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THE EFFECT OF ADDITIONAL MATERIALS CONCRETE USING THE SAND WITH HIGH LEVELS MUD ON DEFLECTION AND FLEXIBLE STRESS ON CONCRETE BEAMS

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ABSTRACT

Structure of concrete blocks consist of concrete and reinforcing steel that work together to carry the load acting on the beam. Besides that the steel reinforcement where the use of materials to make concrete is also noteworthy. On the implementation of the field often found sand used for concrete mixes are not eligible. Among these are the levels of sludge that is more than 5 %, so that when it is used to mix concrete sand must be washed first. In this study, researchers will examine whether such additives affect the deflection and bending stress on concrete beams using sand with high mud levels. Tests on the flexural strength of concrete beam in the laboratory by making seven variations of the beam with a size of 20 x 20 x 60 cm, which consists of a variation of 1 is the beam that uses sand Lumajang, variation 2 is beam by using sand Mojokerto, Variation 3 is the beam by using Mojokerto sand plus 15 % fly Ash, variation 4 is a beam that uses sand Mojokerto plus 15 % additive substance, variation 5 is beam by using sand Jombang and variation 6 is a beam that uses sand Jombang plus 13 %. Variation 7 is a beam that uses sand Jombang plus 13 % other additives. The result showed that the concrete beams using sand Jombang with additional material 13 % additive substances able to carry a maximum load of 15,500 kg, with a maximum deflection of 5.1 mm, the bending stress of 504 kg / cm^2 and bending moment of 472 500 kgcm. Concrete beams using Jombang sand with the addition of additive 13 % experienced significant improvement to flexural testing at age 28 days.

Keywords: mud, sand, deflection, fly ash, other additives, bending stress.

INTRODUCTION

Concrete block is the main structure in the burden on a building made of reinforced concrete, so the ability of the structure to prevent excessive deflection, it should be noted that the material will be used. Concrete beam structure consisting of concrete and steel reinforcement that work together to carry the load acting on the beam. Besides the use of steel reinforcement use of materials to make concrete is also noteworthy.

On the implementation of the field often found sand used to mix concrete are not eligible including the levels of sludge that is more than 5 %, so that when it is used to mix concrete sand must be washed first.

Previous researchers conduct research using sand Lumajang, Mojokerto, Jombang with mud content was respectively 3.6 %; 20 %; 18 % for concrete mixes with fly Ash added according to the % excess sludge levels contained in the sand. The result showed an increase in the compressive strength of concrete at 14.57 % for the addition of fly Ash by 13 % and obtained an increase in concrete compressive strength of 28.53 % for the addition of fly ash by 15 %. For the concrete mixture by adding the additive substances according to the % excess levels of sludge contained in the sand. The result showed an increase in the compressive strength of concrete by 21.29 % for the addition of additive substances by 13 % and obtained an increase in concrete compressive strength of 37.82 % for the addition of fly ash by 15 %.

Based on the above results in this study the researchers will examine whether such additives affect the deflection and bending stress on concrete beams using sand with high silt levels with a flexural strength testing of concrete beams in the laboratory by making seven variations of the beam with a size of 20 x 20 x 60 cm, which consists of a variation of 1 is the beam that uses sand Lumajang. Variation 2 is beam by using sand Mojokerto. Variation 3 is the beam by using sand Mojokerto plus 15 % fly Ash. Variation 4 is a block that uses the sand Mojokerto plus 15 % additive substances. Variation 5 is beam by using sand Jombang. Variation 6 is a beam that uses sand Jombang plus 13 %. However, variation 7 is a beam that uses sand Jombang plus 13 % other additives.

LITERATURE REVIEW

a) Previous researchers

By research of [1] to test the levels of mud sand , by means of wet or in other words by means of precipitation by using sand Lumajang, Mojokerto, Jombang with the results of sludge levels such as in Table-1.

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Tabele-1. Level mud in the sand.

	Origin of sand		
	Lumajang	**Mojokerto**	**Jombang**
High of mud (h) mm	1	7, 3	7
Total high (H) mm	27, 5	37, 5	38
Levels of mid (h/H) x100 (%)	3, 6	20	18

With mud levels contained in the sand will be mixed with concrete by adding fly ash according to the % excess sludge levels contained in the sand. Do testing of concrete compressive strength at the age of 28 days. The result showed an increase in the compressive strength of concrete as shown in Table-2.

Table-2. Comparison of concrete compressive strength-01.

