

The Study of Sand Qualities from Flash Flood Impact in North Luwu Regency to Be Used as A Fine Aggregate

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Abstract. Research of the qualities of sand from the flash flood in North Luwu Regency, South Sulawesi Province, Indonesia in mid-2020 was motivated by the abundance of sand material left as a result of the natural disaster. The aim is to find out whether the sand can be used as fine aggregate for building materials such as concrete and concrete brick. The standard method used is based on SNI-1970-2008 and SNI 03-2834-2002. The result is mud content 1.99%, water content 3.69%, specific gravity in the loose condition 1.099 Kg/L, specific gravity in solid condition 1.162 Kg/L, Apparent Specific Gravity 2.701, Saturated Surface Dry (SSD) 2.411, Bulk Specific Gravity (dry) 2.366, absorption 5.799%, and fineness modulus is 2.247. Based on the variable, only absorption did not meet SNI. The conclusion is the sand from the flash flood in North Luwu Regency can be used as a fine aggregate for building materials.

Keywords: Sand qualities; fine aggregate; North Luwu Regency, SNI

1 Introduction

The flash flood that occurred in North Luwu Regency, South Sulawesi Province on Monday, July 13, 2020, left various sad stories. In addition to the loss of life, severe infrastructure damage was also inseparable from this disaster. Starting from residents' houses, roads, school buildings, and office buildings were completely submerged by the mud generated by the flash flood. According to a report from Suara.com dated July 15, 2020[1], there were six districts that were affected by flash floods, of which the worst damage was in Sabbang and Baebunta District, where the height of the sand mud reached 3-4 meters.

Until the completion of the emergency response period, the situation in North Luwu, especially in areas affected by flash floods, has not yet fully recovered. This was because there is still a lot of sandy mud left. Many houses, agricultural land, and plantations of residents are still buried because the location for disposing of the sandy material is no longer available in the area. The best solution so that the material does not become an environmental problem anymore is to use it. There are several ways that can be done, including turning it into fine aggregate for the manufacture of building materials such as concrete and bricks which later can also help the community to provide their own materials for the reconstruction of their damaged infrastructure.

However, as we know that not all materials are good to be used as fine aggregates of building materials. Instead of being useful, it might even be detrimental later. A prior study is needed to determine whether a natural material can be suitable or not to be used as a fine aggregate. There have been many previous studies that have investigated the characteristics of sand and its use in certain cases and areas, for example by Mochammad Qomaruddin et al., 2018, about a comparative study of the characteristics of river sand in Jepara Regency by measuring the specific gravity, water content, and silt content of various river sands in the district to be used as a concrete mixture[2].

For the research conducted by Adhytius H. Pagut et al, 2017, regarding the technical characteristics of concrete and mortar using Bondo Hitam and Bondo Merah sands by comparing them with Takari Sands, the result is that fine aggregates using Bondo Hitam and Bondo Merah sands have greater compressive strength than Takari Sands[3]. A study conducted by R. Ilangovana et al, 2011[4] which is in line with M. Shahul Hameed and A. S. S. Sekar, 2009 [5] concluded that natural sand mixed with mine dust and marble mud dust can increase the compressive strength of concrete.

Jeffrey et al., 2018, researched an experimental study of the effect of the use of sand from several areas of Pontianak on the compressive strength of concrete, the result is that there are differences in characteristics in various regions in Pontianak which result in differences in the compressive strength of each different fine aggregate [6]. Similarly, Antonius et al., 2012, who researched the effectiveness of quartz sand as fine aggregate on the mechanical properties of concrete concluded that the quality of quartz sand is good for making concrete [7].

Judging from the incident, the sand from the flash flood in North Luwu Regency was a type of excavated sand mixed with river sand[8]. The sand material comes from sandy mountain landslides and is then carried by a very large volume of water from the upstream area of the river to the downstream. Materials physics is an interdisciplinary field of physics that studies the properties and structures of materials and their applications. With this material science, we can study the nature or characteristics of a natural material such as sand whether it is suitable or not to be used as a useful material such as concrete and concrete brick. As a measure in determining whether or not a type of sand is used as fine aggregate, a standard is needed as a reference, in this case, SNI S-04-1989-F[9] and SNI 03-2834-2002[10]. If the results are good for use as fine aggregate, it is certain that the material can be used as fine aggregate for concrete or concrete brick.

Based on the background above, the purpose of this research was to know the quality of the sand from flash floods in the North Luwu Regency based on testing its characteristics, including mud content, specific gravity, bulk specific gravity, absorption, and sand fineness modulus. The urgency of this research is (1) as a lesson on how to utilize an abundant local natural resource which is an environmental problem, and (2) as a reference for the community or local government that the sand resulting from the flash flood was feasible or not to be used as a building material such as concrete and concrete brick.

