Review of K-250 Concrete Compressive Strength Using Mix Design Manual on Development Projects Continued Talud Airport of Syukuran Aminuddin Amir Luwuk

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Abstract. Compressive strength is the stress that occurs in the test object when the load is applied until the test object is destroyed. Before making the test object, the first stage is to do a slump test. If it meets the standard specifications then manufacture the test object. The specimens were dried in the sun for 7, 14, and 28 days without any vibrations then the samples were allowed to stand until they hardened and did not crumble. At the mixing stage, it is still done manually using the excavator bucket's volume ratio. This study aimed to determine whether the compressive strength of concrete reaches k-250, using qualitative research using the method of compressive strength of concrete k-250. The results obtained in this study are the longer the test object is dried, the greater the compressive strength obtained. The highest compressive strength value was obtained from the test on June 11, 2022, which was 461.35 kg/cm2. Whereas in other tests it decreased, but in other tests, it has shown a value that is suitable for use (suitable for embankment buildings) and meets the quality requirements for compressive strength in terms of the standards that have been set and the values obtained have met the category based on the standard SNI 03 1974-1990.

Keywords: Slump Test, Test Object, Compressive Strength.

1 Introduction

In recent years, the progress of science and technology is getting faster and faster so that it can change the order of one's life. The positive impacts also vary, one of which is the discovery of technologies that can simplify one's life where human needs are increasingly complex. In the world of construction, concrete still plays an important role as the main material used. This is because concrete has several advantages such as ease of workmanship, high compressive strength, and economic value in its manufacture and maintenance. However, there are several weaknesses of concrete, including the low ability to withstand tensile loads because concrete is a brittle material. The concrete's brittle nature causes it to crack immediately if it gets a tensile force that is not too large [1].

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In this modern era, infrastructure development is moving faster and in a sustainable manner. Construction activities such as the construction of buildings, roads, housing, hotels, modern markets, communication networks, irrigation to transportation facilities, and infrastructure occur in almost every corner of the city. The use of concrete as the main material is inseparable from construction design activities. Concrete has always been known as a material with adequate compressive strength, easy to form and produce locally, relatively rigid, and economical. Concrete is made by mixing Portland cement or hydraulic cement, fine aggregate, coarse aggregate, and water with or without additional admixtures. The quality of concrete is strongly influenced by its constituent materials [2].

The uniformity of concrete quality is strongly influenced by the uniformity of the basic materials and the method of implementing concrete planning [3]. The required quality and uniformity of concrete can be achieved if the concrete manufacturing process is carried out properly and by procedures. Several methods can be used to make concrete plans, including the ACI (American Concrete Institute) and the SNI (Indonesian National Standard) methods. Concrete mix planning (Mix Design) is a very important step in quality control and concrete quality. The compressive strength of concrete is one of the main performances of concrete. The compressive strength of concrete is the ability of concrete to accept compressive forces per unit area. Compressive strength testing is carried out to determine the level of strength of the concrete that is expected to result, as well as by the planned concrete quality.[2] Based on this background, this study aims to review the compressive strength of K-250 concrete using a manual mix design.

Manual stirring Using simple equipment with human power. Manual Stirring is still used today, its implementation is very easy. Manual mixing for low concrete quality and small work volume, so that workmanship and mix evenness are easily achieved. What needs to be considered in manual work is the evenness of mixing the ingredients, if there is still a color difference then the mixture is not even. If it is not smooth, the mixing is done again. Mixing concrete manually using the excavator bucket volume comparison.

Thus, the researcher will conduct a study entitled "Overview of K-250 Concrete Compressive Strength Using Mix Design Manual on Development Project Continued Talud Airport of Syukuran Aminuddin Amir Luwuk".

2 Method

The testing process in this study includes 2 types, namely: Slump Test and Concrete Compressive Strength Test.

2.1 Slump Test

The slump of concrete is the level of viscosity or viscosity in the form of cohesion properties in freshly made concrete. This quantity is very influential on whether or not the work process is easy to relate to the level of dilution or concrete mix. If the dilution

of the concrete is getting thinner, then the field implementation can be done easily. The amount of concrete slump value is the level of dilution of the mix in the process. Usually, the value required in building construction is around 60 to 180 mm. Likewise, with the use of ready-mix concrete, a slump test is often carried out before the concrete is poured into the casting media [4].

The results obtained on the slump are obtained through test results by filling fresh concrete in a cone known as the Abrams cone. After that, this cone is pulled upwards until the concrete in it moves down. This decrease is known as the slump value. If the value is greater, the fresh concrete will become more dilute. The slump test can be seen in Fig. 1 [5].

