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Analysis Test of Fine Aggregates at the Upstream of Jeneberang River

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Analysis Test of Fine Aggregates at the Upstream of Jeneberang River

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Abstract. The purpose of the research was to find out: 1) mining location distribution and 2) fine aggregate gradation originated from construction material mine locations located at the upstream of Bili-bili reservoir. The research combined descriptive and experimental research. Descriptive research was conducted to map the distribution and area of construction material mining, whereas experimental research was conducted to analyze fine aggregate gradation of materials originated from the mining areas. The research result indicated that 1) Lanna Village with two mining points, Tambang Luas and SP1, became the largest mining location with total mining area of more than 97 Ha. SP4 in Bontokassi Village was no longer became a mining area since it cannot be accessed by the miners; 2) Gradation analysis in mining materials based on fineness modulus for Tambang Luas, SP1, and SP3 locations were in a fine category. Whereas, SP2 and SP5 were in the rough category. Based on the aggregate zone, Tambang Luas, SP1, and SP3 were located in Zone 2 relatively rough materials, whereas SP2 and SP5 were in zone 1 rough.

Keywords: mining, gradation analysis, construction materials, Bili-bili DAM

1. Introduction

Resources in the river include water resources and excavation C resources such as gravel and sand. Human use excavation C resources in the form of sand and crushed stone around the watershed; however, if river preservation is not maintained it could damage the watershed. As a water system, the watershed is influenced by the upstream part, especially the biophysical conditions of catchment and absorption areas that are threatened by human interferences. The interferences often occurred in the river area are, among others, garbage disposal into the river, slum housing development, and stones mining of crushed and sand. The interferences could disturb the ecosystem in the watershed.

Materials in building construction work in Makassar City are dominated by materials from Gowa Regency. Fine and rough aggregates used are from the Jeneberang watershed upstream area, specifically in the upstream of Bili-bili reservoir. The many locations of materials mining in the upstream of the reservoir should be a concern especially in terms of the materials quality. Nurlita [1] stated that a good aggregate gradation is related to the direct source of the quarry or the mining location. Regarding the granule composition requirement, the Department of Public Work [2] divided fine aggregates into four zones based on the reality that natural fine aggregates are within one of the granule composition. Concrete mixture planning arranged in SK SNI T-15-1990-03 gives a requirement of fine aggregates that consist of four zones and rough aggregates that consist of three types. Bentz et al. [3] describe that concrete mixture with the aggregate combination is still debated. On one side, the making of concrete requires good workability with small air content and resistant to segregation, reduce in shrinkage, and hydration heat effect. On the other hand, however, there are difficulties related to aggregate mobilization from other locations to obtain continuous aggregate combination [1].

2. Research Method

The research combined descriptive and experimental researches. Descriptive research was conducted to map the distribution and area of construction material mining, whereas experimental research was conducted to analyze the fine aggregate gradation of materials obtained from the mining areas. Variables in the research were location areas of the construction material mining and fine aggregates. Data were analyzed using the descriptive method to reveal the phenomenon of fresh concrete in various natural aggregate combinations.

The research location was at the upstream of Jeneberang River located in Bontojai Hamlet, Barisallo Village, Parangloe Sub-district, Gowa Regency, South Sulawesi. The experimental research was conducted at the Material Testing Laboratory, Department of Civil Engineering Education and Planning, Faculty of Engineering, Universitas Negeri Makassar. The research was conducted from April to June 2018.

3. Results and discussion

3.1 Mining location

To find out the location distribution of mining points, direct measurement was conducted at the mining location using GPS (Global Position System) by taking a coordinate point in each location. All mining areas were located at Parangloe Sub-district, Gowa Regency, exactly at Lanna Village, Barisallo Village, Bontokassi Village, and Lanjoboko Village. Location sampling was conducted using GPS data and then processed. Next, the topography map was created using ArcGIS. The location and mining areas were divided into SP-1, SP-2, SP-3, SP-4, SP-5, and Tambang Luas. The clear illustration of the areas can be seen in Figure 1.

