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# COMPARISON OF FINE AGGREGATE TO MORTAR STRENGTH BETWEEN SAND AWANG BANGKAL AND SAND BARITO

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**Abstract**

The progress of developing building construction in our country affects the number of diverse building functions resulting in the number of buildings, the acceleration of the desired building, and the demand for higher-quality construction. Mortar is a mixture consisting of Cement, Fine Aggregate, and Water. The adhesive in the mortar can be in the form of clay, lime, or cement. Fine Aggregate (Sand) in the mortar mix is a filler (glued material) either in a hardened or unhardened state. Research was conducted at the Structure and Materials Laboratory of the Banjarmasin State Polytechnic. Data collection was carried out by the method used to collect, study and collect data or sources related to the topic raised in a study. Studies can be obtained from various sources, such as journals, papers, reports, documentation books, the internet (browsing), and libraries. The results of the compressive strength on the age of mortar At the age of 3 days Semen Gresik Pasir Barito is 6.05 Mpa, At the age of 7 days Semen Gresik Pasir Barito is 6.05 Mpa, At the age of 14 days Semen Gresik Pasir Awang Bangkal is 8.66 Mpa, At the age of 28 days Semen Gresik sand Awang Bangkal 10.68 MPa. It can be concluded that Pasir Barito is included in zone IV, and Pasir Awang Bangkal is included in zone II.

## Introduction

The progress of constructing buildings that are developing in our country affects the number of various building functions resulting in the number of buildings, the desired acceleration of buildings, and demands for higher quality construction (Simanjorang & Nawawi, 2022).

Mortar combines fine aggregate (Sand), binder (Portland Cement, Clay, Lime), and water. The function of the mortar is the binding matrix of the constituent parts of a construction, both structural and non-structural (Umum & al S.P.M., 1970). The use of mortar for construction is structural, for example, masonry mortar for foundation structures, while for non-structural purposes, for example, brick masonry mortar for infill walls (Sari, Wallah, & Windah, 2015).

The standard specifications for mortar refer to its compressive strength, namely where the mortar must be able to accept the load (Ali & Walujodjati, 2021). Considering that as a part of mortar construction, it plays an essential role in carrying loads, several factors influence the results of the compressive strength of the mortar, including the type of cement, the amount of

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cement, the Water Cement Factor (F.A.S.) and the density, aggregate properties and also the age of the mortar. As with concrete, therefore, the use of mortar specimens must comply with the Specification Standard (Taufik, Kurniawandy, & Arita, 2017).

The author is interested in raising this discussion by trying to find the effect of the compressive strength of mortar at 3, 7, 14, and 28 days of age with a comparison of delicate aggregate variations of Awang Bangkal sand from Karang Intan and Barito sand from Barito Kuala Regency. Based on this background, the author wishes to raise the, namely "Comparison of Fine Aggregate (Awang Bangkal Sand and Barito Sand) Against Mortar Compressive Strength" (Pranoto, Halim, & Sudibyo, 2021).

## Method

**1. Literature Study**

A literature study is a method used to collect, examine and collect data or sources related to the topic raised in a study. Studies can be obtained from various sources, such as journals, papers, reports, documentation books, the internet (browsing), and literature.

**2. Lokasi Penelitian**

This independent lecturer research was conducted at the Laboratory of Material and Rock Testing Structures, Department of Civil and Earth Engineering, State Polytechnic of Banjarmasin.

**3. Testing Standards**

The material research on mixtures will be carried out at the Material and Rock Test Structure Laboratory, Department of Civil and Earth Engineering, State Polytechnic of Banjarmasin (Bintoro, Limantara, & Winarto, 2018). The properties of the materials used and examined in this study use the following methods.

