1st International Symposium on Physics and Applications

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The 1st international Symposium on Physics and Applications, 1st ISPA or ISPA 2020, was held from December 17 to 18, 2020 on Department of Physics, Institut Teknologi Sepuluh Nopember (ITS). The event was organized by the Department of Physics, Faculty of Sciences and Data Analytics, ITS. Considering the covid-19 pandemic and the travel restriction, ISPA 2020 was conducted via Zoom Meeting. In addition, the symposium is supported by Airlangga University, State University of Surabaya, and National University of Singapore. This Proceedings issue compiles oral presentations that were submitted by the authors after rigorously reviewed by a special committee designated by the Journal of Physics Conference Series (JPCS) editor for ISPA.

Hopefully, we can develop research collaboration for supporting and increasing the quality of research in the physical sciences and its applications. We are grateful to the organizing and editorial committee that have actively contributed to accomplish a well-balanced scientific program. We also thank to graduate students lively participated, the keynote and invited speakers and also the participants who are going to be the presenter in ISPA 2020. The organizing and editorial committee, keynote and invited speakers are listed below.

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1	Hiroaki Yamanaka	Tokyo Institute of Technology, Japan
2	Suryani Dyah Astuti	Airlangga University, Indonesia
3	Hery Suyanto	Udayana University, Indonesia
4	Kuwat Triyana	Gajahmada University, Indonesia
5	Suasmoro	Institut Teknologi Sepuluh Nopember, Indonesia
6	Agus Purwanto	Institut Teknologi Sepuluh Nopember, Indonesia

In the symposium, we invited 6 keynote speakers and 6 invited speakers from Thailand, Malaysia, Taiwan, Japan, Bangladesh, and Indonesia. The symposium has successfully obtained positive responses from researchers by collecting significant and qualified 72 papers for oral presentations that have selected from 98 abstracts received. The presenters and participants are shown in **Figure 1**. The all papers are included addressing the research topics of the conference including theoretical physics, laser and optoelectronics, instrumentation and acoustics, earth sciences (geophysics), bio and medical physics, and material physics.

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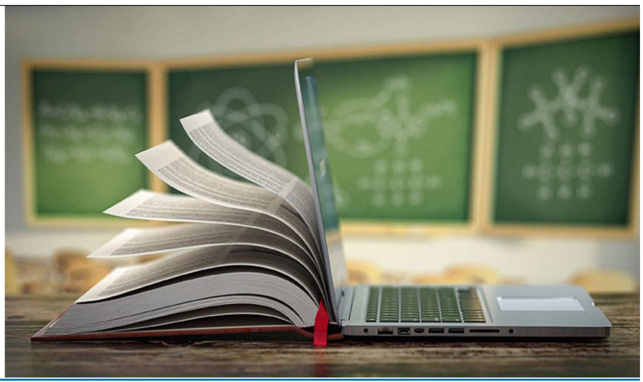

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Mapping of weathered layer thickness and Seismic Vulnerability in Tegal using HVSR method

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Abstract. The Baribis-Kendeng-Tegal fault is part of the Baribis-Kendeng fault segment that extends from West to East in the north of Java Island. The existence of this fault segment affects seismic activity in Tegal. The research was conducted by microtremor measurement to determine the earthquake susceptibility index and the thickness of the weathered layer in Tegal City. The data collection method in the study used the HVSR (Horizontal-to-Vertical Spectral Ratio) method to determine the subsurface conditions of the study area. The results of the horizontal component analysis of the vertical component showed a spectrum peak at the dominant frequency and amplification factor. The thickness of the weathered layer was obtained from the comparison of the value of Vs 30 of the study area to its natural frequency value. The seismic vulnerability index was obtained by squaring the amplification and dividing it into its natural frequency. Measurements carried out at 37 points in Tegal City obtained varying thickness of the weathered layer, ranging from 4.29 meters to 88.14 meters and seismic vulnerability values ranging from 0.08 to 16.65.

1. Introduction

The subduction process of the Indo-Australian Plate against the Sunda Block Order in the south of Java Island resulted in high geodynamic conditions on the Island of Java so that the Java mainland region was formed which can be seen through fault patterns. These fault patterns contributed to shallow earthquakes that occurred in Java Island [1]. The Baribis-Kendeng Fault is a reverse fault that is known to be active since the Late Neogene period until now. The Baribis-Kendeng fault pattern can be traced from west to east in the northern part of the island of Java [2]. Through GPS observations, it is known that the Baribis-Kendeng fault movement is 0.2 - 5 mm / year [3]. This fault is an active fault that causes some damage, such as the Karawang earthquake (1862), the Kuningan earthquake (1842), the Majalengka earthquake (1912), and the Madiun earthquake (2016) [4] [5].