	Sand				
	Jombang+13 % Cement	**Mojokerto + 15 % Cement**	**Jombang+13% Fly ash**	**Mojokerto + 15 % Fly ash**	**Lumajang**
Compressive strength (Mpa)	22,45	21,90	25,14	28,20	21,94
Enhancement (%)	2,32		14,58	28,53	
Reduction (%)		0.18			

Dewi Pertiwi, 2014 [2] conducted research by using sand Lumajang, Mojokerto, Jombang with mud levels respectively 3.6 %; 20 %; 18 % for the concrete mix by adding additive substances according to the % excess sludge levels contained in the sand. The result showed an increase in the compressive strength of concrete as shown in Table-3.

Table-3. Comparison of concrete compressive strength-02.

	Sand				
	Lumajang	**Mojokerto**	**Mojokerto +Additive 15 %**	**Jombang**	**Jombang + Additive 13 %**
Compressive strength (Mpa)	21,94	22,28	30,24	22,26	26.612
Enhancement (%)		1,5	37,82	1,4	21,29

From the result of the increase compressive strength of concrete using additional materials as fly ash or other additives. The researchers conducted advanced research in the form of testing bending strength and deflection of the beam by using three types of sand mentioned above at the age of 28 days.

b) Concrete

Concrete is a mixture of Portland cement or other hydraulic cement, fine aggregate, coarse aggregate and water with or without additional shaping the mixture of solid. Concrete is a function of its constituent ingredients consisting of hydraulic cement materials (Portland cement), aggregate rough, fine aggregate, water and additives (admixture or additive). To know and study the behavior of composite elements (materials making up the concrete). And also need knowledge about the characteristics of each component [2, 3, 4, 5].

c) Fly ash [6]

Fly ash is defined as fine grains of coal combustion residues results or powdered coal. As an added ingredient of concrete, fly ash is considered to improve the quality of concrete in terms of strength, watertightness, resistance to sulfate and ease in the concrete construction. The use of fly ash can also reduce the use of cement as well as a form of waste utilization that will help protect the environment.

Fly ash or fly ash is an additional ingredient manufacture of concrete mix to get quality high compressive strength of concrete. Building materials fly ash can be used both for the manufacture of concrete aggregate mix (ready mix), additional paving materials or concrete brick.

Fly ash or fly ash has very fine granular particles that can become cavities filler (filler) in the concrete so as to increase the strength of concrete and adds watertightness in concrete as well as having the advantage can prevent cracks smooth (crack) on the concrete surface. With the utilization of fly ash 15 % - 30 % of the 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 material costs so that efficiency can be improved [7].

d) Additive substance [6]

Types of chemical additives (Additive substance) divided into 7 types namely:

a. Tipe A Water Reducing Admixtures
b. Tipe B Retarding Admixtures
c. Tipe C Accelerating Admixtures
d. Tipe D Water Reducing and Retarding Admixtures
e. Tipe E Water Reducing and accelerating admixtures
f. Tipe F Water Reducing , High Range Admixtures
g. Tipe G Water reducing, High Range Retarding Admixtures

Additional types of materials used in this study are the type C that serves to accelerate the binding and the development of early strength concrete.

e) Flexural strength [8]

Measurement of flexural tensile strength is important to estimate the concrete elements were fractured. It is difficult to determine the strength of concrete is directly and is therefore determined by the bending test. Figure-1 is bending test method with third point loading. The test used on the concrete beams to measure flexural tensile strength. At the time destroyed (failure) or Modulus of Rupture is very important in the tensile strength of concrete. Modulus of Rupture fr specifies ACI of 7.5 $(fc)^{0..5}$ for normal concrete. Modulus of rupture is the tension in the most distant fibers. Elastic bending is calculated based on the formula for ultimate bending moments are determined experimentally in a material.

The value of a Rupture Modulus higher than the actual tension. This is caused by not linear distribution of concrete compressive stress on the verge of collapse. For materials, the stress - strain diagram approach a straight line entirely up to the ultimate strength then the difference between maximum tensions which is true with the modulus of rupture is small.

Modulus of Rupture is determined by the standard test object beam 150 x 150 x 530 mm3 with a span of 450 mm or beam 100 x 100 x 350 mm3 with a span of 300 mm.