(a). Cement fineness (S.N.I. 15-2530-1991)
(b). The specific gravity of cement (S.N.I. 03-2531-1991)
(c). Consistency of cement (S.N.I. 15-2049-2004)
(d). Cement setting time (S.N.I. 03-6827-2002)
(e). Specific gravity and absorption of fine aggregate (S.N.I. 1970-2008)
(f). Organic content (S.N.I. 03-2816-1992)
(g). Weight of fine aggregate (S.N.I. 03-4804, 1998)
(h). Fine aggregate silt content (SNI.03-4142, 1996)
(i). Acceptable aggregate moisture content (National Standardization Agency, 2011)
(j). Sieve analysis of fine aggregate (National Standardization Agency, 1990)
(k). Testing of flow table mortar (S.N.I. 03-6825-2002)
(l). Mortar compressive strength test (S.N.I. 03-6825-2002)

**4. Material Preparation**

The materials used include:

(a). The cement used is P.C.C. cement (Gresik)
(b). The sand used is Awang Bangkal sand and Barito sand
(C). The Water used is PDAM water

**5. The proportion of Test Objects**

Proportions for making mortar test specimens with variations to obtain relevant results in each mortar composition are based on (Dewi, Rifqi, & Hilmy, 2022). The total proportion of the mixed ratio is 1Pc: 3Ps, with 15 samples for each variation.

**6. Material Testing Stage**

The following is an explanation of the stages of material testing in this Final Research activity (Ali & Walujodjati, 2021) dan (Pranoto et al., 2021)**:**

(a). Material Characteristics Testing

They tested the characteristics of the material using the S.N.I. method. Characteristic tests include sieve analysis, specific gravity and absorption, delicate aggregate gradation zone, fineness modulus, moisture content, silt content, organic content, and bulk density of fine aggregate.

(b). Determination of Mixed Proportions Variations

Determination of the proportion of the mixture is carried out to obtain data on the compressive strength of the specimens for each variation of the mixture.

(c). Calculation of Mix Formulas

The Mix Formula calculation is carried out to determine how much material is needed for the manufacture of the test object by calculating the total volume per proportion and using the data from the expected test results that have been done previously as additional data to calculate the Mix Formula.

(d). Cement Water Factor Test (F.A.S.)

The cement Water Factor Test (F.A.S.) is carried out to determine the ratio of the proportion between cement and water so that the mixture is not excess water which can result in the compressive strength of the mixture not being maximum.

(e). Test Objects

I am making the test object using a square mold of 5 cm x 5 cm x 5 cm with the number of test objects per proportion of the mixture, namely as many as 9 test objects per proportion.

(f). Treatment of Test Objects (Curing)

Treatment of the specimen (Curing) is carried out after the mortar is removed from the mold the day after the manufacture of the specimen, except for the specimen, which will be compressed at three days. Treatment of the test object (Curing) is carried out by immersing the test object in water until the compressive strength test is carried out. This is done to keep the surface of the specimen constantly moist to ensure the cement hydration process (cement and sand reaction).

(g). Compressive Strength Testing

Mortar compressive strength testing was carried out at three days, seven days, 14 days, and 28 days with a note that the test object must be removed from the water a maximum of 3 days before the test is carried out.

(h). Compressive Strength Test Data Analysis

Analysis of the compressive strength test data of the mortar test object, namely in the form of compressive strength data at the age variation of the compressive strength test for each proportion of the mortar mixture. To obtain a relationship between the compressive strength of each mortar mixture proportion variations with the age of the mortar.

## Results and Discussion

### A. Cement Testing Results

The blocks of cement used in the research/testing are tonnes and gresik blocks of cement. The test results can be seen in table 1 (Hariono, Rusli, & Hernanti, 2016).

**Table 1**
**Testing of Semen Gresik**

| No | Kinds of Examination | Semen Gresik | | specification SNI |
|---|---|---|---|---|
| | | Reference Standard | Results | 15-2049-2004 |
| 1. | Specific gravity | SNI 03 – 2531 - 1991 | 3,145 | Maks 3,2 |
| 2. | Cement Fineness | SNI 15 – 2530 - 1991 | | |
| | Stuck in Sieve No. 100 | | 0% | 0,0 % |
| | Stuck in Sieve No. 200 | | 4% | |
| 3. | Consistent | SNI 15 – 2049 - 2004 | 26% | - |
| 4 | Binding Time | SNI 03 – 6827 – 2002 | | |
| | Beginning | | 80 minute | Min 45 minute |
| | End | | 150 minute | Maks 360 minute |

*(Test results/own research)*

Based on graph .1 above, the initial setting time is reached when the Vicat needle descends as deep as 25 mm for 30 seconds. The initial setting time for Gresik cement is 80 minutes. Meanwhile, the final setting time was reached at 150 minutes when the Vicat needle was placed above the sample for 30 seconds and did not decrease (Nasional, 2002).