2 Research Methods

The method used in this study was an experimental method, where the quality of the sand to be studied will be determined to be used as fine aggregate as a mortar mixture. To find out, the sand must be measured for various characteristics such as mud content, water content, specific gravity, bulk specific gravity, and fineness modulus. And finally, it will be matched with the applied standard, namely by using SNI.

2.1. Research Place

This research was conducted at the Laboratory of Structure and Materials, Civil Engineering Department, Faculty of Engineering, Andi Djemma University, Palopo City, Province of South Sulawesi, Indonesia.

2.2 Research Materials and Tools

The materials and tools used in this research were sand from the flash flood in North Luwu, freshwater, measuring cup, Grail, digital scale, oven, pipette, sieve, tray, conical mold and temper (compacting), volumetric flash tube, vibrating machine, bucket, gradation checker tool (sieve), vessels, and containers.

2.3 Work Procedures

For Testing the characteristics of sand/fine aggregate:

- Provide the main material, namely sand from the flash flood in North Luwu at three different points,
- For specific gravity test refers to ASTM C 128-78[11],
- For the mud's content test refer to SNI S-04-1989-F [9],
- For water content test refers to ASTM C 566-89[12],
- For specific gravity (Apparent, Bulk Specific Gravity (Dry), Bulk Specific Gravity (SSD) , and water absorption test refer to SNI 03-1970-2008[13],
- And for fineness modulus refer to ASTM C 33[14].

2.4 Flow Chart

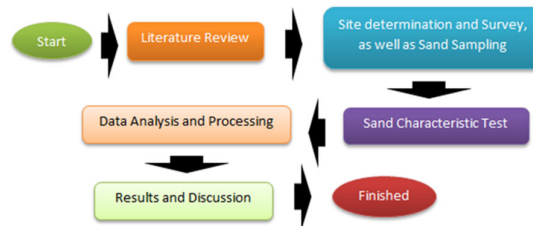


Fig 1. Research Flow Chart

3 Result and Discussion

The results of this study can be seen in Table 1 below:

Table 1. The test result of sand/fine aggregate characteristics

No.	Sand Characteristics	Interval	Test Result				Average	Expl.
			I	II	III			
1	Mud content	Maks. 5%	1,80	2,33	1,86	1,99%	Yes	
2	Water content	2% - 5%	4,28	1,71	5,08	3,69%	Yes	
3	Specific Gravity							
	a. Loose condition	1,4-1,9 Kg/l	1,110	1,061	1,125	1,099 Kg/l	Yes	
	b. Solid condition	1,4-1,9 Kg/l	1,189	1,127	1,169	1,162 Kg/l	Yes	
4	Absorption	0,2% - 2%	7,298	5,932	4,167	5,799%	No	
5	Bulk Specific Gravity							
	a. Apparent	1,6 - 3,3	2,785	2,615	2,704	2,701	Yes	
	b. SSD	1,6 - 3,3	2,484	2,398	2,352	2,411	Yes	

	c. Dry	1,6 – 3,3	2,315	2,264	2,430	2,336	Yes
6	Fineness modulus	1,5 – 3,8	2,30	2,07	2,37	2,247	Yes

In this experiment, the sand samples used were taken from three different places at random in the flash flood-affected area in North Luwu Regency. The results of the three samples were then averaged. From the research results shown in Table 1 above, it was known that of all the variables of the measured sand characteristics, only the absorption does not meet the standards, where the good absorption value according to SNI is in the range of 0.2%-2%, while the average sand studied was 5.799%. However, this figure is not too far from the standard value, it is still within the tolerance limit for a fine aggregate. This shows that the absorption of sand from the flash flood can be said to be quite high, meaning that if it is used as a fine aggregate in a mortar or concrete mixture, it requires more water in the mixture.

Interestingly, the research results obtained even though the sand under study was sand from flash flood, but the results of the mud content obtained have an average value of 1.99% while the specified limit should not be more than 5%. This shows that the sand was very clean and does not need to be washed first if it is used as a concrete mixture.

4 Conclusion

Based on the results of the sand characteristics test obtained, it can be concluded that the sand from the flash flood in North Luwu Regency was of very good quality to be used as fine aggregate for concrete or concrete brick mixtures.

Acknowledgements

This research was supported by the Indonesian Christian University, Jakarta and Laboratory of Structure and Materials, Civil Engineering Department, Faculty of Engineering, Andi Djemma University, Palopo, South Sulawesi Province, Indonesia.

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