Proceedings of the 3rd Annual

Basic Science International Conference 2013

Basic Science Advances in Energy, Health and Environment

April 16-17th, 2013 | University of Brawijaya
Malang, East Java, Indonesia

Faculty of Mathematics and Natural Sciences
University of Brawijaya
Preface

All praises are due to Allah, God Almighty, Who made this annual event of successful. The “3rd Annual Basic Science International Conference (BaSIC-2013)” is an annual scientific event organized by the Faculty of Mathematics and Natural Sciences, Brawijaya University. As a basic science conference, it covered a wide range of topics on basic science: physics, biology, chemistry, mathematics and statistics. In 2013, the conference took a theme of “Basic Science Advances in Energy, Health and Environment” as those three aspects of life are hot issues.

The conference in 2013 was the continuation of the preceding conferences initiated in 2011 as the International Conference on Basic Science (ICBS), where it was a transformation from the similar national events the faculty had organized since 2004. What also changed in year 2013 was the use of the ISSN for the conference proceedings book, instead of an ISBN used in previous proceedings books. The change was based on the fact that BaSIC is an annual event, and, therefore, the use of ISSN is more appropriate. The proceedings book was also divided into four books: Physics, Biology, Chemistry and Mathematics, each with a different ISSN. The proceedings were also published in electronic forms that can be accessed from BaSIC website. I am glad that for the first time both types of publication can be realized.

This event is aimed to promote scientific research activities by Indonesian scientists, especially those of Brawijaya University, in a hope that they may interact and build up networks and collaborations with fellow overseas counterparts who participated in the conference. This is in line with university vision as a World Class Entrepreneurial University.

I am grateful to all the members of the program committee who contributed for the success in framing the program. I also thank all the delegates who contributed to the success of this conference by accepting our invitation and submitting articles for presentation in the scientific program. I am also indebted to PT Semen Gresik and PT PLN (Persero) for their support in sponsoring this event.

I wish for all of us a grand success in our scientific life. And I do hope that the coming conferences will pick up similar success, and even better.

Malang, April 2013

Johan Noor, Ph.D.
Conference Chairperson
Foreword by the Rector of Brawijaya University

First of all I would like to congratulate the Organizing Committee for the success in organizing this amazing event. I believe all dedicated time and efforts will contribute to the advancement of our beloved university.

I would like to welcome all participants, domestic and overseas, especially the distinguished invited speakers, to Malang, to the conference. An international conference is a good means to establish and build relationships and collaborations among participants. So, I hope this conference will facilitate all of you, the academicians and scientists, to setup a network of mutual and beneficial collaboration. As a university with a vision to be “A World Class Entrepreneurial University”, Brawijaya University will support all efforts to realize that dream.

Finally, I do hope that the conference will run smoothly and nicely and is not the last one. I would like to thank all parties who have lent their hands in making this conference happened.

Malang, April 2013

Prof. Dr. Yogi Sugito
Rector, Brawijaya University
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Prof. Hideo Tsuboi, Nagoya University, Japan
Prof. Jia-Lin Wang, National Central University, Taiwan
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Discussion/Questions/Answers
CERTIFICATE

This certificate is awarded to

Muhammad Farid

in recognition of his/her contribution as a

Presenter

The 3rd Annual Basic Science International Conference 2013 on April 16-17, 2013

Prof. Dr. H. Marjono, M.Phil.
Dean, Faculty of Mathematics and Natural Sciences
University of Brawijaya

Johan AE Noor, Ph.D.
Chairperson
Abstract
North Bengkulu district is one of the districts in the province of Bengkulu, which is located adjacent to the Indian Ocean. This location is also near to the active tectonic plate subduction between the Indian-Australian and Eurasia. Earthquakes which occurred in the Bengkulu province from 1994 to now has led to extreme shoreline changes. These changes are predicted because the coastal in North Bengkulu district has a relatively low seismic vulnerability index and are in areas prone to earthquake. This research aimed (1) knowing the speed of abrasion in some locations that cause changes in the shoreline, (2) know the Seismic Vulnerability Index at several locations in the coastal region of North Bengkulu. Microtremor data at several coastal locations are acquired using a digital seismograph short period 3 component. HVSR method give dominant frequency (f_0) and the amplification factor (A) at each site and they were reviewed. Using the value of f_0 and A, can be calculated the value of the seismic vulnerability index (K_g). Abrasion speed can be calculated by means of overly between North Bengkulu map printed in 1994 to 2012. Seismic vulnerability Index in several locations are measured has a value that varies between 1.2 to 16.1 and speed abrasion between 1.4 to 5.7 meter per year. In coastal locations which have high seismic vulnerability index value tended to have high values of speed abrasion and vice versa.

