

Interactive “Palu Earthquake and Tsunami Museum” as Architectural Mitigation Media

Christine Wonoseputro, S.T., M.A.S.D.¹, Clarissa Handoyo Anggresta²

¹Petra Christian University, Indonesia
christie@petra.ac.id, changgresta@gmail.com

Indonesia is located on the edge of “Ring of Fire”, causing it to experience a high rate of natural disasters as the Ring of Fire is also where 90% of all earthquakes occur. Beneath Indonesia is where three major tectonic plates – the Pacific, the Eurasian, and the Indo-Australian meet. Thus, as a country with a very high disaster-risk level, Indonesia needs to implement a more effective mitigation strategy that can be thought to society. This paper will present an interactive earthquake and tsunami museum design idea to promote architecture as an effective mitigation media to educate the society regarding natural disasters, most notably earthquakes and tsunamis. Through the outlines of the design concept, it is expected to transfer “vehicle for three dimension” messages in the mitigation process as information, communication, and public education. To solve the design problems, it uses a symbolic approach and applies the concept of interactive activity programs in spatial sequences. The goal of the program is to bring a more significant impact in communicating the mitigation process for the community at any groups and hoped the impact of natural disasters can be reduced in the future.

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Background

Indonesia’s location on the edge of the Earth’s Ring of Fire made it to be a country that is prone to disaster. Its geographical location has put Pacific, Eurasian, and Indo-Australian tectonic plates to be beneath Indonesia. As a sub-tropical country located on the equator, Indonesia is threatened with what has been divided into 3 categories by The Indonesian National Disaster Management Agency (BNPB)- geological disaster (earthquake, tsunami, volcano eruption, landslide), hydro-meteorological disaster (flood, giant flood, drought, extreme weather, high-wave tides, land and forest fire), and anthropogenic disaster (virus plague, accidental industrial-technological failure). Over the past decade, the number of disaster that had occurred in Indonesia has kept on increasing, and unfortunately, the number of lost lives were measurably high each time.



Figure 1: The increasing number of disaster occurred in Indonesia over the past decade
Source: (Badan Nasional Penanggulangan Bencana Indonesia, 2019)

On 28 September 2018, a large, shallow earthquake struck in the neck of the Minahasa Peninsula, Indonesia, with its epicenter located in Donggala Regency, Central Sulawesi. The 7.5 Magnitude quake was reportedly located 77 km (48mi) away from the provincial capital of Palu (Central Sulawesi) and was felt as far away as Samarinda on East Kalimantan and also in Tawau, Malaysia. This event was preceded by a sequence of foreshocks, the largest of which was a magnitude 6.1 tremor that occurred earlier that day. The second phase of this earthquake is known as liquefaction, which is rare to occur in several previous natural disaster cases within Indonesia. In two locations this led to mudflows in which many buildings became submerged causing hundreds of deaths with many more reportedly missing. The earthquake itself happened during the 40th anniversary of the city of Palu. Those make the number of loss getting worse. During that time, a lot of people gather near the waterfront in order to celebrate it.

As this disaster rarely happened, the society needs to be re-educated regarding these range of disasters in order to survive the next probable disasters, considering Indonesia's high disaster-risk level. Professor Djwantoro Hardjito, a Petra Christian University Civil Engineering lecturer wrote an article entitled "*Indonesia Darurat Mitigasi Gempa*", translated as "Indonesia is exigent for earthquake mitigation", saying that "Indonesia needs to be more willingfull to learn and adapt as a precautious action, not only in habit and behavior, but also in political-will for decision makers". Thus, mitigation would not only to give knowledge, but it would also be a base foundation to the culture of Indonesia to experience and survive disasters. Palu and Donggala consider as valuable lesson to the world.

Literature Review

In 2015, United Nations held World Conference on Disaster Risk Reduction in Sendai, Japan, and released Sendai Framework for Disaster Risk Reduction as the first agreement between UN member post-2015 development agenda. This agreement concluded the priorities of the framework for action is consisted of 4 main points:

- a. Priority 1: Understanding disaster risk
- b. Priority 2: Strengthening disaster risk governance to manage disaster risk
- c. Priority 3: Investing in disaster risk reduction for resilience
- d. Priority 4: Enhancing disaster preparedness for effective response and to "build back better" in recovery, rehabilitation, and reconstruction

1. The Purpose of Mitigation

Based on The Federal Emergency Management Agency of United States, the meaning of mitigation itself is the action to lessening the impact of disasters in order to reduce the number of victims, and based on The Indonesian National Disaster Management Agency, it is a series of action to reduce the risk of disaster, and to increase the awareness and the ability to avoid menace. The cycle of disaster management is consisted of 3 stages – pre-disaster (preparedness), during (emergency response), post-disaster (recovery). Therefore, mitigation lies into the first stage of disaster management, serving with several purposes:

- a. Increases the understanding of the society regarding the importance of precautious mitigation in order to reduce the risk of disaster
- a. Increases the effort taken in being precaution of disaster
- b. Encourage a corporation between government, agencies, and private sectors in developing a precaution habit
- c. As a guide for agencies

2. Laws Regulating Mitigation

Indonesia has an independent law regarding disaster management, and mentioned that disaster mitigation program is included with

- a. Planning and executing of space layout are based on disaster-risk analysis
- b. The arrangement of construction, infrastructure, and building layout
- c. Educating, training, and counseling regarding mitigation.