The West Pantura region has several faults in the form of plate faults in Cirebon, Brebes, Pemalang, and Pekalongan. Three faults are squeezing the City and Tegal Regency areas, namely the Baribis-Kendeng Fault of Cirebon (0.5 mm / year), the Baribis-Kendeng Brebes Fault (4.5 mm / year), and the Baribis-Kendeng Fault of Pemalang (4.5 mm / years) (Gumilang, 2018). The Tegal region itself is traversed by the Baribis-Kendeng Tegal Fault (4.5 mm / year) with East North East (ENE) Strike and Dip 45S [6]. This causes Tegal City to become a city that is prone to earthquake activity.

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Based on the Geological Map of Purwokerto and Tegal, Tegal City is composed of alluvium rocks such as gravel, sand, silt and clay; as river and coastal sediment with a thickness of up to 150 m [7]. Earthquake damage is not only affected by the magnitude of the earthquake, but also by the geological conditions of an area [8]. Areas prone to damage caused by earthquakes occur in areas of thick soft sediment that are above the hard bedrock [9]. The less compact the rocks form an area, the greater the effect of an earthquake that will occur in that area. This is due to areas that have non-dense rock properties, so they are easily damaged and if an earthquake occurs, the damage caused by the earthquake will be even greater [10].

Therefore, It is necessary to map earthquake-prone areas in Tegal City, seeing the high seismic activity, constituent rocks, and the thickness of the sedimentary layers. The use of natural microseismic waves of an area can describe the subsurface conditions. By using the HVSR method, the subsurface characteristics parameters will be obtained in the form of natural frequency (fo) and amplification (A) [11]. These parameters can be used to determine the thickness of the weathered layer and the level of soil vulnerability in the study area.

2. Method

This research was conducted by measuring the microseismic signal at 37 points in 4 sub-districts of the Tegal City. The research was conducted using a 3-component LE-3D lite seismometer (Vertical, North-South, West-East) with a distance between points of ±1km. The data collection duration measured at each point varies around 30-45 minutes. The data recorded was a three-component signal (Vertical, North-South, West-East) stored in Mini Seed (.msd) format. The data was processed using geopsy software by comparing the H / V spectrum to obtain subsurface characteristics parameters in the form of natural frequency (fo) and amplitude (Ao).

According to [12], the thickness of the sediment layer (H) is related to the natural frequency (fo) and the speed of the S wave on the surface (Vs), so that the Equation 1 was used to obtain the thickness of the weathered layer:

$$H = \frac{Vs}{4fo} \tag{1}$$

The value of the S wave velocity (Vs) on the surface was determined based on data from the [13] by entering the research area data. S waves at ground level are shear waves that occur up to a depth 30m (Vs30) which can deform rock layers [14]. The value of shear wave velocity up to a depth of 30m can be used as a determination of geotechnical parameters in infrastructure development [15]. Furthermore, the value of soil vulnerability was calculated using Equation 2 [11].

$$Kg = \frac{Ao^2}{fo} \tag{2}$$

Then, the value of weathered layer thickness and soil vulnerability index were interpreted into a map, then analyzed and made conclusions.

3. Results and Discussion

The calculation of thickness of sediment layer used the dominant frequency and shear wave velocity at a depth of 30m (Vs30) using Equation (1). Based on the processing result data, the value of the weathered layer thickness around Tegal City ranges from 4.29 m−88.14 m as in the Figure 1. The figure can be seen that the entire sub-district tegal selatan has a thick-weathered layer. In Margadana sub-district, there is a contrasting thickness of the weathered layer. The western part of Margadana sub-district has a thin-weathered layer thickness, while in the western part it is thick. The northwestern part of Tegal Barat sub-district is composed of a thick-weathered layer, while in the northeast, it has a thin-weathered layer. In the sub-district Tegal Timur, it can be seen that the value of the weathered layer thickness in the center of the sub district is high, while in the north and south it is low. This is consistent with the geological map of the Purwokerto and Tegal sheets which states that the City of

Tegal is composed of alluvium: gravel, sand, silt and clay; as river and coastal sediments with varying thickness below 150 meters [7].