**B. Satisfactory Aggregate Test Results (Barito Sand)**

The fine aggregate used is Barito sand. By testing the specific gravity, absorption, silt content, moisture content, organic content, bulk density, and sieving analysis, the results of the proper aggregate testing (Barito Sand) can be seen in table 2.

**Table 2**
**Satisfactory Aggregate Test Results (Barito Sand)**

| No | Macam Pemeriksaan | Pasir Barito | | Spesifikasi |
|---|---|---|---|---|
| | | Standart / Rujukan | Hasil | SII 0052-80 |
| 1 | Berat jenis | SNI 1970-2008 | | Min 2,5 |
| | Berat jenis Bulk (%) | | 2,603 | |
| | Permukaan Jenus SSD (%) | | 2,619 | |
| | Berat Jenis Semu (%) | | 2,644 | |
| | Penyerapan | | 0,604 | Maks 3% |
| 2 | Kadar Lumpur | SNI 03-4142-1996 | 0,211 | Maks 5% |
| 3 | Kadar Air | SNI 1971-2011 | 1,293 | - |
| 4 | Kadar Organik | SNI 03-2816-1992 | No.5 | Standart Warna No.3 |
| 5 | Berat Isi Agregat | SNI 1973-2008 | | |
| | Berat Isi Lepas (Kg/Lt) | | 1,638 | |
| | Berat Isi Dengan Tusukan (Kg/Lt) | | 1,672 | |
| | Berat Isi Dengan Hentakan (Kg/Lt) | | 1,809 | |
| 6 | Susunan Grading Agregat | SNI 03-1968-1990 | | Zona 4 |
| | 3/8" | | 100 | 100 |
| | No.4 | | 100 | 90-100 |
| | No.8 | | 97,8 | 75-100 |
| | No.16 | | 93,06 | 55-90 |
| | No.30 | | 81,51 | 35-59 |
| | No.50 | | 35,15 | 8-30 |
| | No.100 | | 1,15 | 0-10 |
| 7 | Fan Modulus | | 2,93 | |

*(Test results/own research)*

The calculation data in table 2 is in Appendix III.

Table 2 shows that the fine aggregate (Barito sand) in the organic content test did not meet the specification requirements (Wahjoedi, Kusdiyono, Supriyadi, Wahyono, & Mahbub, 2022).

**Table 3**
**Sieve Analysis of Fine Aggregate (Barito Sand)**

| Nomor Saringan | | Berat Tertahan (gr) Contoh | | Kumulatif Tertahan (gr) Contoh | | Kumulatif Persen | | | | | Daerah Gradasi Susunan Butir (Zone) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tertahan Persen | | Lolos Contoh | | Rata-Rata | |
| mm | inch | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | | |
| 9,52 | 3/8" | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | Zona 4 |
| 4,76 | No.4 | 0 | 0 | 0 | 0 | 0,00 | 0,00 | 100 | 100 | 100,00 | |
| 2,38 | No.8 | 1,9 | 2,5 | 1,9 | 2,5 | 1,91 | 2,54 | 98,10 | 97,50 | 97,80 | |
| 1,19 | No.16 | 4,3 | 5,2 | 6,2 | 7,7 | 6,24 | 7,81 | 93,81 | 92,30 | 93,06 | |
| 0,59 | No.30 | 6,3 | 16,8 | 12,5 | 24,5 | 12,59 | 24,85 | 87,52 | 75,50 | 81,51 | |
| 0,279 | No.50 | 36,9 | 55,9 | 49,4 | 80,4 | 49,75 | 81,54 | 50,70 | 19,60 | 35,15 | |
| 0,149 | No.100 | 49,9 | 18,2 | 99,3 | 98,6 | 99,10 | 98,60 | 0,90 | 1,40 | 1,15 | |
| Pan | | 0,9 | 1,4 | 100,2 | 100 | 100,00 | 100,00 | 0,00 | 0,00 | 0,00 | |