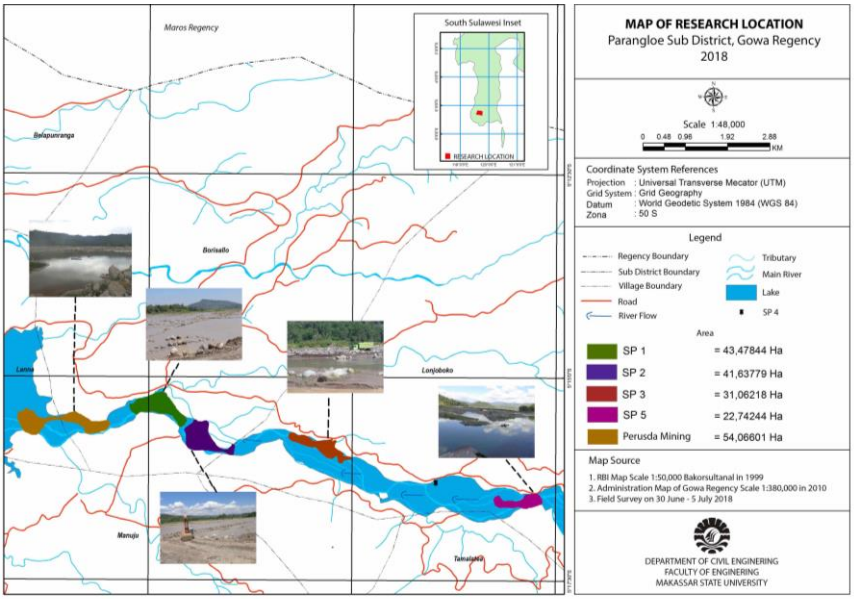

Figure 1. Mining location distribution map in Parangloe Sub-district

Figure 1 clearly illustrates the location distribution of construction material mining points located at the upstream of Bili-bili reservoir. Tambang Luas was the nearest location from the reservoir, whereas SP-5 was the farthest. SP-4 was no longer used as a mining area. Based on the measurement and data processing, data in the form of location coordinate of the mining points at Parangloe Sub-district were obtained as follows in Table 1.

Table 1. Mining location area at Parangloe Sub-district

Location	Site	Location Area
Tambang Luas	Lanna Village	54.06601 Ha
SP 1	Lanna Village	43.47844 Ha
SP 2	Barisallo Village	41.63779 Ha
SP 3	Barisallo Village	31.06218 Ha
SP 4	Bontokassi Village	-
SP 5	Lanjoboko Village	22.74244 Ha
	Total	192.986686 Ha

Table 1 indicates that Lanna Village was the largest area of construction material mining with two mining points, which were Tambang Luas and SP-1 with a total area of more than 97 hectares. SP-4, however, was no longer used as a mining location. The result of mining location distribution mapping indicated that Lanna Village with 2 mining points had potential as an aggregate material producer. Based on the contour of Jeneberang River channel and the sloping river slope elevation, the position of Lanna Village that located in the upstream area of Bili-bili reservoir allowed the accumulation of aggregate materials [4] [5]. The factor permitted the flow speed to slow down thus the accumulation of materials became easier. Therefore, it became one of the factors to be considered by the local government through the Perusahaan Daerah (regional company) to take on the role as the administrator of the location in order to could control them. As well as in SP-1 location that closes to the area. As for the location in Bontokassi Village (SP-4), it was no longer a mining location since the check dam was damaged thus it complicated the excavation access in the location according to the regulation, which is 300 m in the downstream, and 100 m in the upstream [6]–[8].

3.2 Fine aggregate gradation analysis

3.2.1. Aggregate fineness modulus

Based on the result of gradation analysis, data on aggregate fineness modulus were obtained as presented in Table 2.

Table 2. Aggregate fineness modulus

Points	Fineness Modulus	Category
Tambang Luas	2.13	Fine
SP 1	2.32	Fine
SP 2	2.74	Medium
SP 3	1.82	Fine
SP 4	-	-
SP 5	2.83	Medium

Table 2 indicates that Tambang Luas, SP-1, and SP-3 locations had sand quality within the category of fine, whereas SP-2 and SP-5 had sand quality within the category of the medium.

3.2.2. Aggregate zone

Fine aggregate zone, based on the gradation analysis, could also be seen by comparing the result of gradation analysis with standard zone limit can be seen in Figure 2-6 for Tambang Luas, Sand Pocket 1 (SP 1), SP 2, SP 3, and SP 5, respectively.

