Effect of addition of ceramic granules on compressive Strength Concrete

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ABSTRACT

Future technological developments are now demanding concrete action to improve the performance of concrete produced, both in terms of quality, materials and how to apply, it is not free from the demands and needs of the community towards a more advanced infrastructure facilities. It is therefore necessary to find an alternative as the base material is replaced with a grain of sand concrete waste ceramics. Attempts to utilize the waste form ceramic grains will not only reduce environmental problems but it can provide economic value for development, as well as efforts to conserve natural resources.

The study was conducted at the Concrete Laboratory of the University of Islam "45" Bekasi using the IS and ISO standards, the quality of K-*175* concrete plans. Level of addition of ceramic granules 0%, 5%, 10%, 15%, 20% of the weight of sand. Press firmly on the treatment of testing performed on concrete specimens at the age of seven days, 14 days, and 28 days.

The test results of concrete compressive strength at 28 days of treatment, showed normal concrete compressive strength (*without* mixture of ceramic granules) is 187.21 kg/cm2. There was a decrease the value of concrete compressive strength of concrete on the ceramic granules are added to the mixture of 5% is 147.99 kg/cm2, the mixture of 10% is 140.08 kg/cm2, the mixture of 15% is 131.40 kg/cm2, the mixture of 20% is 124.43 kg/cm2.

Keywords: Ceramic granules, compressive strength of concrete, Environment, Aggregate

1. BACKGROUND

One of the activities of civil engineering work that is renovating the old buildings were damaged or if it does not pay attention to environmental issues then the work would damage the environment. To prevent damage to the environment and more people are utilizing waste ceramics, one of which is utilized by the artists is to create mosaic tiles are used both to decorate the walls and floors. In the field of civil, of course, waste ceramics can be used as a substitute for fine aggregate (sand) in concrete.

Future development of concrete technology demanded the effort to improve the performance of concrete produced, both in terms of quality, material and applied way, this does not escape from the demands and needs of the community towards an increasingly advanced infrastructural facilities. It is therefore necessary to find an alternative as the base material is concrete sand is replaced with ceramic waste debris. Attempts to utilize ceramic debris waste not only reduces the environmental problems but can provide economic value to the construction, as well as an effort to conserve natural resources.

2. THEOLOGICAL PROBLEM

In this research can be formulated the problem to be investigated, namely:

1. How big is the influence of the addition of ceramic granules to the value of compressive strength of

concrete produced?

2. Does the addition of ceramic granules of concrete can be applied in the field?

3. PURPOSE AND BENEFITS OF RESEARCH

The purpose of this study was to investigate the effect of the addition of ceramic granules against compressive strength of concrete.

The benefits of this research is that it can find application in the field and using ceramic granules as a replacement for sand.

4. LIMITATION OF PROBLEMS

The study was limited to a particular part that needs to be known as a construction material requirements. Given time constraints, costs and the ability of researchers, the study of the nature of this laboratory will be limited to:

1. Finding the optimal amount of compressive strength on concrete mixtures with the addition of ceramic and perform collision testing standards such as:

a. Physical testing of aggregate.

b. Mix Design.

c. Testing consistency (slump) concrete.

d. Concrete compressive strength testing.

2. Concrete compressive strength testing performed on the concrete age of 7 days, 14 days, and 28 days with the addition of the composition of the ceramic granules espectively 0%, 5%, 10%, 15%, 20% of the weight of sand.

3. Concrete quality tested (normal concrete), and that will be achieved by the addition of ceramic granules are concrete quality K-175.

4. Material for concrete:

a) Sand used in this study were sand Galunggung.

b) Gravel used in this study is gravel crushing Purwakarta.

5. Ceramic granules is derived from a ceramic factory.

6. The analysis was not until the budget analysis in the application in the field.

5. REVIEW AND BASIS OF THEORY REFERENCES

A. PRESS STRENGTH CONCRETE

Concrete compressive strength is the ability to accept large compressive force of unity. Although the concrete there is a small tensile stress, compressive stress is assumed that all are supported by concrete.

