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STUDY THE USE OF ADDITIONAL MATERIALS TO IMPROVE QUALITY CONCRETE USING THE SAND WITH HIGH LEVELS SLUDGE

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ABSTRACT

With the increasing use of concrete in the construction industry, the more the effort to make it. According to ISO, the sand used for the concrete mix should not contain levels of sludge, which is more than 5%. In reality, however, the field-level implementation sludge contained in the sand for the concrete mix is often overlooked, because to achieve a level of mud that is less than 5% sand, must be washed first. For washing the sand in large quantities will require plenty of water and quite a long time. Previous researchers conducted a study on the effect of aggregate mud content; the quality of the concrete, the results obtained from these studies that the mud content of 7% to 20% decreased the compressive strength of concrete is not too significant to normal, with the percentage decrease of 0.432%, 0.996 %, 2.847%, 4.858%. Based on the findings above, this time researchers will conduct experiments with the manufacture of concrete mixtures in the laboratory using additional materials such as cement and fly ash with a percentage based on the excess mud contained levels on a sand. The test specimen used in the form of the cylinder size 150mm x 300mm, used sand containing mud content of 18% and 20%, in which the experiment makes 5 Variations specimen, variation 1 by adding 13% of cement by weight of cement to the sand with 18% mud content, variation 2 by adding 15% cement, 20% for mud levels. Variation 3 adds the fly Ash 13%, while variation 4 adding 15% fly ash. For variety of 5, use sand containing mud with content of 3.6% as a comparison for Normal Concrete. The result showed an average compressive strength of concrete for variation 1 is 22,45Mpa the medium compressive strength of concrete for variation 2 is equal to 21.90 MPa. Then the mean compressive strength of concrete of variation of 3 is equal to 25.14 MPa. Next the mean compressive strength of concrete is equal to 28.20 MPa for variation 4. Finally, the compressive strength of concrete for variation of 5 is equal to 21.94 MPa. Thus variation 1 has increased the compressive strength of concrete by 2.32%. Variation 2 decreased by 0.18%. Variation 3 an increase of 14.58%. Variation 4 an increase of 28.53% against the normal concrete (Variation 5).

Keywords: levels of sludge, sand, concrete compressive strength, fly ash, cement.

INTRODUCTION

With the increasing use of concrete in the construction industry, the more the effort to make it. At SNI, sand used for the concrete mix should not contain levels of mud, more than 5% However, in reality the implementation of the field mud contained levels in sand for a concrete mix, are often overlooked. Due to achieve the levels of mud is less than 5% sand must be washed first. For washing the sand in large quantities will require plenty of water and quite a long time.

P Previous researchers conducted a study on the effect of aggregate mud content to the quality of concrete. The results of these studies obtained results that the mud content of 7% - 20%, decreased compressive strength is not too significant, the percentage of normal concrete with a decrease of, 0.432%, 0.996%, 2.847%, 4.858% [[1] and [2]]. Based on the above results, the researchers will conduct experiments, manufacture of concrete mix, laboratory using additional materials such as cement and fly ash with excess levels of percentage based mud, which is contained in the sand. Test object, which is used in the form of cylinder size 150mm x 300mm, used sand containing mud content of 18% and 20%, which makes the 5 experimental variation. Specimen consisted of a variation of 1 by adding 13% of cement by weight of cement to the sand with mud content 18%. Variation 2 with 15% adding cement to mud content of 20%. For variation 3 adding 13% of fly Ash. Variation 4 adds 15% fly ash. Then variation 5 using sand containing mud content of 3.6% as a comparison (Normal Concrete).

LITERATURE REVIEW

Previous research

Previous researchers conducted a study influence the aggregate mud content, the quality of concrete. The study includes: testing the characteristics of aggregates, mix design, the manufacture of specimen, and compressive strength testing the results of the study obtained results that the mud content of 7% - 20%, decreased compressive strength of concrete is not too significant to normal with a percentage decrease of 0.432%, 0.996%, 2.847%, 4.858% [1]. The effect that occurs when the level of mud a lot. The more the amount mud in the mix, then the amount of the surface of mud, will more and more also, so it will require more cement to bind the surface between each aggregate [2].

Concrete

Concrete is a mixture of Portland cement or other hydraulic cement, fine aggregate, coarse aggregate and water, with or without an additional mixture to form a solid future. Concrete is a function of the constituent materials are composed of hydraulic cement (Portland cement), aggregate coarse, fine aggregate, water and additives (admixture or additive). To find and study the

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behavior of composite elements (concrete constituent materials), we require knowledge of the characteristics of each component [3].