Fig. 1. Testing the Slump Test

Slump Test Tool:

1. Abrams cone mold made of metal, Base diameter 200 mm, top diameter approx. 100 mm and has a height of 300 mm.
2. The stick should be about 26 mm and 60 cm in diameter [6].
3. Base made of wood or iron
4. Ruler or meter
5. Small spoon or shovel
6. Measuring cup or measuring cylinder to measure the volume of water
7. Containers for placing concrete materials.

Tests on the slump of concrete can be carried out if the combination of materials to form concrete has reached plastic properties. The purpose of the slump value test is to determine the level of flexibility or dilution in the concrete mixture made. This workability effect is useful for assessing workability in concrete. The range of slump values commonly used is about 8 cm to 12 cm. If the slump value is around 0 cm, it can be ascertained that the concrete's workability level is poor. Values like this are usually found in non-sand concrete.

The slump value in concrete is influenced by the fas value with a direct comparison. That is, if the fas value is small, the slump value will also be small. If the fas value

becomes large, the slump value is even greater. Testing the slump value using the Abrams cone is the oldest test in Indonesia. The use of this method is based on the ASTM C-143 standard. There are several tools needed in the testing process including:

1. Use a steel funnel with a diameter of about 20 cm at the bottom. The upper diameter ranges from 10 cm and the height reaches 30 cm. The two sides of the shovel face each other and have handles that serve as handrails to raise the cone
2. A stick with a diameter of 16 mm and a length of up to 60 cm is made of steel. The ends are hemispherical in shape. This is useful for compacting the concrete mixture that has been filled into the Abrams cone.

Measurements in the slump test intend to know the size of the height of the concrete mixture after lifting the container. The workable concrete mix will usually be poured into molds and compacted. Compaction carried out without the use of a vibrator usually reaches a slump value of 7 to 12 cm. Meanwhile, the slump value in concrete compaction has a value range of more than 12.5 cm. The use of vibrating tools needs to be avoided to avoid aggregate segregation and bleeding. This is done so that the results of the concrete dough have longer toughness and durability.

2.2 Concrete Compressive Strength Test

Testing the compressive strength of concrete using cube specimens is very commonly used to determine the compressive strength of concrete according to the standards of the Indonesian Reinforced Concrete Regulations 1955 (PBI 1955) and the Indonesian Reinforced Concrete Regulations 1971 (PBI 1971) [7]. After the issuance of Standard Procedures for Calculation of Concrete Structures for Buildings (SK SNI T-15-1991-03 [8] and SNI-03-2847-2002 [9]) the compressive strength of the plan is stated with the notation K. The cube test object is needed to determine the compressive strength of concrete, the test object The dimensions of the cube are 15cm x 15cm x 15cm. By PBI 1971 to convert the compressive strength of concrete based on the cube test object so that it is equivalent to the compressive strength of concrete with a cylindrical specimen multiplied by a factor of 0.83 or convert using the formula f'c=(0.76+ 0.2log(F'ck/15)). f'ck [10].

Test Objects of Concrete Compressive Strength Test

The test object used for compressive strength is in the form of a cube with dimensions of 15cm x 15cm x 15cm can be seen in Fig. 2.

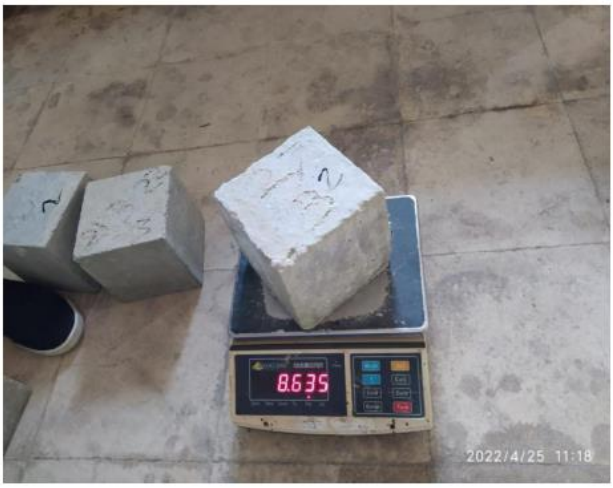

Fig. 2. Concrete compressive strength test object in the shape of a cube

Concrete Compressive Testing Tools

Compressive Strength Testing Tool

1. Print holder or sample printing media (15cm x 15cm x 15cm length)
2. A digital scale that serves to measure the mass of the sample.
3. The tool used to test the compressive load of the sample is a Frashguand compressive strength tester with a compressive capacity of 2000 kN.