*(Test results/own research)*

Fan Modulus = 1,90

Based on the sieving analysis test that has been carried out by himself. It can be seen that the cumulative average passed on the sieve shows that this (Barito) sand is included in zone IV (Ali & Walujodjati, 2021). Seeing from the average, it is in the middle of the cumulative limit of zone IV.

**C. Satisfactory Aggregate Test Results (Bangkal Awang Sand)**

Agregat halus yang digunakan adalah pasir Barito, dengan melakukan pengujian berat jenis, penyerapan, kadar lumpur, kadar air, kadar organik, berat isi, analisa saringan, hasil dari pengujian agregat halus (Pasir Awang Bangkal) dapat dilihat pada tabel 4.

**Table 4**
**Satisfactory Aggregate Test Results (Bangkal Awang Sand)**

| No | Macam Pemeriksaan | Pasir Awang Bangkal | | Spesifikasi SII 0052-80 |
|---|---|---|---|---|
| | | Standart / Rujukan | Hasil | |
| 1 | Berat jenis | SNI 1970-2008 | | Min 2,5 |
| | Berat jenis Bulk (%) | | 2,751 | |
| | Permukaan Jenus SSD (%) | | 1,786 | |
| | Berat Jenis Semu (%) | | 2,85 | |
| | Penyerapan | | 1,258 | Maks 3% |
| 2 | Kadar Lumpur | SNI 03-4142-1996 | 5,315 | Maks 5% |
| 3 | Kadar Air | SNI 1971-2011 | 5,611 | - |
| 4 | Kadar Organik | SNI 03-2816-1992 | No.3 | Standart Warna No.3 |
| 5 | Berat Isi Agregat | SNI 1973-2008 | | |
| | Berat Isi Lepas (Kg/Lt) | | 1,667 | |
| | Berat Isi Dengan Tusukan (Kg/Lt) | | 1,727 | |
| | Berat Isi Dengan Hentakan (Kg/Lt) | | 1,697 | |
| 6 | Susunan Grading Agregat | SNI 03-1968-1990 | | Zona 2 |
| | 3/8" | | 100 | 100 |
| | No.4 | | 95,5 | 95-100 |
| | No.8 | | 77,13 | 95-100 |
| | No.16 | | 56,33 | 90-100 |
| | No.30 | | 43,97 | 80-100 |
| | No.50 | | 14,2 | 15-50 |
| | No.100 | | 1,89 | 0-15 |
| 7 | Fan Modulus | | 2,78 | |

*(Test results/own research)*

The calculation data in table 4 is in Appendix III.

Based on table 4, the test results can be concluded that the fine aggregate (Awang Bangkal sand) in the mud content test does not meet the specifications.

**Table 5**
**Sieve Analysis of Fine Aggregate (Bangkal Sand Awang)**

| Nomor Saringan | | Berat Tertahan (gr) Contoh | | Kumulatif Tertahan (gr) Contoh | | Kumulatif Persen | | | | | Daerah Gradasi Susunan Butir (Zone) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tertahan Persen | | Lolos Contoh | | Rata-Rata | |
| mm | inch | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | | |
| 9,52 | 3/8" | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | |
| 4,76 | No.4 | 85,9 | 79 | 85,9 | 84,7 | 9,31 | 9,20 | 91,00 | 100,00 | 95,50 | |
| 2,38 | No.8 | 159,1 | 183,9 | 245 | 183,9 | 26,55 | 20,18 | 74,33 | 79,92 | 77,13 | |
| 1,19 | No.16 | 202,1 | 187 | 447,1 | 370,9 | 48,45 | 40,69 | 53,16 | 59,50 | 56,33 | |
| 0,59 | No.30 | 118,5 | 112,7 | 565,6 | 483,6 | 61,29 | 53,06 | 40,74 | 47,19 | 43,97 | Zona 2 |
| 0,279 | No.50 | 239,5 | 315,4 | 805,1 | 799 | 87,24 | 87,66 | 15,65 | 12,75 | 14,20 | |
| 0,149 | No.100 | 117,8 | 112,5 | 922,9 | 911,5 | 96,69 | 99,53 | 3,31 | 0,47 | 1,89 | |
| Pan | | 31,6 | 4,3 | 954,5 | 915,8 | 100,00 | 100,00 | 0,00 | 0,00 | 0,00 | |

