The analysis of mortar concrete with the variety of sands in Jepara (keling sand, bangsri sand) using strong pressure method

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Abstract. Along with the increasing of infrastructure development in Indonesia especially in jepara, so the necessary of material also increase, for example: sand. Nowadays, mintilan is the sand that often be used in making infrastructure in the government because it is considered that it has the good quality, whereas in the other hand the river sand is also abundant, but the government perverted mintilan sand as the development material. River sand is usually used by the middle to lower county because the house because the price is cheaper than mintilan sand. After doing this research we hope that: can know the quality of the river sand if it is used in infrastructure, knowing the river sand in Jepara that have the good quality, such as: keling sand, bangsri sand, The stages of this research are: preparation, sand inspection (mud content and organic faces, filter analysis, moister content and weight, and specific gravity), making specimens based on SKSNI 03-6825-2002 ASTM C 305, making compressive strength test. The test result show that at 3,7,14,21,28 days old show that keling sand (93,2 kg/cm²), bangsri sand (135,2 kg/cm²). The use of river sand as the construction material by the government and community will have consequence on the balance of mintilan sand and river sand. The specific treatment on the river sand will that quality that is almost same as mintilan sand.

1. Introduction
Now, The World of Construction in Indonesia is more advanced with the number of housing developments, office affairs or educational facilities. Therefore it is required an alternative in using construction materials. In economical term, the construction materials especially local sand is easy to be gotten naturally, so the price is relatively cheap, if it is compared with the use of mintilan sand from when compared to the use of sand mintilan from Mount Merapi.

Sand is like one of the building materials that are needed by the community. People's demand to build residential buildings is quite high along with population growth. The use of river sand as mortar
or species, concrete, plastering in residential buildings or other buildings are common in Jepara Regency and Muntilan sand is still a prima donna because it is sharp, hard and clean. However, the provision of this sand also has limits, and in order to conserve natural resources, the use of local sand must be intensified. The use of local sand not only reduces the use of Muntilan sands, but it can save freight costs in addition to increasing the incomes of the local community of Jepara regency because it can be done by the local people. The Problems that occur are characteristic data about these sands are unknown and moreover there is no data that can show the quality of mortar produced.

Mortars are mixed dough that are consisting of sand (fine aggregates) plus adhesives (clay, lime, Portland cement, fly ash) and freshwater [1]. The mortar function is as the constituent part of the binder of a construction both structural and non-structural. The use of mortar for structural construction is mortar pairs for foundation structure, while non-structural is mortar pairs of bricks on filler wall. Mortar has a compressive strength and bending which is a function of the quality of its constituent material. For example is adding supplement that becomes an integral part of high strength and high performance concrete mix design [2].

To get the good mortar yield for construction materials, it is required to test the quality of the compressive strength of mortar [3]. This can be used as a reference by the community in planning the use of local sand in Jepara Regency as the construction material (mortar). Due to the above description, the writers are interested to make a research by using the title “The Analysis of Mortar Concrete with The Variety of Sands in Jepara (Sand Rivet, Sand Bang) Based on The Strong Pressure Method.”

2. Methodology
In this study the variables that will be examined are the variable of mortar quality using local sand that has been washed and that has not been washed toward the compressive strength of mortar. The sampling variable is 2 (two) river location in Jepara Regency. Concrete materials can be collected from the concrete companies [4].

As a scientific research, this research should be implemented in a clear and regular systematic, so it is obtained the satisfactory result and can be responsibility. Therefore, the implementation of this research is divided into several stages, that are:

The Production of The Specimens
The specimens that are used in this research are mortar cubes with size 5 cm x 5 cm x 5 cm and the tests are committed using the methods that are suitable in SNI [5]. In this study, it is made 60 sample specimens which are consisted of mortar samples with washed sand and unwashed sand mortar samples[6].
a) The Materials:
   - Cement (PPC) ; - PDAM Water
Refined Aggregate (washed sand and unwashed sand that are from 4 (four) river locations in Jepara Regency).

b) The Testing Procedures:

For processing mixed plastering mortar is based on SNI 03-6882-2002 as follows:
1. Prepare the materials that will be used to make concrete mortar (water, cement, and sand) after doing the previous test of organic refined aggregate of sand [1].
2. Mix the materials of mortar with ratio that is suitable with design mix that has been determined.
3. Prepare the cube-shaped molds 5 cm x 5 cm x 5 cm[2].
4. After the mixture is spread evenly, put it into the mold until it is full and then puncture and flattened until the mixture mortar is visible by cement water.
5. After it is connived for 24 hours to make the mixture of mortar concrete becomes ossified, then it is dismissed from the mold. And then continue to the mortar treatment by submerging using water.
6. The mortar specimens will be tested in age 3, 7, 14, 21, 28 days.
   - Test the compressive strength of mortar concrete test results according to predetermined age, then done placement mortar cubes on the test machine.
   - The emphasis is made constantly at a speed of 4-6 kg / cm2 / dt until the object is destroyed, then read and recorded on the dial in the pressure machine.

c) Calculation analysis

After the experimental data can then be calculated

The Test of Mortar Compression

a) Tools
- Cube mold
- Pressure machine

b) The Test Procedure:
- The test of mortar concrete compression result is suitable with predetermined age, then put the mortar cubes on the testing machine.
- The pressing is done constantly using 4-6 kg/cm²/s velocity until the object dissolved, then read and write on the dial in pressure machine.

c) Calculation Analysis

After get the data result then analyze

3. Result And Discussion

3.1 Testing of Portland Cement

In essence Portland cement production is a major component in the concrete construction, beside that cement also contributes large amounts of greenhouse gases, because the production of 1 ton of Portland cement also releases about 1 ton of carbon dioxide into the atmosphere[3]. The use of Portland limestone cement has many benefits, both of technical and economical [4]. To reduce energy consumption and CO2 emissions and increase production, cement manufacturers mix or integrate mineral additions such as slag, natural pozzolana, sand and limestone[5]. The test of the cement is used to know the normal consistency of the cement that is used.