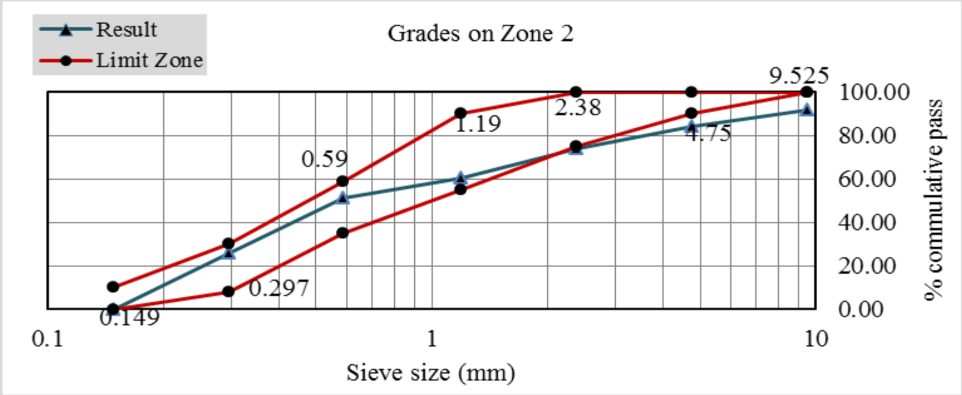

Figure 2. Graphic of gradation analysis test in Tambang Luas

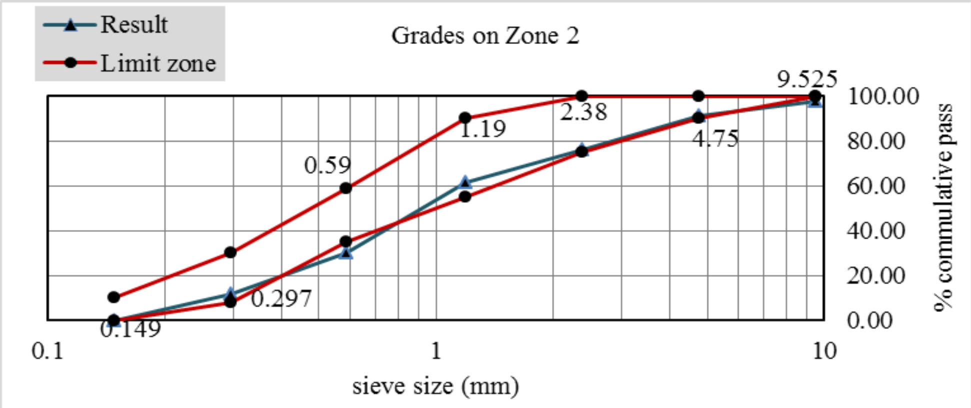

Figure 3. Graphic of gradation analysis test in Sand Pocket 1 (SP 1)

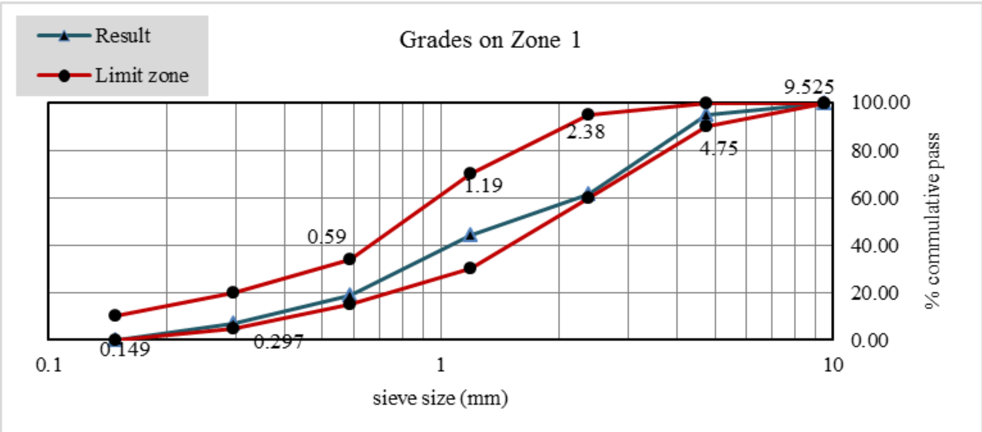

Figure 4. Graphic of gradation analysis test in Sand Pocket 2 (SP 2)