*(Test results/own research)*

Fine Modulus = 2,87

Based on the sieving analysis test that has been carried out by himself. It can be seen that the cumulative average passed on the sieve shows that this sand (Awang Bangkal) is included in zone II. Seeing from the average, it is in the middle of the cumulative limit of zone II.

**D. Calculation of Mixed Mortar Mix (Mix Design)**

For the calculation of mortar mix according to (Gumelar As'at & Nuriani, 2021), the materials used are fine aggregate of Barito and Awang Bangkal sand, the cement used is grit cement, and the water used according to the determined proportion.

The following is the proportion of mortar mixed with a mixture of 1 part Portland cement and three parts sand.

**Table 6**
**Mix Design Calculation Results Comparison of 1Pc:3Ps (Barito)**

| Proporsi Campuran | Semen | Agregat Kondisi Jenuh Kering Permukaan | Air (gr/ml) |
|---|---|---|---|
| | | Pasir Barito | |
| - Perbandingan Setelah Revisi | | | |
| a. Bobot (Gr) | 889,71 | 3526,47 | 527,68 |
| b. Volume (Lt) | 215,69 | 2821,18 | 527,68 |
| - Koreksi Perbandingan Campuran Uji | | | |
| a. Bobot | 1,00 | 3,96 | 0,59 |
| b. Volume | 0,80 | 13,08 | 2,45 |
| - Tiap Campuran Uji/ 1 Zak Semen (50kg) | | | |
| a. Bobot (Kg) | 50,00 | 198,18 | 29,65 |
| b. Volume (Lt) | 12,12 | 158,55 | 29,65 |
| Perbandingan (dengan 15 sampel uji) | Semen = 890 gr<br>Pasir = 3526 gr<br>Air = 528 gr/ml | | |

**Table 7**
**Mix Design Calculation Results Comparison of 1Pc:3Ps (Awang Bangkal)**

| Proporsi Campuran | Semen | Agregat Kondisi Jenuh Kering Permukaan | Air (gr/ml) |
|---|---|---|---|
| | | Pasir Barito | |
| - Perbandingan Setelah Revisi | | | |
| a. Bobot (Gr) | 889,71 | 3525,54 | 527,68 |
| b. Volume (Lt) | 215,69 | 2820,43 | 527,68 |
| - Koreksi Perbandingan Campuran Uji | | | |
| a. Bobot | 1,00 | 3,96 | 0,59 |
| b. Volume | 0,80 | 13,08 | 2,45 |
| - Tiap Campuran Uji/ 1 Zak Semen (50kg) | | | |
| a. Bobot (Kg) | 50,00 | 198,13 | 29,65 |
| b. Volume (Lt) | 12,12 | 158,50 | 29,65 |
| Perbandingan (dengan 15 sampel uji) | Semen = 890 gr<br>Pasir = 3526 gr<br>Air = 528 gr/ml | | |

*(Test results/own research)*

## E. Konsistensi Mortar

Consistency testing uses a melting table tool to determine the amount of water needed in the cement paste. This test was carried out using fine aggregate sand Barito and Awang Bangkal. The binding time is carried out if the consistency meets the requirements.

