when tsunami waves hit buildings, a circular shape that has no angles and flat sides is able to smooth the flow of water through it. The circle column structure in the following figure:



**Figure 8**

**Circle Shape Column Image**

Source: Anak Teknik Indonesia, 2022

The results of the analysis carried out then the author applied the shape of a circle column structure to the tsunami disaster response building, with a circle shape that resulted in this disaster response building being stronger to withstand water pressure when a tsunami disaster occurred. Column structure in the shape of a circle of Batu Bengkung beach tourism on picture next:



**Figure 9**

**Structural Picture of Batu Bengkung Beach Tourism Column**

Source: Personal Design, 2023

In the results of the analysis carried out, the author designed a Tsunami disaster response building. Vertical evacuation buildings against tsunamis are called tsunami shelter buildings. This building is intended for the community in the face of tsunami. The author has conducted an analysis which location on Batu Bengkung beach is prone to Tsunami planning based on data from the 2024 Tsunami disaster in East Java and in the next year. Here's an example of a Tsunami Shelter:



**Figure 10**

**Pictures of Tsunami Shelter Batu Bengkung Beach Tour**

Source: Personal Design, 2023



**Overview of site condition analysis**

Based on observations made by observing the site directly, findings such as site boundaries, existing buildings or facilities, and activities and activities of the perpetrators were collected. The boundary of Batu Bengkung Beach is surrounded by hills and the Indian Ocean ocean. Explanation of tread boundaries in the following figure:



**Figure 11**  
**Picture of Batu Bengkung Beach tourist boundary**  
 Source: Personal Analysis, 2023

In Batu Bengkung Beach Tour, researchers make observations on what buildings and facilities have been built by the manager. This factor is the main element of comfort in accommodating visitors who travel to the place. Explanation in the following table:

**Table 1 Building Analysis Table on Batu Bengkung Beach**

No.	Building / Facilities
1.	Ticket window
2.	Informational posts
3.	Merchant stalls
4.	Toilet
5.	Gazebo
6.	Watchtower

Source: Personal Analysis

The activities of the perpetrators are divided into beach manager activities, stall trader activities, and visitor activities. Full explanation in the following table:

**Table 2 Perpetrator activity analysis table**

Perp	Activity
Beach manager	Take care of tickets, guard at information posts, keep an eye on the beach, maintain cleanliness, get around security
Warungs	Arranging stalls, cooking, serving buyers, washing cutlery, socializing.
Visitors / tourists	Buy tickets, recreation, relax, swim, take pictures, travel, buy culinary at stalls, socialize.

Source: Personal Analysis

Based on the analysis that has been done, there are no elements of disaster mitigation found in Batu Bengkung Beach Tourism. While in reality, this region has the potential for a dangerous tsunami disaster. In the aspect of facilities, it is necessary to carry out renovation or redevelopment by considering tourist standards with anti-tsunami building aspects.

### Formulation of recommendations

Based on the problem through the findings and analysis that has been done, there are relevant solution recommendations. This is related to the improvement and addition of disaster mitigation aspects in Batu Bengkung Beach Tourism, especially the tsunami disaster. The explanation is in the following table:

**Table 3 Aspects of tsunami mitigation on Batu Bengkung beach tourism**

No.	Mitigation Aspects	Application	Purpose
1.	Determination of location and evacuation route at Batu Bengkung beach location	Determination of a high and safe evacuation location by utilizing the hills around the beach. As well as providing signage at several points as information on evacuation routes.	So that all Batu Bengkung beach tourism actors can understand and know the areas and routes that can be used when evacuation is needed.
2.	Early warning system on Batu Bengkung beach	In the form of alarms or sirens, placed at several points,	So that Batu Bengkung beach tourism actors can know that a tsunami disaster will occur soon, and the beach manager immediately directs and carries out the evacuation process for all people.
3.	Establishment of a vertical evacuation building or a sturdy Tsunami Shelter on the coast of Batu Bengkung	Buildings with effective guidance standards for disaster mitigation, as established by FEMA.	So that Batu Bengkung beach tourism has a building that is devoted as a shelter against tsunamis. Anticipate if the evacuation process to a safe area is not possible.

Source: Personal Analysis

In addition, regular training to tourism facility managers, security officers, and surrounding communities will improve preparedness and response to tsunami threats. Periodic disaster simulations can help all parties involved understand evacuation procedures and emergency measures needed. Cooperation with related parties, such as the Regional Disaster Management Agency (BPBD), the police, and other relevant agencies, is a key factor. Coordination in the development of disaster response plans, procurement of safety equipment, and implementation of risk mitigation efforts will strengthen the overall tsunami response system in this tourist destination.

### Conclusion

Batu Bengkung Beach, Malang Regency, has great tourism potential, but is also vulnerable to tsunami risk. In-depth analysis shows the shortcomings of disaster mitigation and some of the design results of disaster response buildings that have been designed by the authors. The recommendations involve the construction of anti-tsunami buildings, breakwaters, early warning, regular training, and cooperation with BPBD to improve preparedness and response to potential disasters.

With the implementation of this recommendation, it is hoped that Batu Bengkung Beach can remain an attractive tourism destination and can improve safety for its visitors.

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