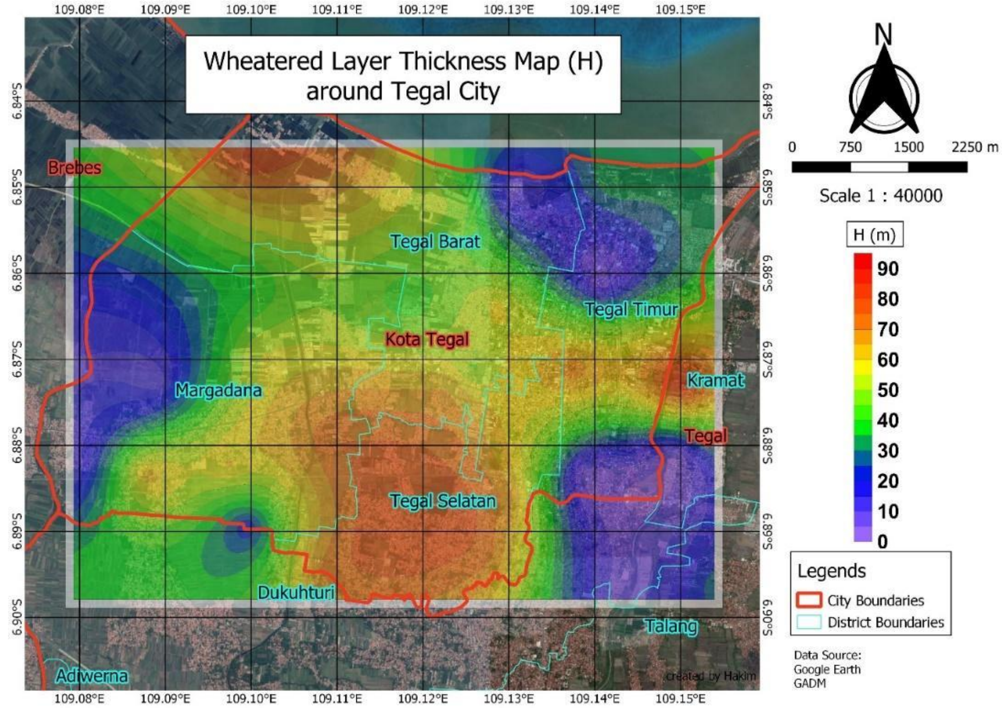

Figure 1. Distribution map of weathered layer thickness values in Tegal City

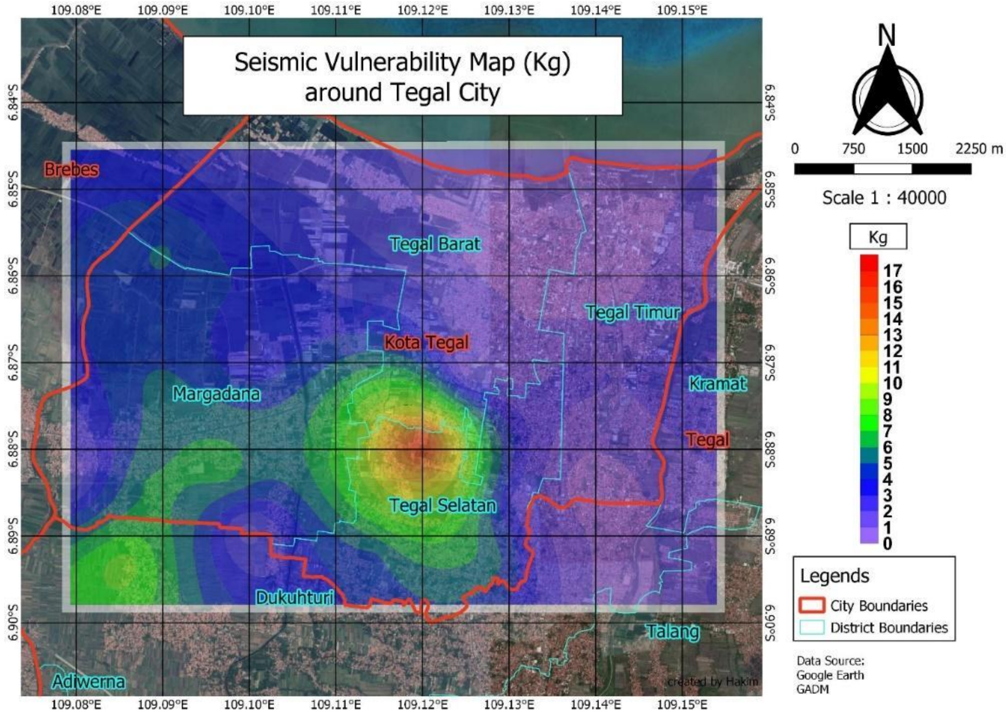

Figure 2. Distribution map of Seismic Vulnerability in Tegal City

Based on the seismic vulnerability mapping in Tegal City (Figure 2), the area that has the highest seismic vulnerability value is in the "Tegal Selatan" sub-district, while in the other three sub-districts it has a low seismic vulnerability value. High seismic susceptibility values are generally found in soils with soft sedimentary rock lithology. This high value describes that the area is prone to earthquakes. In contrast, small seismic susceptibility values are generally found on soils with strong and stable constituent rocks so that when an earthquake occurs, the area only experiences minor shocks [16]. Based on Figure 1 and Figure 2, the areas prone to damage in the event of an earthquake are located in the northern part of the "South Tegal" sub-district. This is because it has a thick weathered layer value and a high seismic intensity value compared to other areas.

4. Conclusion

Through this research, we can conclude that the weathered layer thickness in Tegal City varies from 4.29 m – 88.14 m. The area that has the highest vulnerability value in the event of an earthquake is the Tegal Selatan sub-district. It can be seen from the high thickness of the weathered layer and the seismic vulnerability index in the area.

5. Acknowledgement

We are thankful to Ristekdikti for funding this research and to the National Unity and Community Protection Agency, Bappeda, and BPBD of Tegal Regency who have granted permission to collect data in the Tegal City area. We also express our gratitude to the IT Telkom Purwokerto academic community who helped in completing this paper.

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