Modulus of Rupture calculated using the formula:

$$\text{fr} = \frac{M}{Z} = \frac{M\,x\,C}{I} \quad (1)$$

where

C = Distance fiber which is reviewed
M = Mornen bending work on a cross-section
I = Moment of inertia of the cross section

And calculating fr considered to behave linearly. Results of Modulus of Rupture depending on the printing, curing, humidity, load center or on two points (1/3 span). Testing can be performed according to ASTM 78 and C09 [8, 9]. The size of the specimen is 152 x 152 x 508 mm3 (6 x 6 x 20 in3).

How to fill, consisting of two layers each layer was fulfilled 60 times. For rigid concrete compacting (According to Standard B 5 11881 part 4 dimensional test object 150 x 150 x 750 mm3). The theoretical tensile strength of concrete is calculated by the formula:

$$R = \frac{P\,x\,L}{b\,x\,d^2} \quad (2)$$

where

R = Modulus Rupture = fr
P = Total maximum load
L = Expanse
b = The width of the specimen
d = high beams

The equation above is used when the beam was broken between the two loads for example in the middle of the landscape. When the beam is damaged beyond use both the imposition of the formula:

$$R = 3\,x\,\frac{p\,x\,a}{b\,x\,d^2} \quad (3)$$

where
a = The average distance between the damaged point and the nearest pedestal.

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From this experiment can also be obtained bending tensile stress value of concrete σct:

$$\sigma\ ct = \frac{1{,}8\ x\ P}{a^2} \quad (4)$$

where

a = The average distance between the damaged point and the nearest pedestal

RESEARCH METHODOLOGY

The study was conducted by conducting laboratory experiments of concrete and materials by making concrete mix using the test specimen in the form of a beam size of 200mm x 200mm x 600 mm. as many as three test specimens for each variation. Compressive strength 20 MPa concrete plans to create a variation of the beam which is 7. Variation 1 which uses sand Lumajang. Variation 2 by using sand Mojokerto. Variation 3 by using sand Mojokerto plus 15 % fly Ash. Variation 4 are using sand Mojokerto plus 15 % additive substances. Variation 5 by using sand Jombang. Variation 6 using sand Jombang plus 13 %. Variation 7 are using sand Jombang plus 13 % other additives.

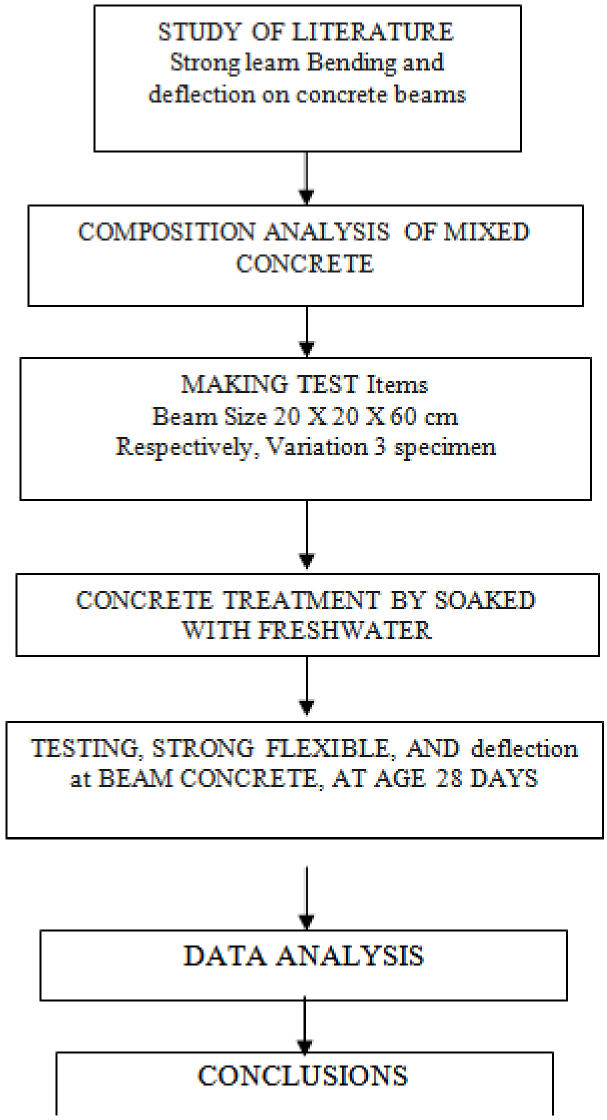

Figure-2. Research flow diagram.

RESULTS AND DISCUSSIONS

a) Deflection on concrete beams

From the results of testing deflection on concrete beams in the laboratory with the using of additional material in concrete mixtures using sand with high silt levels can be seen in Figure-3 and Figure-4.