Determination of compressive strength can be performed using test equipment and press the cylindrical test piece with a diameter of 15 cm and 30 cm high. Compressive strength measurements based on ISO SK M 14 -1 989 F (SNI 03-1974-1990). Working load or distributed continuously through the center of gravity, is then calculated by the formula:

$$\sigma c = \frac{P}{A} \ (kg/cm^2)$$

σc = (kg/cm2)

Description: σc = Compressive Strength Of Concrete

P = maximum compressive Strength on concrete samples

A = cross-sectional area on concrete examples (cm2)

B. PLANNING MIXED CONCRETE

Concrete mix design is a complex thing when viewed from the differences in the nature and characteristics of constituent materials, such as the building blocks will lead to variation of the resulting concrete products.

Basic criteria for design of concrete is the compressive strength and its relationship with water factors of cement used. The purpose of the concrete mix design is to determine the proportion of cement, fine and coarse aggregate, and water that meets the following requirements:

1. Relationship compressive strength of cement and water factor obtained from the results of field research in accordance with the materials and conditions of the proposed work. Designed concrete compressive strength shall meet the requirements of the average are eligible based on the standard deviation of test results of compressive strength ago (age 28 days) for the condition and type of construction the same.
2. Another criterion to consider is ease of workmanship (workability). As mentioned above, a small cement water factor will result in a higher power, but the ease of workmanship will not be achieved. Selection of aggregate used will also affect the nature of the workmanship. Large grains which would mislead the difficulty mainly because it will cause segregation.
3. Another thing to consider is durability (durability), durability of concrete is the time it takes the material to be able to continue their use as planned, despite outside attacks physically, mechanically or chemically. Durability of concrete will be reduced in case of corrosion of reinforcement, shrinkage occurs, chemical attack, a blow or impact on the concrete and aggregate instability, giving rise to cracks in the concrete.
4. The final completion of the concrete surface, the less good cohesion is one of the causes of poor finishing, when printed on a reference concrete upright, such as sand scratches and color variations, and can also bring difficulty in patching the horizontal plane into a final settlement of fine and solid (Mulyono, 2003).

To determine the mix proportions of concrete can be used method of Japanese Industrial Standards (JIS) or with SNI. In this study, the authors used the method is the method of JIS. Things that need to be determined in the calculation of concrete mix proportions as follows:

1. Determining the water cement ratio with cement (w/c).
2. Specifies the maximum coarse aggregate to be used.
3. Choosing the viscosity of concrete (slump) as appropriate.
4. Determine the air content.
5. Determine the percentage of fine aggregate (S / A).
6. Determining the weight of water (Ww) is adjusting the S / A and water (kg).

In the JIS method, to determine the value of w / c, we have to use a graphic way. The method is as follows:

1. Determine the value of compressive strength of concrete are planned. Additional security number if needed for the job arrives 10% done with care and 15% for a less thorough job.
2. Drag the vertical line until the compressive strength of concrete are planned.
3. Then drag the horizontal line to a curved line that is in the graphic method of JIS.

C. CALCULATING VOLUME OF WATER

To determine the amount of water use or to specify concrete kentalnya dilute or younger, so if the concrete is too much water, the viscosity of the concrete if the concrete will be reduced and the water is reduced, then the concrete will be hard to printed / done.

$$VW = \frac{Ww}{GW \times 100} (m^3)$$

VW = (m3)

Description: VW = Air Volume (m3)

Ww = Weight of Water (Kg)

GW = Air density (kg)

D. CALCULATING NUMBER OF WEIGHT CEMENT

To determine the amount of cement that we will use for the purposes of the concrete mix so that the cement used by the rules as desired.

$$WC = \frac{Ww}{W/C} (Kg)$$

WC = (Kg)

Description: Cement WC = Weight (kg)

W / C = Air Cement Factor (Kg)

Ww = Weight of Water (Kg)

$$VC = \frac{WC}{Gc \times 1000} \ (m^3)$$

VC = (m3)