3. Factors Affecting Disaster Risk Level

Zakaria in Nirmalawati (2011) wrote there are several factors that could have caused disaster risk to increase, such as

- a. The lack of understanding regarding the characteristic of disaster
- b. Behaviors that affects to the quality of natural resources
- c. Lack of information regarding early warning
- d. The inability in facing distress.

4. Mitigation as early Prevention System Against Natural Disaster

The natural disaster prevention programs can be categorized into 3 phases, which are pre, during (emergency response), and post disaster phase. Pre Disaster programs obtain to reduce numbers of victims, including matters and human life. Those included:

4.1. Awareness Development

The development of early warning system, system maintenance, logistic stock system, and mass training system.

- a. Self-evacuation training development to people who live in high risk natural disaster zone regularly.
- b. Government regulation about city planning and city development, especially in high risk natural disaster area

4.2. Mitigation

- a. Mitigation is an early information system in order to make the impact of natural disaster getting worse. This pre-disaster programs in order to reduce number of loss in the future, such as developing publication, education, and information about natural disaster
- b. In planning and development, this case can be done thoroughly. The ideal mitigation programs should be developing both by people and government.

As a high risk country with natural disaster, Indonesia government should spread of natural disaster prevention programs. Those include:

a. Awareness

People are being aware through natural disaster symptoms. For example: people in charge have to be alert of doing action, before natural disaster take place or after it happens.

b. Knowledge

By being familiar with differ situation and techniques, people could adapt to survive in any probable distress situation when facing disaster.

c. Recovery

People are able to overcome disaster, according doing prevention, rescue rehabilitation, and reconstruction. In some cases, natural disaster has not only caused material damaged, but it also takes psychological impact. Post natural disaster can cause riots, robbery, and mental health problems.

Methodology

In order to solve and sharpen design problems, primary data and secondary data are needed as a consideration to produce synthesis . Data collection is done by collecting information about the Palu earthquake through various information sources. While supporting data for analyzing design problems is carried out by conducting interviews with several parties whom directly involved in the natural disaster mitigation process. Other is done by literature study, precedent study, and problem analysis. The design approach chosen is symbolic approach as an alternative to solve the design problem. This approach will see architecture as a visual object, which capable to express spaces and display images in order to give a "message" to the observer . In this case, it is expected that architecture is a medium that capable of "communicating" with observers in conveying mitigation messages.

Results and Discussions



Figure 2: Site plan design
Source: (Author, 2019)

The whole design was based on the referral zoning in the building concept. Rooms are distinguished based on the characteristic of each zone. As a result, the museum is consisted of 4 major areas – preliminary zone that includes entrance and main lobby, unstable zone that is consisted of main disasters, stable zone that is consisted of the areas tells post-disaster stories, and management office for the workers and officials of the museum to work.

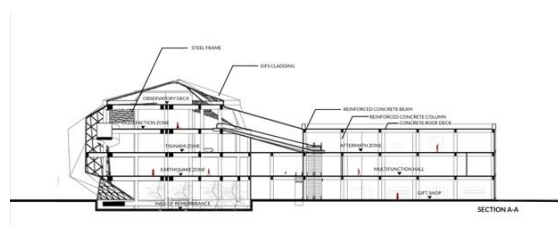


Figure 3: Museum section showing horizontal zoning
 Source: (Author, 2019)

This concept is also applied not only to the vertical zoning, but also to its horizontal zoning, placed chronologically with the incident, making the building circulation to in a linear sequence.



Figure 4: Grieving zone
 Source: (Author, 2019)

The grieving zone is a semi underground space, built with an intention to reminisce the victims, shows through lines of vanishing men but standing on their ground. Whereas dying trees symbolizes the end of lives. Another purpose of the hall was to be able to initiate an intimate feeling of every visitor with the situation, made through a mirrored floor that would “enlarge” the space, but filled with installation of mourning.

The atmosphere was made to be dark-toned in order to enhance sadness, and materials that produces echoes are used to enhance the hollowness feeling of the space, making the hall to be spacious yet confined at the same time.



Figure 5: Pre-disaster zone
 Source: (Author, 2019)

As a part of the prologue, pre-disaster zone was design as a space for the visitors to be able to feel relax. It is set to have a calm, warming tone, picturing regular day that people spent normally. so the colors of pastel is used around the room. Benches and vases are placed for visitors to be able to enjoy them. Whereas the finishing of the room uses carpet flooring with matte colors, pampering whoever is the area.