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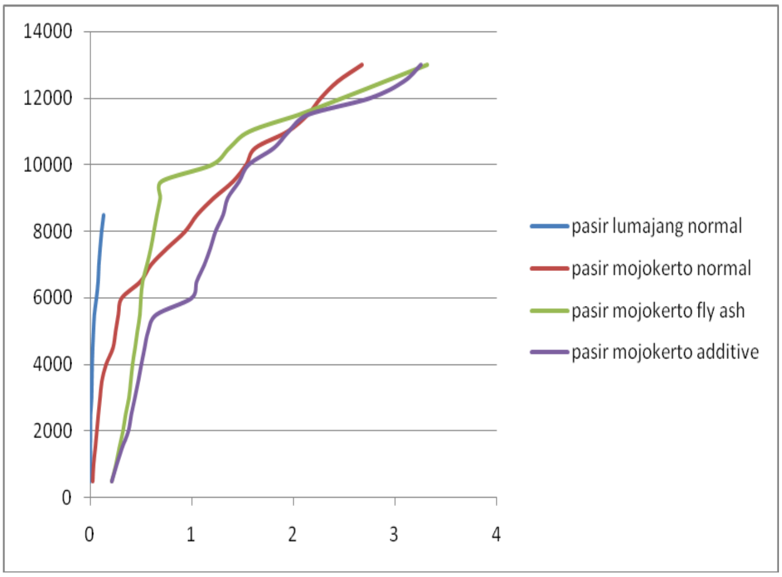

Figure-3. Graph of comparison deflection by using sand Mojokerto.

In the concrete beams using sand Mojokerto with additional material 15 % fly ash and 15 % other additives with a maximum load of 13, 000 kg has increased the value of deflection.

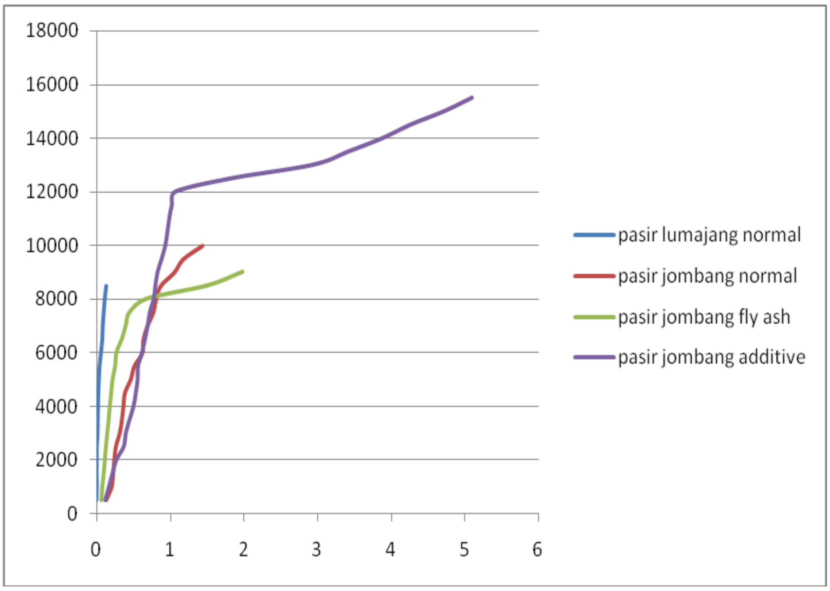

Figure-4. Graphs of comparison of deflection by using sand Jombang.

In the concrete beams using sand Jombang with additional material and 13 % substance additive experienced a significant increase in the value of deflection with a maximum load of 15, 500 kg.

b) Bending stress of concrete beams

From the results of calculation of bending stress on concrete beams using additives in concrete mixtures using sand with high silt levels can be seen in Figure-5.