Description: Cement VC = Volume (m3)

Gc = Portland Cement Type Weight (Kg)

Cement WC = Weight (kg)

E. DETERMINING AIR CONTENT

Air at room temperature testing is to determine what percentage of the drying air temperature for the test object / concrete examples.

$$Va = \frac{(a)}{100} \ (m^3)$$

Va = (m3)

Description: Va = Volume of air (m3)

(a) = standard conditions of air (m3)

$\Sigma V = VC + VW + Va$ (m3)

Description: ΣV = Total volume of paste (m3)

VW = Volume of water (m3)

VC = Volume of cement (m3)

Va = Volume of air (m3)

$VA = 1 - \Sigma V$ (m3)

Description: VA = the aggregate volume (m3)

ΣV = Total volume of paste (m3)

F. CALCULATING WEIGHT AGGREGATE NUMBER OF SMOOTH

The purpose of this calculation is to determine how much sand will be used for concrete mix, so that the sand used shall be in accordance with the calculation.

$$VS = \frac{(S/A \times VA)}{100} \ (m^3)$$

VS = (m3)

Description: VS = Volume of sand (m3)

S / A = This type of adjustment and water (m3)

VA = the aggregate volume (m3)

WS = VS x GS x 1000 (Kg)

Description: WS = Weight of sand (Kg)

GS = specific Gravity of sand

G. CALCULATING AGGREGATE NUMBER OF HEAVY CRUDE

The purpose of this calculation is to determine the volume and weight of coarse aggregate / gravel is used to mix concrete, so the comparison does not exceed pre-determined.

VG = VA - VS (m3)

Description: VG = Volume of gravel (m3)

VS = volume of sand (m3)

VA = the aggregate volume (m3)

WG = VG x Gg x 1000 (Kg)

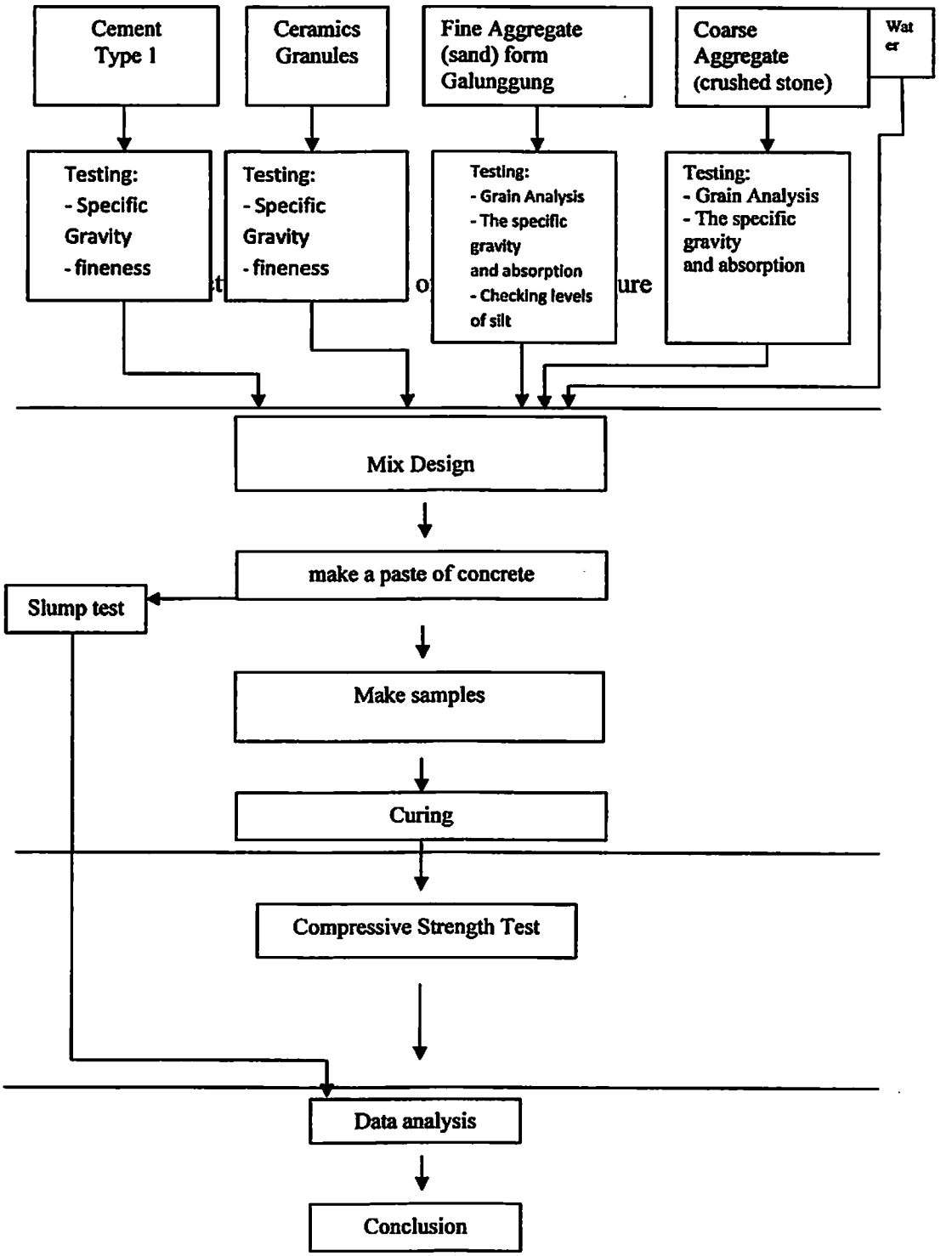
Description: WG = weight of gravel (kg)