KEYWORDS: Speed Abrasion, Seismic Vulnerability Index, HVSR, North Bengkulu Districts

A. INTRODUCTION
The north Bengkulu geographically in the range of 101.6° to 102.5° longitude and 3.2° to 3.6° latitude, mostly a plateau with an altitude below 150 m there is a unidirectional longitudinal section west coast from south to north. The north Bengkulu district directly adjacent to the eastern province of Jambi, Lebong and Kepahiang District, in the northern district bordering Mukomuko, South section bordering Central Bengkulu and Bengkulu city, in the western part of Indonesia borders the ocean (Figure 1). The total area of North Bengkulu district is 554,854.00 hectares or 554.854 km². In tectonics, North Bengkulu district is part of Bengkulu Province is in the subduction zone (infiltration) between the Indian-Australian plate and the Eurasian, so it is often hit by earthquakes. Seismic vulnerability index in North Bengkulu district varies from 0.6 to 13.7, while the rate of coastal erosion moving from 1.4 to 5.7 meters per year [1].
Taking into account the quantity of seismic vulnerability index and the rate of erosion has been known that high-value seismic vulnerability index for areas with high erosion rate and vice versa that the low seismic vulnerability index for the region very low rate of abrasion. This fact suggests that there is a relationship between seismic vulnerability index at a rate of coastal erosion. Examples of affected beaches abraded in Figure 2a and 2b.

Figure 2a. The Shore abrasion in the Tras Terunjam area - Mukomuko district, 2008

Figure 2b. The Shore abrasion in Serangai area - North Bengkulu district 2010

Earthquake that occurred since 1900 up to 2010, approximately 95% of the earthquake under the Indian Ocean [2]. With the relative distance closer to the source of the earthquake, the coastal area is a zone greater likelihood of receiving energy earthquakes and will have implications for greater damage than the land heading upstream. Possible damage suffered by the beach is pelulukan (liquefaction) and abrasion [3]. Many points along the coast abrasion Bengkulu province allegedly due to conditions of high soil vulnerability.

The high vulnerability of the land is presumably because this region is in soft soil conditions ($V_{S30}$ USGS, 2011). The causes of coastal erosion such as wave power, wind power, mining sand and so on, has been studied by many researchers. Bartlett stated abrasion occurs because of the high vulnerability of the coastal ocean dynamics such as the pounding waves, wind, destruction of shade trees and ocean currents [4]. According to Donahue results, that the destruction or erosion coastal erosion by ocean waves beating against the walls of continuous beach [5]. According Kodoatie and Sjarief results, that the abrasion is a process of transformation of the beach caused by waves, currents, and tides [6]. Wibisono found that there are several factors that led to the erosion is due to the effects of wave refraction [7]. In addition to the causes mentioned above there are allegations that the earthquake which occurred in the province of Bengkulu help speed the movement of the rate of abrasion, it can be observed from the location of coastal erosion that occurs in every type of beach and the concentration of earthquakes that have occurred in the province. Many coastal areas affected by erosion into further thought to know the cause of the abrasion.

B. THEORETICAL FRAMEWORK

1. Seismic Vulnerability Index

Seismic Vulnerability Index ($K_g$) is defined as an index that describes the level of vulnerability of the surface layer of soil to deformation during the earthquake. Results of research conducted by Nakamura[8], Nakamura et al. [9], Gurler et al. [10], Saita et al. [11], and Nakamura [12], provide empirical information that the seismic vulnerability index is the square of the peak value of microseismic spectrum divided by the resonant frequency, which is defined as:

$$K_g = \frac{A^2}{f_0}$$ (1)

Where $K_g$ is the seismic vulnerability index, $A$ is the peak of microseismic spectrum, and $f_0$ is the resonance frequency.

2. Shoreline change

Shoreline change is a phenomenon of changing the coordinates on the boundary between sea and land in a region. These changes can occur due to several reasons, such as rising sea levels due to global warming and climate change [13], [14], the influence of tides [15], and affected by abrasion and accretion that occurs in the body the beach [16]. The change happened affected by the coastline and out of sediment washed downstream resulting in destructive or constructive forces that alter the beach profile [17]. Beach profile shape is strongly influenced by wave attack, sediment
properties such as density and resistance to erosion, the size and shape of the particles, waves and current conditions as well as coastal bathymetry [18]. Shoreline change has been monitored by the Hermano B and Suwartana using Landsat which is visible as a change of abrasion and accretion. Landsat image map of North Bengkulu district as shown in figure 3.

The map above is made with 1:250,000 scale so that the change does not seem coastline. In the data acquisition rate of abrasion siubah a 1:25.000 scale and processed with ArcMap so by zooming (zoom), the erosion rate can be calculated

C. DATA ACUSSION

1. Microseismic Data

Microseismic data acquired directly through microseismic measurements on any type of beach. The number of microseismic measurements over 32 locations, each location was measured for 30 minutes with a sampling frequency of 100 Hz. Microseismic survey techniques that do adhere to standards SESAME European Research Project 2004. Example microseismic data display survey results can be seen in Figure 4.