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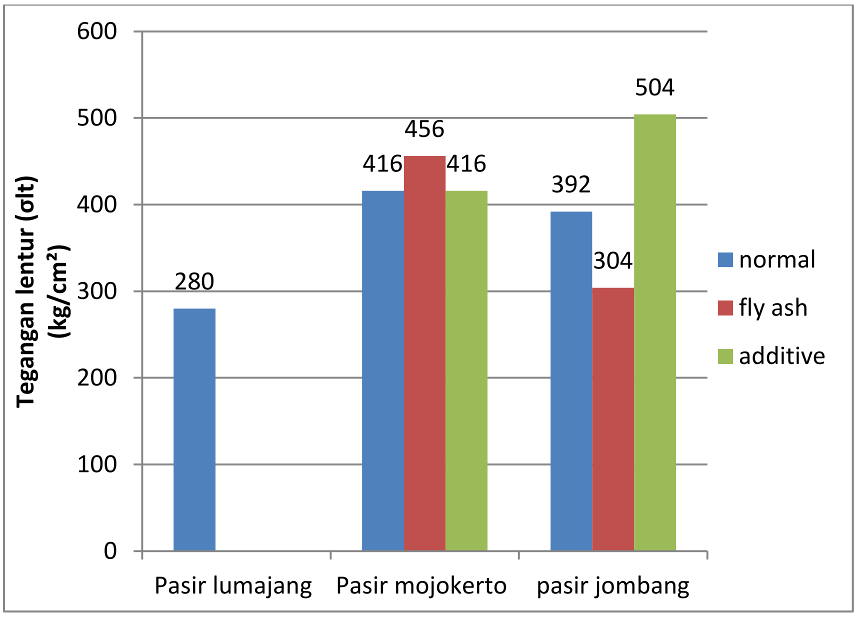

Figure-5. Graphs of comparison of bending stress on beams.

In the concrete beams using sand Jombang with additional material 13 % additive substance has a value of highest bending stress.

c) Bending moment at concrete beams

From the results of calculation of bending moment on concrete beams using additives in concrete mixtures using sand with high silt levels can be seen in Figure-6.

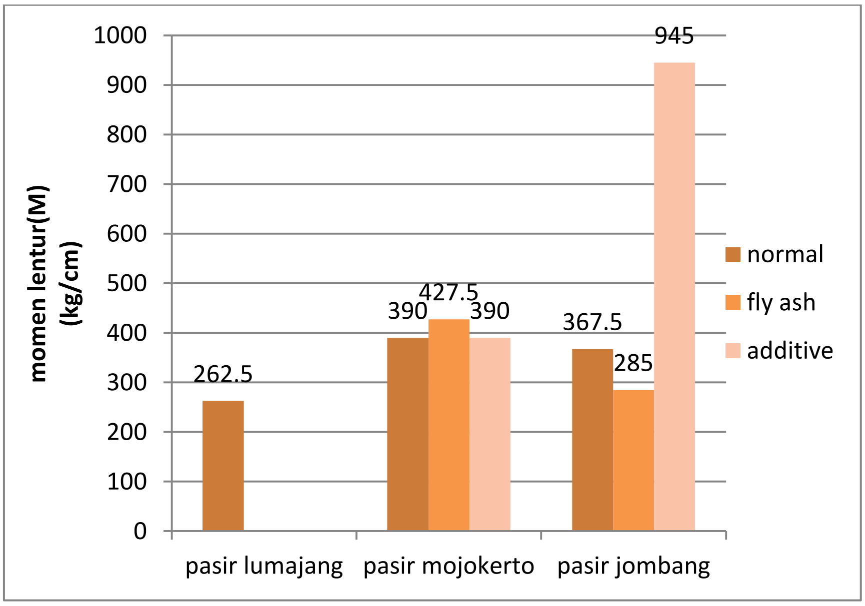

Figure-6. Comparison chart of the bending moment on the beam.

In the concrete beams using sand Jombang with additional material 13 % additive substances have a value of the highest bending moment?

CONCLUSIONS

Based on the above results it can be concluded as follows:

a) From the test results for the beam deflection performed in the laboratory obtained:

- In the concrete beams using sand Mojokerto with additional material 15 % fly ash and 15 % other additives with a maximum load of 13, 000 kg the result is an increase in deflection by 19.34 % and 17.85 % of the deflection of normal concrete beams.

- At Concrete Beams using sand Jombang with additional material 13 % additive substances generating a maximum deflection of 5.11 mm with a maximum load of 15, 500 kg was applied. The value of deflection is the highest compared with the deflection that occurs in concrete beams which uses fly ash additives or normal.

b) The value of bending stress of concrete beams obtained the following results:

- The bending stress on the concrete beams using sand Mojokerto with additional material fly ash is increased 4.56 % against the normal concrete beams.

- Bending stress on the concrete beams using sand Jombang with additional materials other additives are experiencing an increase in 5:04 % against normal concrete beams.

c) The value of bending moment on the concrete beams using sand Jombang with additional material 13 % additive substance has the highest value of 945, 000 kgcm than the bending moment of concrete blocks which uses sand Lumajang and mojokerto.

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