Fly ash

Fly ash (fly ash) is defined as fine grains result of coal combustion residues or coal powder. As an added ingredient of concrete, fly ash is considered to improve the quality of concrete in terms of strength, water tightness, resistance to sulphate and ease of workmanship concrete. The use of fly ash can also reduce the use of cement and also as a form of waste utilization that will help preserve the environment.

Fly ash is mixture additives, manufacturing of concrete to get quality concrete with high compressive strength. Building materials, fly ash can be used both for the manufacture of concrete aggregate mix (ready mix), additional paving materials, or concrete block.

Fly ash has a very fine granular particle, so it can be filling cavities (filler), in concrete so as to increase the strength of concrete and increase the water tightness of concrete. In addition, have the advantage of fine cracks can prevent (crack) on the surface of the concrete. With the utilization of fly ash 15% - 30% by weight of cement, the amount of cement will be reduced significantly and increase the compressive strength of concrete. Reduction in the amount of cement can reduce the cost of materials so that the efficiency can be increased [4].

Compressive strength of concrete

Compressive strength of concrete depending on the water cement. It also depends on compaction during the implementation. Concrete compressive strength, fc' is determined by the difference in the standard cylinder (size 15 cm x 30 cm). Were treated under standard conditions, the laboratory at a certain loading rate (at 6 ± 4 kg / cm 2 per second) at 28 days. In practice, there are three kinds of a specimen size, the shape of the cube with size 100 x 100 mm, 150 x 150 mm, while the cylinders 150 x 300 mm, 100 x 200 mm. In the British Standard, cylinders are allowed to use 100 x 200 mm if the maximum diameter of 20 mm coarse aggregate [5].

Compressive strength of concrete is calculated using the equation [[6] and [7]]:

$$fc' = \frac{P}{A}(Mpa) \quad (1)$$

where fc' is a compressive strength of concrete (Mpa)
P is a maximum load (N)
A is a the area of the test specimen (m2)

METHODS

The study was conducted by performing in laboratory experiments. The concrete and materials to make concrete mix using a cylindrical specimen size 150mm x 300mm with a total of 30 test specimens for each variation. Concrete compressive strength of 20 MPa planned used sand containing silt content of 18% and 20%. In the experiment, there are 5 variations of the test object consisting of a variation of 1 by adding 13% of the cement by weight of cement for sand with silt content of 18%. Variation 2 by adding 15% to the level of the cement slurry 20%. For variation 3 adding 13% of fly Ash. Variation 4 adding 15% fly ash. For a variation 5 using sand containing silt content of 3.6% as a comparison (Normal Concrete).

Concrete tested at 28 days which then analysis calculation, compressive strength of concrete with a statistical test for normal distribution and compared with common concrete compressive strength [8].

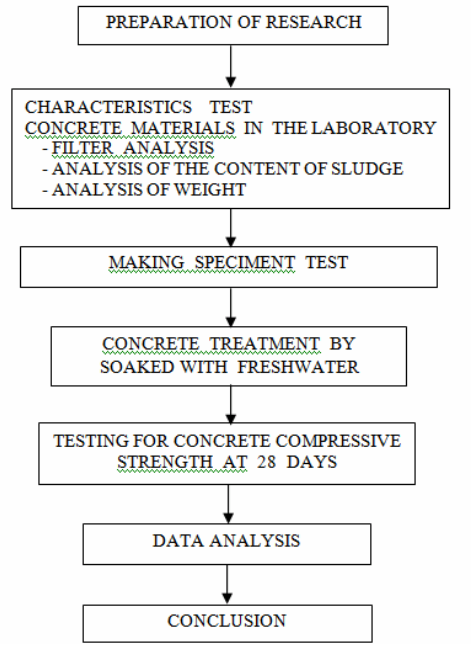

Figure-1. Flowchart of the research.

RESULTS AND DISCUSSIONS

Analysis of the mud levels on sand

In this study, analysis of the levels of silt sand, which is used is wet or in other words by way of deposition. The results of the analysis of the levels of sludge on sand can be seen in Table-1.

Table-1. Sludge levels on sand.

	Type of Sand		
	Sand 1	**Sand 2**	**Sand 3**
High of mud (h), mm	1	7,3	7
Total high (H), mm	27,5	37,5	38
Content of mud (h/H) x 100 (%)	3,6	20	18

Based on the calculation of the levels of silt, sand obtained results on the levels of silt sand 2 and 3 are 20%

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dan18% or greater than 5% so that the manufacture of the concrete mix for use Sand 2 with the amount of cement is added at 15%. Whereas for sand 3, plus 13% of cement weight.