From the experiment result, it is made graph between the percentage of water that is used by decrease of needle obtained, so it get the percentage of water that will be used to get 10 mm needle drop. A 10 mm needle drop is normal consistency. So it is needed 31% water percentage from the cement that is used to get normal consistency.

From the analysis results is obtained the first binding of cement with the assumption of 25 mm degradation is obtained 106 minutes with a temperature of 30 ° C. This test is done to know the level of cement bonds to aggregate by time or setting time. After get the result, it will be known the maximum time of cement that is used to harden properly, therefore when mixing the mixture should be less than the binding time.
3.2 Dry Weight Of Sand, SSD, And Wet Weight Testing

Testing of dry weight of sand, SSD, and wet weight of sand is to know condition that is made as reference in making mix design. This condition will affect the amount of water that is used and will affect the power that will be resulted. SSD conditions are searched to determine the sand condition in a neutral measurement of water.

![Figure 2. SSD Testing of Keling Sand and Bangsri Sand](image)

3.3 Mud Content and Organic Muck

Mud Content Testing

| Table 1. Mud Content of Shaking System |
|---------------------------------------|
| Kind of Sand          | Keling Sand | Bangsri Sand |
| Sand High + Mud       | 130 cc      | 130 cc       |
| Sand High             | 116,5 cc    | 113,5 cc     |
| Mud High              | 13,5 cc     | 16,5 cc      |
| Mud Content           | 10,37 %     | 12,7 %       |

| Table 2. Mud Content of Bangsri Sand Washed System |
|-----------------------------------------|
| Test 1 | Test 2 |
| First Weight of The Sand | 200 gram | First Weight of The Sand | 200 gram |
| Weight After Washed      | 174 gram  | Weight After Washed      | 172 gram  |
| Mud Weight               | 26 gram   | Mud Weight               | 28 gram   |
| Average of Mud Weight    | 27 gr     |

| Table 3. Mud Content of Bangsri Sand Washed System |
|-----------------------------------------|
| Test 1 | Test 2 |
| First Weight of The Sand | 200 gram | First Weight of The Sand | 200 gram |
| Weight After Washed      | 176 gram  | Weight After Washed      | 174 gram  |
| Mud Weight               | 24 gram   | Mud Weight               | 26 gram   |
| Average of Mud Weight    | 25 gr     |

From the mud content test, the mud content with the shaking system is 10.37% for bangsri sand and 12.7% for keeling sand.

Organic Content Testing

| Table 4. Organic Sand Content |
|-------------------------------|
| Kind of Sand | Color        |
|----------------|--------------|
| Keling Sand   | Brown Blackish|
| Bangsri Sand  | Yellow Brownish |


From the testing of organic contains in keling sand and bangsri sand identify that both of sands has not been clean entirely. Therefore it is needed the washed process in order the sands are cleaner (mud content or organic content). Bangsri sand has lowest organic content so it is better than keeling sand.

![Graph of Cumulative of Endured Weight](image1)

**Figure 3.** Cumulative of Endured Weight

![Figure 4. FM (Smoothness of Modulus)](image2)

**Figure 4.** FM (Smoothness of Modulus)

From the data of the filter analysis testing result above can produce FM (Smoothness of Modulus), the sand that has the high FM value so it has stronger bond of cement and the quality is better than using the sand that has low FM value[6].

3.4 The Result of The Testing of Average Mortar Compression

The compression testing using compression machine[7][8][4]

| No | Kind Of Sand | The Compression (Original) Kg/Cm² |
|----|--------------|----------------------------------|
|    |              | 3  | 7  | 14 | 21 | 28 |
| 1  | Keling Sand (original) | 45,6 | 57,6 | 72,8 | 88,8 | 93,2 |
| 2  | Bangsri Sand (original) | 95,6 | 107,2 | 127,2 | 130,4 | 135,2 |
| 3  | Keling Sand (washed) | 49,6 | 85,6 | 102,4 | 107,2 | 111,2 |
| 4  | Bangsri Sand (washed) | 119,6 | 144,0 | 196,0 | 188,0 | 224,0 |
4. Conclusion
From the testing can be obtained the following results:
1. The comparison between keeling sand and the bangri sand is visible from the mud content, it is higher keeling sand’s mud content with value 10, 37% than bangsri sand’s mud content with value 10, 70% using shaking system. For the washed system, keeling sand is 13, 50% and bangsri sand is 12, 5%. It indicates that keeling sand is better than bangsri sand.
2. The organic contents of both sands have the significant difference, that is keling sand has brownish yellow colour and bangsri sand has blackish brown colour. It shows that the organic content that is contained in keeling sand is bigger because it has thick color.
3. Keling sand has the smoothness grain in the amount of 3, 71 and bangsri sand has the smoothness grain in the amount of 3, 81.
4. From the testing of mortar compression using bangsri sand has the better compression than keeling sand, by improving in each testing age.

Acknowledgement
The authors are thankful to RISTEK DIKTI, Department of Civil Engineering, Faculty of Engineering, UNISSULA Semarang and Department of Civil Engineering, UNISNU Jepara for successful completion of this work.

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