Concrete Testing Materials

The materials used in this study, namely:

1. Coarse Aggregate (Gravel)
2. Fine Aggregate (Sand)
3. Cement
4. Water

Concrete Testing Process

Tests on concrete are carried out on fresh concrete material which can be in the form of cubes or cylinders which represent the concrete mixture. Concrete is an artificial stone made by mixing several selected materials, namely fine aggregate, coarse aggregate, and cement which are stirred and formed into structures for buildings.

Concrete Compressive Strength Testing Process

If the concrete to be tested has been prepared properly, then prepare a concrete compressive strength test kit. This tool is specifically designed to test the compressive strength of concrete. Place the concrete to be tested in the center of the testing machine. Operate the testing machine with a constant load increase between 2 Kg/cm2 to 4 Kg/cm2 per second. This load test continues until the concrete is crushed. Keep a good

record of the maximum load during the test. Also, record the test concrete's condition and the fractional shape's image [11].

From these data, the compressive strength of concrete can then be calculated using the formula P/A(Kg/cm2). In this formula, P is the maximum load in Kg. Meanwhile, A is the cross-sectional area of the specimen in cm2. Concrete compressive strength tests are generally carried out on concrete aged 3 days, 7 days, and 28 days. Then the test results are taken from the average value of at least 2 tested concrete. In this way, accurate results can be obtained.

3 Result and Discussion

This research consists of three phases, the first phase is testing the Slump Test, the second phase is making samples or test objects and the third phase is testing the compressive strength in the laboratory. The Slump Test phase and the sample or specimen preparation phase are carried out at the Thanksgiving Development Projects Continued Talud Airport of Aminuddin Amir Luwuk, while the compressive strength test for the test object is carried out at the PUPR Service Laboratory (Public Works and Spatial Planning) Banggai Regency.

Compressive Strength Testing is an attempt to obtain an estimated value of the compressive strength of concrete in the existing structure, by applying pressure to concrete samples from structures that have been implemented. The materials used for the manufacture of samples are sand, cement, water, and gravel. The process of making samples or test objects carried out in this study includes the process of testing the Slump Test, printing, drying, and compressive strength testing.

3.1 Results

Slump Test Testing. The Slump Test is the viscosity level of the concrete mixture which affects the construction process. Concrete slump is one of the important terms in construction.[4] The use of concrete for constructing a building itself must have several criteria. This is important so that the buildings built have strength and durability for a long time and are not prone to collapse. The samples made were samples with a testing time of 7, 14, and 28 days. To calculate the amount of Slump, the following formula is used:

Large slump = Height of mold - Height of test object

Compressive Strength Testing. The compressive strength test on the sample is carried out to obtain the maximum load. By using a test tool, namely Frashguand with a pressure capacity of 2000 kN. This test is carried out using 6 to 9 samples every week with the same bucket ratio. In testing the compressive strength of the sample using a size of 15cmx15cmx15cm.

The formula for calculating the average value of compressive strength

$$\text{Compressive Strength(MPa)} = \frac{\text{Maximum Load}}{\text{Cross} - \text{sectional Area}}$$

$$\text{Mean} = \frac{\text{Total Compressive Strength}}{\text{Amount of Data}}$$

$$\text{Cube Compressive Strength}(\text{kg/cm}^2) = \frac{\text{Compressive Strength (Mpa)x 10}}{\text{C}}$$

$$\text{Conversion} = \frac{\text{Cube Compressive Strength (kg/cm}^2)}{\text{Conversion Value}}$$

3.2 Discussion

Slump Test Testing

1. Testing the Slump Test (07 June 2022) at 3 test times with a standard of 5-12 cm, the height of the test object was 22.5 cm, 21.5 cm, and 22.0 cm, so the size of the Slump Test was obtained at 7.5 cm, 8 .5 cm, and 8.0 cm.
2. Testing the Slump Test (June 09, 2022) at 3 test times with a standard of 5-12 cm, the height of the test object was 20.0 cm, 22.5 cm, and 22.0 cm, so the size of the Slump Test was obtained at 10.0 cm, 7 .5 cm, and 8.0 cm.
3. The Slump Test (June 11, 2022) at 3 test times with a standard of 5-12 cm, the height of the test object was 23.0 cm, 24.5 cm, and 25.0 cm, so the size of the Slump Test was 7.0 cm, 5 .5 cm, and 5.0 cm.
4. The Slump Test (June 13, 2022) at 3 test times with a standard of 5-12 cm, obtained test object heights of 25.0 cm, 21.0 cm, and 21.0 cm. The calculation of the large Slump Test obtained is 5.0 cm, 9.0 cm, and 9.0 cm.
5. Testing Slump Test (14 June 2022). Based on the research conducted, it can be explained that in the 3 Slump Test tests with a standard of 5-12 cm, the height of the test object was 20.0 cm, 21.0 cm, and 18.0 cm. The calculation of the large Slump Test obtained is 10.0 cm, 9.0 cm, and 9.0 cm.