Figure 6: Earthquake zone
Source: (Author, 2019)

The first area in the unstable series is the earthquake zone. It has a character that contradicts with the previous zone as an imagery to the atmosphere when earthquake strikes in a sudden with the intention to give earthquake-related knowledge to the public. Some earthquake simulators are also located within the area to give a real life experience the feeling to be shake by the ground, making the simulators as an amusement for not only children, but also adults to try. This zone uses natural colors of greyish concrete, and a dimly mood so enhance the atmosphere.

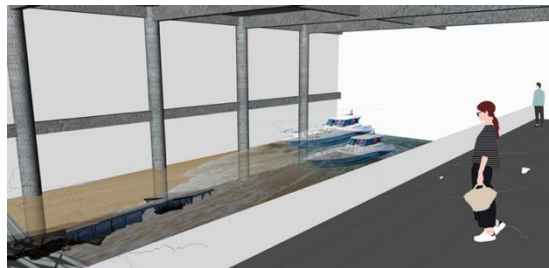


Figure 7: Tsunami zone
Source: (Author, 2019)

The second part of the unstable series is the zone designed to feel the atmosphere of being in a tide, so visitors can sense the feeling of being in a high wave situation. At the end of the zone, a live-effect tsunami simulator room will give visitors an imagery that shows the tsunami phenomenon from the middle of the ocean to the shore. Blue tone is dominant in this area, but neutralized with neutral colors. Whereas the materials for the simulator uses water for the seawater, and real sand as the shore.



Figure 8: Liquefaction zone
Source: (Author, 2019)

A hydraulic system is used to take the visitors from the tsunami simulator to the liquefaction zone. As liquefaction zone shows wavy ground post earthquake situation due to the lost of the soil strength, it uses dark-toned colors and literal sand to create a realistic atmosphere, creating an ambience of being sucked in into the soil. Some miniatures such as broken houses and flipped cars are also placed to enhance the tension.



Figure 9: Aftermath zone
Source: (Author, 2019)

Aftermath zone tell the story of future planning from the government regarding recovery of the city. It has the more rigid structure and ambience to show a stronger character compared to the previous zones. The tone used in the zone is warm toned colors as a contrast to the colors from the non-stable zone, who uses cool-toned colors. Whereas the material for the aftermath zone uses ceiling to cover structures, and translucent glass that dominants the whole cover of the building.

Conclusion

The arrangement of either space and sequential pattern holds a symbolic meaning of burden to go on a process from pre-incident to becoming a stronger community that they will be. This symbolism can be seen through the vertical sequential zoning that were arranged chronologically based on the series of disaster. So a linear circulation was chosen for the museum in order for the visitors to be able to see and feel the whole story.

As a learning facility, earthquake and tsunami simulators are expected to be able to give an experience for visitors the feeling to be in the middle of a disaster, hence teaching them what should they do next in order to survive. This museum is expected to be a pioneer that would raise the awareness for the next generation, and as a constant reminder to the society the importance to have the basic knowledge of disaster mitigation. In the future, this museum is also expected to become one of Palu's icon for international tourism that is owned and will support the income of Palu.

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You must insert an acknowledgement note (particularly to research funding body) at the end of your paper.

References

- Desfandi, M. (2014). *Urgensi kurikulum pendidikan kebencanaan Berbasis kearifan lokal di Indonesia*. SOSIO-DIDAKTIKA: Social Science Education Journal, 1(2), 191-198.
- Hardjito, D. (2018, October 27). *Indonesia Darurat Mitigasi Gempa*. Kompas. Retrieved January 5, 2019, from <https://kompas.id/baca/opini/2018/10/27/indonesia-darurat-mitigasi-gempa/>
- INDONESIA, P. R. (2007). *Undang-undang republik indonesia nomor 24 tahun 2007 tentang penanggulangan bencana*.
- Kawamata, Y. (2016). *EARTHQUAKE ENGINEERING RESEARCH FACILITIES IN NIED: POSSIBLE CONTRIBUTIONS TO INTERNATIONAL DISASTER MITIGATION*. In Proceedings of the 4th International Conference of Archi-cultural Interactions through the Silk Road, Nishinomiya, Japan (pp. 198-201).
- National Mitigation Framework. (n.d.). *What is Mitigation?*. Department of Homeland Security. Retrieved June 20, 2019, from <https://www.fema.gov/national-mitigation-framework>
- Nirmalawati, N. (2012). *Pembentukan Konsep Diri Pada Siswa Pendidikan Dasar Dalam Memahami Mitigasi Bencana*. SMARTek, 9(1).
- No, P. M. D. N. (33). Tahun 2006 Tentang Pedoman Umum Mitigasi Bencana.
- Sunarti, V. (2014). *Peranan Pendidikan Luar Sekolah Dalam Rangka Mitigasi Bencana*. SPEKTRUM: Jurnal Pendidikan Luar Sekolah (PLS), 2(2).



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