Gg = Specific Grafity of aggregate

6. RESEARCH METHODOLOGY

The influence of research Steps Against a Strong Addition Granules Ceramic Tap Concrete illustrated in the following flowchart:

The sequence / stages of this study in more detail contained in:



7. TEST RESULTS AND ANALYSIS OF COMPRESSIVE STRENGTH CONCRETE

From the test results of concrete compressive strength of 28 days, compressive strength of normal concrete (without granules ceramic mixture) of 187,21 kg/cm2, while the compressive strength of concrete is added granules ceramic mixture was reduced in 5% of 147,99 kg/cm2, mixture of 10% of

140,08 kg/cm2, 15% of 131,40 kg/cm2, 20% of 124,43 kg/cm2. Meanwhile, when the compressive strength that must be achieved based on a plan of 184 kg/cm2. This means that the addition of ceramic granules by 5%, 10%, 15%, 20% of normal concrete mixes will not increase the compressive strength of concrete. This can be caused due to land-based ceramics resulting in lower compressive strength.

8. CONCLUSION

After analyzing the test results, the results of the study the influence of granules Addition Ceramic Tap Strong Against Concrete can be summarized as follows:

1. All materials used in this study (fine aggregate and coarse aggregate) meet the requirements that have been determined, making it feasible to be used as research material in the concrete mix.
2. Compressive strength of normal concrete (without added ingredients granules ceramic) age 28 days, compressive strength value of 187,21 kg/cm2.
3. Compressive strength of concrete with the addition of ceramic granules 5% at 28 days of 147,99 kg/cm2.
4. Compressive strength of concrete with the addition of 10% ceramic granules at 28 days of 140,08 kg/cm2.
5. Compressive strength of concrete with the addition of 15% ceramic granules at 28 days of 131,40 kg/cm2.
6. Compressive strength of concrete with the addition of 20% ceramic granules at 28 days of 124,43 kg/cm2

9. RECOMMENDATION

From the description above and refer to the results of research, so to get better research results suggested some of the following:

1. The use of ceramics in the granules concrete additive should be added with other ingredients to increase strongly compressed.
2. Concrete with ceramic granules can be used for lightweight applications such as sidewalks, drainage covers etc.
3. Concrete with ceramic granules is not recommended for major constructions.
4. The study did not perform calculations on the ground for the application is recommended for applications in the field calculation.

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