Gradation analysis of grain

The grains of sand on Gradient Tests, from 3 locations are used to determine the size of a grain of sand. The size of grains of sand will affect the material requirements and the compressive strength of concrete [9]. The test results can be seen in Table-2.

Table-2. Gradation of granules.

	Type of Sand		
	Sand 1	**Sand 2**	**Sand 3**
Gradation of granules	3	3	1
Category	medium grain	medium grain	coarse grain

Analysis density of sand

Sand Density Testing analysis from 3 locations. The test results can be seen in Table-3.

Table-3. Analysis density of sand.

	Type of Sand		
	Sand 1 (Mojokerto)	**Sand 2 (Jombang)**	**Sand 3 (Lumajang)**
Weight of the empty pycnometer (gr) (W)	130	130	130
Weight of pycnometer + water (gr) (C)	635	635	635
Weight of pycnometer + speciment+Water (gr) (A)	940	930	930
Density of sand 500/(C+500-A)(gr/cm^3)	2,56	2,44	2,44

Based on the results of the analysis of the specific gravity of sand, in Table-4 Mojokerto sand density equal to the weight of sand types Jombang of 2.44 g / cm 3, while the weight of the sand type Lumajang amounted to 2.56 g / cm 3. Sand densities are still eligible for based on ASTM sand density 2.10 to 2.60 g / cm3 [10].

Analysis of concrete compressive strength

Based on the results of the analysis mix design with a compressive strength of 20 MPa concrete plan with 30 test specimens for each variation. The composition of the mixture is obtained as shown in Table-4.

Table-4. Comparison of Concrete Compressive Strength

	Sand				
	Variation 1 (Sand 3+13% Cemen)	Variation 2 (Sand 2 + 15% Cemen)	Variation 3 (Sand 3+13% Fly ash)	Variation 4 (Sand 2 + 15% Fly ash	Variation 5 (Sand 1) Normal Concrete
Compressive Strength (Mpa)	22,45	21,90	25,14	28,20	21,94
Increased (%)	2,32		14,58	28,53	
Decreased (%)		0.18			

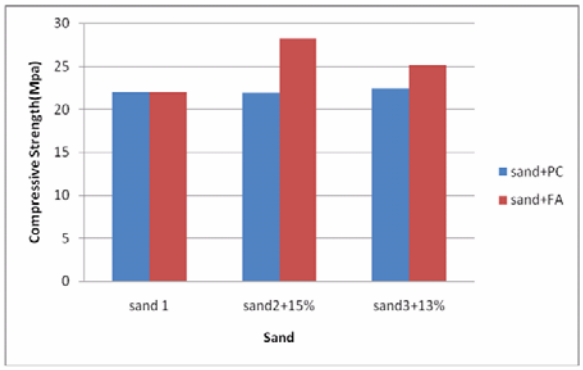

Figure-2. The relationship between the use of sand and concrete compressive strength.

Based on the comparison results of the compressive strength of concrete, the concrete compressive strength is obtained by using the 2 + 15% sand cement decreased 0.18%. If using sand, 3 + 13% cement increased 2.13%. This is because the sand 2, located in zone 3 which is fine grained sand and has a small cavity, so that if the cement coupled cavity filled with cement difficult. By using sand 2 + 15% fly ash concrete compressive strength increased by 28.53%. While using sand 3 + 13% fly ash increased by 14.58%.

CONCLUSIONS

Based on the above results the following conclusions drawn:

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a) Compressive Strength of concrete, using sand 1 (Variation 5) which has a mud content of 3.6% compressive strength of concrete has an average of 21.94 MPa (normal concrete). By using sand 2 with mud levels by 20% with the addition of 15% cement, the variation 2 has an average of compressive strength of concrete 21.90 MPa or compressive strength decreased by 0.18%. While the addition of 15% fly Ash (Variation 4) compressive strength of concrete is 28.20 MPa or an increase of 28.53% against the normal concrete.
b) Compressive Strength of concrete using 3 sand, the mud content of 18% with a mixture of concrete coupled with a 13% cement (Variation 1) has a compressive strength of concrete by an average of 22.45 MPa or an increase of 2.32%. While compressive strength of concrete with the addition of 13% fly ash (variation 3) has a compressive strength of concrete the average amounted to 25.14 MPa increased by 14.58% against the normal concrete.
c) From the above results by using additional materials fly ash increased. The compressive strength of concrete is significant, thus the sand with silt content up to 20% can be used to mix concrete with the addition of 15% fly ash.

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