2. Shorelines change data

Shoreline change data acquired by the overlay technique Landsat image map of the survey in 1994 with Landsat image map of the survey in 2012. Both the map and the results of the 1994 survey map of the survey in 2012 and digitization scanned, scaled and equated equated coordinates then be overlaid. This overlay technique derived from the rate of abrasion of all points surveyed.

D. RESULT AND DISCUSSION

Though the results obtained Geopsy data using resonance frequency and amplification factor. One of the resulting spectrum dpat seen in Figure 5:

Seismic vulnerability index value \( (K_v) \) obtained using equation (1) and the value of coastal erosion rate is calculated by overlaying the map of 1994 Landsat imagery and Landsat image map in 2012 that the results outlined in table 1.

Table 1. The results obtained by the data microseismic and Seismic Vulnerability Index and Abrasion rate beaches on the coast North Bengkulu
COORDINATE RESONANCE FREQUENCY AMPLIFICATION FACTOR SVI VABR

-3.076 101.51 3.300 3.11 2.9 65.0
-3.222 101.60 5.000 3.98 3.2 73.0
-3.275 101.66 13.900 7.99 4.6 82.0
-3.368 101.79 10.000 3.5 1.2 64.0
-3.417 101.88 2.600 2.72 2.8 93.0
-3.422 101.88 3.300 3.71 4.2 70.0
-3.434 101.91 0.700 2.35 7.9 80.0
-3.502 101.98 3.200 2.51 2.0 20.0
-3.559 102.09 1.500 3.64 8.8 104.0
-3.582 102.11 4.200 3.49 2.9 77.0
-3.698 102.24 3.000 6.95 16.1 97.0

The relationship between seismic vulnerability index to the rate of coastal erosion is shown in the graph as shown in Figure 6.

Figure 6. Relationship between the Seismic Vulnerability Index and the abrasion rate

Spatial distribution map of seismic vulnerability index in North Bengkulu district is shown in Figure 7.

Figure 7. Spacial distribution map of seismic vulnerability index in North Bengkulu district.

Microseismic data survey results suggest a correlation between seismic vulnerability index to the rate of coastal erosion. In this penlitian seismic vulnerability index values varied from 1.2 - 16.1, while the value of the rate of erosion varies between 1.4 - 5.7. Variations of both has given mathematical relations that are processed using SPSS-16. These relationships are outlined in Table 2.

Table 2. The results of calculation of correlation between Kg and Vabr with SPSS-16.

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<td>Linear</td>
<td>.458</td>
<td>6.755 1 8 .032</td>
<td>69.108 2.087</td>
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The independent variable is IKS.

The processing model give the relationship between Seismic Vulnerability Index (Kg) at the rate of coastal erosion in the province of Bengkulu (Vabr) that Kg = 69 108 +2087 Vabr the calculated value F = 6755, while the value of F table = 5321 for α = 0.05, which means that the hypothesis that there is a correlation between the value of Kg with Vabr accepted. According to the equation that links the resonant frequency S wave velocity:

\[ \downarrow = 4h \cdot f_o \]  

\( \downarrow \) an average speed of S waves, sediment thickness h and resonansi frequency \( f_o \). The relationship between the velocity of the S wave to the resonance frequency is linear huhubungan so as to lower the resonant frequency tend to be in areas of low velocity means that on soft soils (unconsolidated). In soft soil erosion the chances would be
very high. Therefore the relationship between seismic vulnerability index to the rate of coastal erosion is possible.

Some researchers have conducted a study which explain the correlation between seismic vulnerability index with physical damage to buildings. In general, they said there is a correlation between seismic vulnerability index with physical damage to buildings. Nakamura (2008); Saita et al. (2004), Huang and Tseng (2002)[18], states that the value of the index is likely to increase in the seismic vulnerability of coastal areas. The increasing tendency of seismic vulnerability index decreased S wave velocity or the condition is getting soft. With the soft soil condition is then alleged physical damage to buildings in coastal areas will be along with allegations of coastal erosion in areas physically damaged building.

E. CONCLUSION

The conclusion that can be drawn from the relationship between seismic vulnerability index and the rate of coastal erosion are:

1. The rate of coastal erosion varies according to the condition of seismic vulnerability in the corresponding place. There is a trend in a place that has high seismic vulnerability index would have a high rate of abrasion as well.

2. There is significant correlation at the 95% significance level seismic vulnerability index to the rate of coastal erosion in the linear relationship.

F. REFERENCE


