Correlation of Concrete Strength and Concrete Age K-300 Using Sikacim® Concrete Additive and Master Ease 5010

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Abstract. Concrete which is generally used for building needs must reach the age of 28 days according to SNI to achieve the maximum compressive strength value from the plan. Along with the development of development there needs to be research where concrete is planned so that it can achieve the compressive strength that is planned and has a higher quality even though it has reached the age of 28 days, this study uses Sikacim® Concrete Additive and Master Ease 5010 as additional material to obtain compressive strength values wanted. The results of the research conducted at the University of Civil Engineering Laboratory were attended by K-300 concrete planning using additional material Sikacim® Concrete Additive and Master Ease 5010, from the results of the above studies can be seen the compressive strength when 7-day concrete concrete has reached the compressive strength with an average value of 251.56 kg / cm² from there is the role of additives that function to accelerate the hardening of the concrete. Furthermore, for 28 days old concrete has exceeded the planned target of reaching an average value of 316.44 kg / cm². And the last concrete test when it was 56 days has a value of increase that is high enough to reach an average value of 334.22 kg / cm², here the role of the second additive substance begins to be seen where when the concrete is over 28 days still has a fairly high increase.

1. Introduction

Concrete is a constituent of a building that has a very important part. Concrete is usually used for building structures in homes, buildings, public facilities, shop houses and even concrete often used on pavement. Viewed from its function, concrete is required to have high strength so that the quality of concrete becomes the main thing needed, besides that related to the efficiency of concrete time generally must reach the age of 28 days to achieve maximum compressive strength, so that when not reached the maximum time but the concrete is given excessive load it is possible that the concrete will collapse and collapse. To overcome this, concrete research with the latest innovations is needed with the aim of accelerating concrete to obtain the value planned before the concrete reaches the age of 28 days, and increases the compressive strength of the concrete even though it has passed 28 days.[1]

The substances used to accelerate the drying of concrete are Sikacim® Concrete Additive, this additive used to accelerate the hardening of concrete (the initial strength of concrete) with a reduction of water to 15%, to reduce porosity, facilitate casting. Other substances used are Master Ease 5010 which is an additive that has the function of extending the process of increasing the quality of concrete, so when normal concrete has reached the age of 28 days it does not have an increase in compressive strength anymore. The day will still have an increase in the value of compressive strength so that the long-term use of beton concrete quality will increase further, but because of its slowing down the reaction of the cement the drying process will also slow down so that the new concrete can be opened from curing after concrete is 5-7 days old.[2]
This is to be investigated further on how to achieve maximum compressive strength before 28 days old concrete using these 2 additive substances, namely *Sikacim® Concrete Additive* and *Master Ease 5010*, testing the sample will be carried out twice the first on concrete with the age of 14 days and concrete with 28 days. [3]

1.1. Formulation of the problem
What is the value of compressive strength of concrete with the addition of the Additive *Sikacim® Concrete Additive* and *Master Ease 5010* after the concrete is 14 days and 28 days old?

1.2. Research purposes
To determine the value of concrete compressive strength by adding Additive *Sikacim® Concrete Additive* and *Master Ease 5010* substances after the concrete is 14 days and 28 days old.

1.3. Research sites
Kadiri University Civil Engineering Laboratory

2. Definition and types of concrete
Concrete is one of the construction materials that have been used for buildings, bridges, roads, and others. Concrete mixture material but fine aggregate, coarse aggregate, portland cement or other brand cement, and water, there are some that use additional materials (additives) to become a homogeneous unit. The use of concrete is generally for structures that tend to have high quality.[4]

2.1. Types of Concrete Types
Concrete is divided into several types:
- **High Quality Concrete**
  High quality concrete is concrete with compressive strength above K-350. Generally, the concrete has a high compressive strength so it is usually used for structural buildings . [5]
- **Medium Quality Concrete**
  Medium quality concrete generally has a value of K-300-K-150 which means it has a moderate compressive strength usually for use in residential houses and buildings that have not too high loads.[6]
- **Low Quality Concrete**
  Low quality concrete generally has a value below K-150. Usually used for paving parks and light buildings[2]

2.2. Concrete Composite Material
The materials used for making concrete are generally in the form of sand, water, cement and coral
- **Cement**
  Cement is an adhesive substance in hydraulic concrete by smoothing calcium silicate rock and gypsum rock which can react with water to form new solids and glue on the stones used for concrete.[8]
- **Sand**
  Sand is generally used as fine aggregate for the manufacture of concrete, the function of sand as a mixture or filler of concrete cavities, sand has a function that is vital in the manufacture of concrete, sand also determines the quality of concrete, there are several types of sand one of which is river sand and pa sir from eruption volcanic eruption.[9]
- **Coral**
  Stone that is usually used for making concrete generally uses hard stones, which are stones that escape the abrasion process, usually hard stones are stones from the eruption of Mount[10]
- **Water**
  Water is one of the natural ingredients that d is derived from the nature and mineral content in it, the water in the manufacture of concrete are used as reagents to cement the cement menjadiakan fine aggregate and coarse aggregate becom a concrete blend.[11]
3. Research Method

3.1. Concrete Press Strength Test

The test results of concrete compressive strength depend on the quality of the material and the ratio of cement, fine aggregate, coarse and various types of mixture. Comparison of water to cement is the main factor in determining the strength of concrete [12].