**Table 8**
**Sand Mortar Consistency (Barito)**

| No. Benda Uji | Barito Diameter (cm) | | | | Rata - rata | Flow (%) | Keterangan (Penambahan Air ) (ml) |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | |
| 1 | 12,6 | 12,3 | 12,1 | 12 | 12,25 | 22,5 | 0,5 |
| 2 | 25,3 | 24,3 | 24,6 | 24,7 | 24,73 | 147,25 | 0,7 |
| 3 | 21 | 19,9 | 19,9 | 21,2 | 20,5 | 105 | 0,6 |

*(Test results/own research)*

## F. Mortar Compressive Strength Test Results

The results of the mortar compressive strength test, according to (Indriyati, Malik, & Alwinda, 2019) for one variation of cement type, there were 15 test objects divided into four mortar ages, namely 3, 7, 14, and 28 days. The compressive strength test of the mortar results is shown in Tables 9 and 10.

**Table 9**
**Compressive Strength Test Results of Sand Mortar**

| No | Benda Uji | Kuat Tekan | | | |
|---|---|---|---|---|---|
| | | Umur 3 Hari | Umur 7 Hari | Umur 14 Hari | Umur 28 Hari |
| 1 | Mortar | 57,24 | 58,63 | 62,82 | 85,16 |
| 2 | ( Semen | 55,84 | 62,82 | 80,97 | 125,64 |
| 3 | Gresik Pasir | 68,40 | 60,03 | 86,55 | 86,55 |
| 4 | Barito ) | | | | 86,55 |
| 5 | | | | | 100,51 |
| 6 | | | | | 89,34 |
| **Rata - Rata** | | **60,49** | **60,49** | **76,78** | **95,63** |

*(Test results/own research)*

**Table 10**
**Compressive Strength Test Results of Sand Mortar (Awang Bangkal)**

| No | Benda Uji | Kuat Tekan | | | |
|---|---|---|---|---|---|
| | | Umur 3 Hari | Umur 7 Hari | Umur 14 Hari | Umur 28 Hari |
| 1 | Mortar | 40,48 | 37,69 | 82,36 | 99,12 |
| 2 | ( Semen | 43,28 | 39,09 | 86,55 | 99,12 |
| 3 | Gresik Pasir | 40,48 | 65,61 | 90,74 | 113,08 |
| 4 | Awang | | | | 111,68 |
| 5 | Bangkal ) | | | | 113,08 |
| 6 | | | | | 103,30 |
| **Rata - Rata** | | **41,41** | **47,46** | **86,55** | **106,56** |

*(Test results/own research)*

The results of the mortar tests in tables 10 and 11 at the ages of 3, 7, 14, and 28 days with a total of 30 samples, show that the compressive strength of Gresik cement with Barito and Awang Bangkal sand shows that the average always increases and the highest compressive strength occurs in 28 days old.

## G. Mortar Standard Deviation Calculation

**Table 11**
**Compressive Strength Calculation Results of the Characteristics of Barito Sand**

| **Pasir Barito** | | | | |
|---|---|---|---|---|
| **No Sample** | **Xi (kg/cm2)** | **X (kg/cm2)** | **Xi-X (kg/cm2)** | **(Xi-X)^2 (kg/cm2)** |
| 1 | 143,1 | 102,5 | 40,62 | 1650,277 |
| 2 | 139,6 | 102,5 | 37,13 | 1378,904 |
| 3 | 171,0 | 102,5 | 68,54 | 4698,225 |
| 4 | 90,2 | 102,5 | -12,26 | 150,389 |
| 5 | 96,6 | 102,5 | -5,82 | 33,875 |

| | | | | |
|---|---|---|---|---|
| 6 | 92,4 | 102,5 | -10,12 | 102,326 |
| 7 | 62,8 | 102,5 | -39,65 | 1571,837 |
| 8 | 81,0 | 102,5 | -21,50 | 462,181 |
| 9 | 86,6 | 102,5 | -15,91 | 253,268 |
| 10 | 85,2 | 102,5 | -17,31 | 299,650 |
| 11 | 125,6 | 102,5 | 23,17 | 537,016 |
| 12 | 86,6 | 102,5 | -15,91 | 253,268 |
| 13 | 86,6 | 102,5 | -15,91 | 253,268 |
| 14 | 100,5 | 102,5 | -1,95 | 3,820 |
| 15 | 89,3 | 102,5 | -13,12 | 172,197 |
| **Rata -Rata** | 102,5 | | 0,000 | 11820,502 |