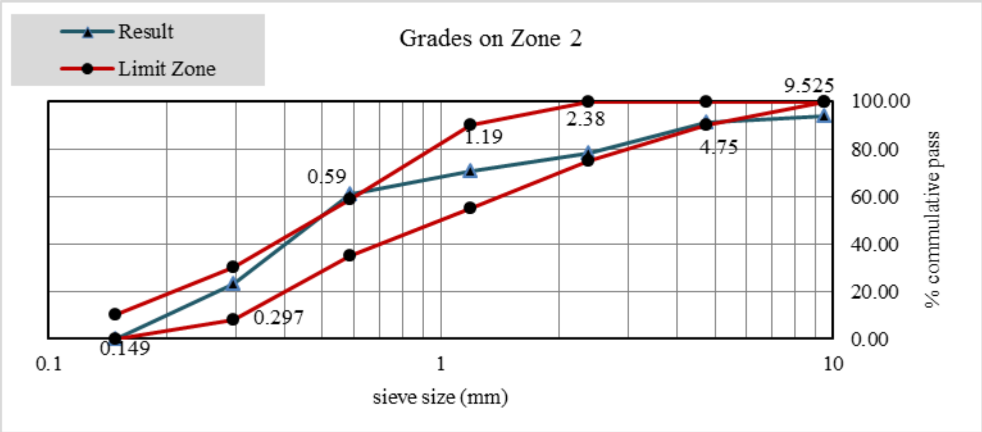

Figure 5. Graphic of gradation analysis test in Sand Pocket 3 (SP 3)

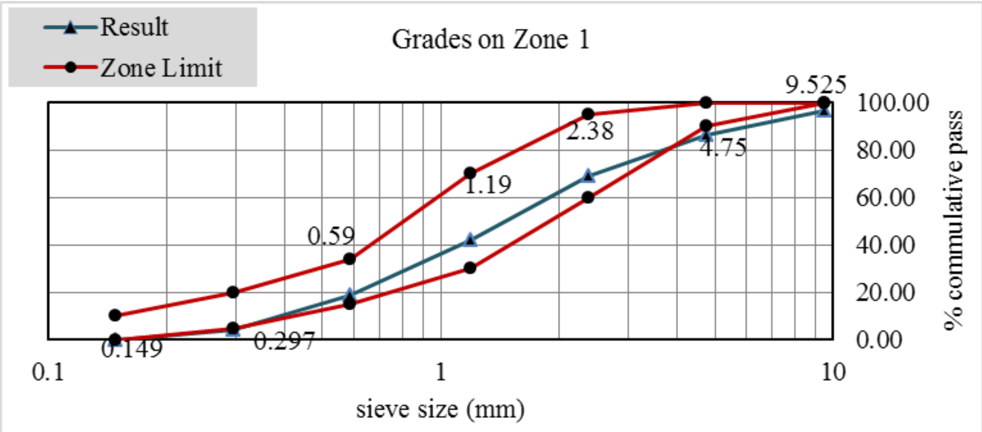

Figure 6. Graphic of gradation analysis test in Sand Pocket 5

In fine aggregate gradation analysis test taken on Tambang Luas, Sand Pocket 1 (SP 1), and SP 3 can be seen that fine aggregate gradation was located in Zone II where the sand produced were relatively rough. Whereas, fine aggregate gradation analysis test taken on Sand Pocket 2 (SP 2) and SP 5 can be seen that fine aggregate gradation was located in Zone I where the sand produced seemed to be rough.

Based on the result of gradation analysis examination and combined with the result of mining location distribution mapping, it can be seen that there was a tendency that materials in Tambang Luas and SP-1 locations were in finer gradation since the locations were located at the downstream area before the Bili-bili reservoir [4][9]. As for SP-3, due to its location in the straight river channel, it permissible that aggregates produced were within the fine category. It is in line with the influence of flow velocity and friction-related gradation that influenced each material granule. In SP-2 location, aggregate zone and fineness modulus indicated rough material. It was due to the location that located at the river meander area that allowed rough materials to settle and not easy to directly follow the flow. Rougher material granules also indicated in SP-5 location since the position of the sedimentary barrier was in the river upstream that generally had the characteristic of larger materials.

4. Conclusion

Based on the research result, the conclusion is Lanna Village with 2 mining points, Tambang Luas and SP-1, became the largest mining area in total more than 97 ha. SP-4, on the other hand, that located in

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Bontokassi Village was no longer used as mining location since it can no longer be accessed by the miners. Gradation analysis test on mining materials based on the fineness modulus for Tambang Luas, SP-1, and the SP-3 location was within the fine category. Whereas, SP-2 and SP-5 were in the rough category. Based on the aggregate zone, Tambang Luas, SP-1, and SP-3 were located in Zone 2 relatively rough materials, whereas SP-2 and SP-5 were in zone 1 rough. The result of gradation analysis on mining materials supports the information from the result of mining location distribution mapping.

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