The results of the concrete compressive strength obtained by testing the structure, using a testing machine by giving compressive loads to the concrete in stages and the speed of the increase in certain concrete over the test object to disintegration. The compressive strength of each sample or test object is determined by the highest voltage (s) that can be achieved by the test object at the age of 28 days which is caused by the test machine that has been determined . [13]

The high voltage that occurs can we find the equation

\[ K = \frac{P}{A} \]

\[ s = \text{Compressive Strength (Kg / cm}^2\) \]

\[ P = \text{Maximum Load (Kg)} \]

\[ A = \text{Area of Press (cm}^2\) \] [14]

3.2. Research design

The process of making concrete to concrete testing

The first process is taking sand (fine aggregate) using an escape sieve with a diameter of 0.40 mm and being held on a sieve with a diameter of 0.39. Sand to be heated by means in the oven to take ingredients according to dry weight, Providing split stone or coral that has been prepared, Providing type I Portland Cement, Providing water for the process of mixing ingredients, The mixing process uses electric stirrer media, Water input, Sikacim® Concrete Additive and Master Ease 5010 and cement into the stirring machine. Turn the stirrer for 10 minutes so that the ingredients can be mixed perfectly. Put split stone or coral on the stirring machine gradually gradually. After all ingredients have been mixed with a mixture of Water, Sikacim® Concrete Additive and Master Ease 5010, split stone and Cement at 15 minutes round the Mixer, the next step is to gradually enter the sand into the concrete mixture.

After all the ingredients are mixed evenly, the concrete mixture is then removed from the mixer to be tested for a slump to measure the water content contained in the concrete mixture, If the water content has been felt to meet the slmp test requirements, enter the concrete mix design mixture into the cube mold with a side size of 15 cm, and compact it using a steel piercing tool and in inserting the fresh concrete mixture into the mold is required to be accompanied by vibrations or molds to solidify and reduce cavities in concrete structures. Let the concrete dry until perfect, between 2-3 days. After the concrete is dry, unload the concrete mold and carry out the next process, which is the concrete curing process or soaking the concrete into the pond during the specified analysis time. Lift the concrete from the curing pond and wind the concrete for 1 day for the drying process. The last process is the test of concrete compressive strength test according to the planned concrete age. [15]

4. Results and discussion

4.1. Results of the Compressive Value Calculation Table

| NO | Test object | Ton Dial Number | Number of Dial in Make Kg | Cross-sectional area of 15 cm x 15 cm (A) | Compressive Strength Test (K) (Kg / cm²) |
|----|-------------|----------------|----------------------------|------------------------------------------|------------------------------------------|
| 1  | Sample 1    | 56             | 56000                      | 225                                      | 248.89                                   |
| 2  | Sample 2    | 59             | 59000                      | 225                                      | 262.22                                   |
| 3  | Sample 3    | 54             | 54000                      | 225                                      | 240.00                                   |
| 4  | Sample 4    | 58             | 58000                      | 225                                      | 257.78                                   |
| 5  | Sample 5    | 56             | 56000                      | 225                                      | 248.89                                   |

average 251.56
From the table above, it can be seen that the compressive strength when 14 days old concrete has reached the value of compressive strength, the average value of concrete at the age of 14 days reached 251.56 kg / cm.

**Table 2 results of concrete compressive strength at 28 days**

| NO | Test object | Ton Dial Number | Number of Dial in Make Kg | Cross-sectional area of 15 x 15 cm (A) | Compressive Strength Test (K) (Kg / cm²) |
|----|-------------|-----------------|---------------------------|----------------------------------------|-----------------------------------------|
| 1  | Sample 1    | 72              | 72000                     | 225                                    | 320.00                                  |
| 2  | Sample 2    | 71              | 71000                     | 225                                    | 315.56                                  |
| 3  | Sample 3    | 69              | 69000                     | 225                                    | 306.67                                  |
| 4  | Sample 4    | 71              | 71000                     | 225                                    | 315.56                                  |
| 5  | Sample 5    | 73              | 73000                     | 225                                    | 324.44                                  |

While for 28 days old concrete has exceeded the planned target, it reaches an average value of 316.44 kg / cm². From there it can be seen the role of additive substances that can improve the quality of concrete.

**Table 3 results of concrete compressive strength when 56 days old**

| NO | Test object | Ton Dial Number | Number of Dial in Make Kg | Cross-sectional area of 15 x 15 cm (A) | Compressive Strength Test (K) (Kg / cm²) |
|----|-------------|-----------------|---------------------------|----------------------------------------|-----------------------------------------|
| 1  | Sample 1    | 76              | 76000                     | 225                                    | 337.78                                  |
| 2  | Sample 2    | 75              | 75000                     | 225                                    | 333.33                                  |
| 3  | Sample 3    | 76              | 76000                     | 225                                    | 337.78                                  |
| 4  | Sample 4    | 74              | 74000                     | 225                                    | 328.89                                  |
| 5  | Sample 5    | 75              | 75000                     | 225                                    | 333.33                                  |

And the last concrete test when it was 56 days had a fairly high increase in value achieving an average value of 334.22 kg / cm², which means that the quality of the target concrete is valued at 300 kg / cm².

4.2. Results grafik and dirams Average Rating

**Graph of each sample**

![Graph of each sample](Image 4)
From the diagram above, it can be seen from the age of 14 days that the 56-day-old concrete has a significant increase in value which indicates that the two additive substances work quite well against the entire sample.

5. Conclusions

Results of studies dilakukan in Civil Engineering Laboratory Kadiri University with concrete planning K-300 using additional materials Sikacim® Concrete Additive and Master Ease 5010, from the above results can be seen at the time of the concrete compressive strength of 7 day-old concrete already achieving an average compressive strength value of 251.56 kg/cm² from there the role of additives that function to accelerate the hardening of the concrete began to appear. The next step for 28-day-old concrete has exceeded the planned target which reached an average value of 316.44 kg/cm². And the last concrete test when it was 56 days has a value that is high enough to reach an average value of 334.22 kg/cm², here the role of the second additive substance begins to be seen where when the concrete is over 28 days still has a fairly high increase.

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