*(Test results/own research)*

$$S = \sqrt{\frac{\sum(Xi-\bar{x})^2}{n-1}} \quad \text{.....(4.1)}$$

$$S = \sqrt{\frac{11820,502}{15-1}} = 29,06$$

$$K = \sum xi - (1.64 \,.S\,.Faktor\ Koreksi) \quad \text{.....(4.2)}$$

$$K = 102,5 - (1.64\,.29,06\,.1) = 54,81 \text{ kg/cm}^2$$

Based on the table and calculations above, it can be seen that the characteristic compressive strength of the ratio 1Pc: 3Ps of Barito sand is 54.81 kg/cm2.

**Table 12**
**Compressive Strength Calculation Results of the Characteristics of Awang Bangkal Sand**

| **Pasir Awang Bangkal** | | | | |
|---|---|---|---|---|
| **No Sampel** | **Xi (kg/cm2)** | **X (kg/cm2)** | **Xi-X (kg/cm2)** | **(Xi-X)^2 (kg/cm2)** |
| 1 | 101,2 | 95,2 | 5,96 | 35,562 |
| 2 | 108,2 | 95,2 | 12,94 | 167,532 |
| 3 | 101,2 | 95,2 | 5,96 | 35,562 |
| 4 | 58,0 | 95,2 | -37,26 | 1388,224 |
| 5 | 60,1 | 95,2 | -35,11 | 1232,796 |
| 6 | 100,9 | 95,2 | 5,69 | 32,433 |
| 7 | 82,4 | 95,2 | -12,88 | 165,961 |
| 8 | 86,6 | 95,2 | -8,69 | 75,596 |
| 9 | 90,7 | 95,2 | -4,51 | 20,309 |
| 10 | 99,1 | 95,2 | 3,87 | 14,972 |
| 11 | 99,1 | 95,2 | 3,87 | 14,972 |
| 12 | 113,1 | 95,2 | 17,83 | 317,888 |

| | | | | |
|---|---|---|---|---|
| 13 | 111,7 | 95,2 | 16,43 | 270,057 |
| 14 | 113,1 | 95,2 | 17,83 | 317,888 |
| 15 | 103,3 | 95,2 | 8,06 | 64,922 |
| **Rata -Rata** | 95,2 | | 0,000 | 4154,677 |

*(Test results/own research)*

$$S = \sqrt{\frac{4154,677}{15-1}} = 17,23$$

$$K = 95,2 - (1.64 \,.17,23 \,.1) = 66,99 \text{ kg/cm}^2$$

Based on the table and calculations above, it can be seen that the characteristic compressive strength of the ratio 1Pc: 3Ps of Awang Bangkal sand is 66.99 kg/cm2.

**Conclusion**

From the results of the research and discussion, it can be concluded as follows: It can be concluded that the characteristics of Awang Bangkal Sand on the mud content test do not meet the specification requirements, and Barito Sand on the organic content test does not meet the specification requirements (Syahriadi, 2021).

A. Based on the average compressive strength of the mortar, the following results are obtained: Pasir Awang Bangkal, at three days old, was 41.41 kg/cm2. At seven days old, 47.46 kg/cm2, 14 days old, 86.55 kg/cm2; and at 28 days old, 106.56 kg/cm2. Barito sand at the age of 3 days was 60.49 kg/cm2. At the age of 7 days, 60.49 kg/cm2. At the age of 14 days, 76.78 kg/cm2, and at the age of 28 days, 95.63 kg/cm2. Based on the calculation of the characteristic compressive strength of the mortar, 64.81 kg/cm2 for Barito sand and 66.99 kg/cm2 for Awang Bangkal sand.

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