The Slump Test is intended to determine how much the level of viscosity of the concrete mix affects permeability, workability, and workmanship. The Slump Test results have met the agreed contract standards, namely 5 cm to 12 cm. In general, the test complies with PBI 1971 standards.

Compressive Strength Testing

1. Compressive Strength Test (08 June 2022)
   a. Compressive Strength (7 Days)
      Samples aged 7 days in testing 3 samples of test objects for compressive strength, obtained an average value of 470000 N, which was converted to 20.89 MPa. The sample area is 22500 mm2 and the sample compressive strength is 387.22 kg/cm2.
   b. Compressive Strength (14 Days)

Samples aged 14 days in testing 3 samples of test objects for compressive strength, obtained an average value of 485000 N, which was converted to 21.55 MPa. The sample area is 22500 mm2 and the sample compressive strength is 295.05 kg/cm2.

2. Compressive Strength Test (June 11, 2022)
   a. Compressive Strength (7 Days)
      Samples aged 7 days in testing 3 samples of test objects for compressive strength, obtained an average value of 560000 N, which was converted to 24.89 MPa. The sample area is 22500 mm2 and the sample compressive strength is 461.35 kg/cm2.
   b. Compressive Strength (14 Days)
      Samples aged 14 days in testing 3 samples of test objects for compressive strength, obtained an average value of 548333.33 N, which was converted to 24.373 Mpa. The sample area is 22500 mm2 and the sample compressive strength is 333.69 kg/cm2.
   c. Compressive Strength (28 Days)
      Samples aged 28 days in testing 3 samples of test objects for compressive strength, obtained an average value of 635000 N, which was converted to 28.22 MPa. The sample area is 22500 mm2 and the sample compressive strength is 340.00 kg/cm2.
3. Compressive Strength Test (14 June 2022)
   a. Compressive Strength (7 Days)
      Samples aged 7 days in testing 3 samples of test objects for compressive strength, obtained an average value of 405000 N, which was converted to 18.00 MPa. The sample area is 22500 mm2 and the sample compressive strength is 333.65 kg/cm2.
   b. Compressive Strength (14 Days)
      Samples aged 14 days in testing 3 samples of test objects for compressive strength, obtained an average value of 513333.33 N, which was converted to 22.82 MPa. The sample area is 22500 mm2 and the sample compressive strength is 312.43 kg/cm2.
4. Compressive Strength Test (June 17, 2022)
   a. Compressive Strength (7 Days)
      Samples aged 7 days in testing 3 samples of test objects for compressive strength, obtained an average value of 555000 N, which was converted to 24.67 MPa. The sample area is 22500 mm2 and the sample compressive strength is 457.21 kg/cm2.
   b. Compressive Strength (28 Days)
      Samples aged 28 days in testing 3 samples of test objects for compressive strength, obtained an average value of 626666.67 N, which was converted to 27.85 MPa. The sample area is 22500 mm2 and the sample compressive strength is 335.54 kg/cm2.

The samples' compressive strength test has met the specification standards. The highest compressive strength of the test object was obtained on the test date of 11 June 2022 at

461.35 kg/cm2. Whereas in other tests it decreased, but in other tests, it has shown a value that is suitable for use (suitable for talud buildings) and meets the compressive strength quality requirements in terms of predetermined standards and the value obtained meets the category based on SNI 03 1974-1990 standards [12].

4 Conclusion

The tested Slump Test has met the concrete workmanship standards and the quality requirements set based on the 1971 PBI standard. The samples' compressive strength test has met the specification standards. The highest compressive strength of the test object was obtained on the test date of 11 June 2022 at 461.35 kg/cm^2. Whereas in other tests it decreased, but in other tests, it has shown a value that is suitable for use (suitable for talud buildings) and meets the compressive strength quality requirements in terms of predetermined standards, and the values obtained have fulfilled the category based on SNI 03 1974-1990.

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