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# USE OF MERAUKE FINE AGGREGATE AND DIGOEL BOVEN COARSE AGGREGATE ON CONCRETE COMPRESSIVE STRENGTH

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**ABSTRACT**

*The increasing development needs in the construction sector indirectly require the availability of substantial material in the area. The use of concrete materials in Merauke Regency is currently increasing, so that the constituent materials used are expected to use from the surrounding environment to be used in concrete-making mixtures. The purpose of this study was to conduct an alternative study, namely the combination of local aggregate in Merauke Regency, with fine aggregates and coarse aggregate from Boven Digoel Regency. The method used in this study is experimental using SNI 03-2834-2000 (Procedures for Making Mixed Plans). Fine aggregates originating from Jagebob Raya Village, Merauke Regency and coarse aggregates from Boven Digoel Regency. From the results of laboratory tests conducted, the concrete compressive strength obtained at the age of 3 days, obtained a value of f'c = 14.27 MPa and for age 7 days the concrete compressive strength value is f'c = 15.85 MPa.*

**Keywords**: concrete, compressive strength, Merauke fine aggregate, Boven Digoel coarse aggregate

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## 1. INTRODUCTION

The use of concrete materials in Merauke Regency is currently increasing, but the availability of inadequate material, both fine aggregate and coarse aggregate is quite difficult. It must be imported from outside the island at a relatively expensive price. Technical personnel, especially in the field of civil engineering (Sedayu and Mangkoedihardjo, 2018). It is to try to do research on available material from the surrounding environment for use from local marines. This is necessary testing of existing characteristics to be used in concrete-making

mixtures. The author tries to do research with another alternative, namely the utilization of local fine aggregates of Merauke Regency with coarse aggregates imported from the nearest area, namely Boven Digoel Regency.

The purpose and objectives of this study are in accordance with the problems that occur are as follows:

a. To find out the local fine aggregate characteristics of Merauke Regency and the rough aggregate of Boven Digoel Regency.

b. To determine the value of concrete compressive strength using fine aggregate of Merauke Regency and coarse aggregate from Boven Digoel Regency.

# 2. METHODOLOGY

Test methods for concrete compressive strength, namely experimental using SNI 03-2834-2000 Procedures for Making a Normal Concrete Mixture Plan. Fine aggregates from the Jagebob Raya village of Merauke Regency and crude aggregates from Boven Digoel Regency. Concrete testing is carried out after the concrete treatment period is immersed in water for each determined concrete age, including 3 and 7 days old.

## 2.1. Concrete compressive strength

The compressive strength of a concrete load is the amount per unit area, which causes the test specimen to be destroyed if it is loaded with a certain compressive force, which is produced by a press machine. The planned concrete compressive strength f'c is the compressive strength determined by the structural planner based on cylindrical specimens 15 cm in diameter and 30 cm high. From the test results less than 28 days. The concrete compressive strength can be determined by the following formula:

$$f'_c = \frac{P}{A}$$

where:

$f'_c$ = Concrete compressive strength (MPa)

P = Maximum load (kN)

A = Cross-sectional area of the test object ($cm^2$)

## 2.2. Concrete building material

### *2.2.1. Aggregate*

Aggregates are defined as granular materials such as sand, gravel, broken stone, and iron furnace crust which are used together with a binding medium to form hydraulic cement concrete or mortar. The aggregate content in a concrete mixture is usually very high, the composition can reach 60% - 70% of the weight of the concrete mixture. Although its function is only as a filler, but because the composition is quite large, the aggregate role becomes very important. Therefore the characteristics of the aggregate need to be studied properly, because aggregates can determine the nature of the concrete to be produced. (Tri Mulyono, 2004).

### *2.2.2. Coarse aggregate*

According to the Indonesian National Standard (SNI 03-2834-2000), coarse aggregates are gravel as a result of natural disintegration of stone or in the form of broken stones obtained from the stone breaking industry and have grain sizes between 5 mm - 40 mm.

Coarse aggregate gradation requirements can be seen in the Table 1 as follows:

**Table 1.** Coarse aggregate gradation

| Sieve size | % pass the sieve | | |
|---|---|---|---|
| | size max 10 mm | size max 20 mm | size max 40 mm |
| 76 | 100 - 100 | 100 - 100 | 100 - 100 |
| 38 | 100 - 100 | 100 - 100 | 95 - 100 |
| 19 | 100 - 100 | 95 - 100 | 35 - 70 |
| 9.6 | 50 - 85 | 30 -60 | 10 - 40 |
| 4.8 | 0 -50 | 0 - 10 | 0 - 5 |

Source: (SNI 03-2834-2000)

### *2.2.3. Fine aggregate*

The fine aggregate is the aggregate whose granules penetrate the 4.8 mm sieve. According to the Indonesian National Standards (SNI 03-2834-2000), fine aggregates are natural sands as a result of the natural integration of stones or sand produced by the stone breaking industry and have the largest grain size of 5 mm. The requirements for fine aggregate gradation can be seen in Table 2 below.

**Table 2**. Fine aggregate gradation

| Sieve size | % pass the sieve | | | |
|---|---|---|---|---|
| | Coarse sand Gradation No. 1 | Medium sand Gradation No. 2 | Rather fine sand Gradation No. 3 | Fine sand Gradation No. 4 |
| 9.6 | 100 - 100 | 100 - 100 | 100 - 100 | 100 - 100 |
| 4.8 | 90 - 100 | 90 - 100 | 90 - 100 | 95 - 100 |
| 2.4 | 60 - 95 | 75 - 100 | 85 - 100 | 95 - 100 |
| 1.2 | 30 - 70 | 55 - 100 | 75 - 100 | 90 - 100 |
| 0.6 | 15 - 34 | 35 - 59 | 60 - 79 | 80 - 100 |
| 0.3 | 5 - 20 | 8 - 30 | 12 - 40 | 15 - 50 |
| 0.15 | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 15 |

Source: (SNI 03-2834-2000)

#### *2.2.3.1. Cement*

Cement is a hydraulic binder in the form of fine powder produced by smoothing the clinker which mainly consists of calcium calcium silicates with casts for additional ingredients. Portland cement is one type of cement which is generally widely used in concrete structural work. According to ASTM C_150, 1985, portland cement is defined as hydraulic cement produced by clinker consisting of hydraulic calcium silicate which generally contains one or more forms of calcium sulfate as additives which are milled together with the main ingredient.

## 2.4. Water

The water used in the concrete mixture must be clean, must not contain mud and be free from damaging materials containing oil, acid, alkali, salt, organic material or other materials which are detrimental to concrete or reinforcement. You should use fresh water that can be drunk. Mixed water used in concrete in which aluminum metal is embedded, must not contain chloride ions.

# 3. RESULTS AND DISCUSSION

## 3.1. Results

### *3.1.1. Aggregate testing*

To clarify the presentation of the results of the study, the following are the results of testing of the concrete constituent used as concrete mixing, testing the characteristics of fine and coarse aggregates include testing moisture content, sludge content, organic content, specific gravity, absorption, sieving (gradation ) and testing of Los Angeles for coarse aggregates.

**Table 3.** Fine aggregate and coarse aggregate

| No | Aggregate test | The test results | |
|---|---|---|---|
| | | Fine aggregate | Coarse aggregate |
| 1. | Water content | 0,37% | 0,71% |
| 2. | Sludge content | 1,1% | 0,23% |
| 3. | Density | 2,58 | 2,59 |
| 4. | Absorption | 1,87% | 2,11% |
| 5. | Organic content | Brown-black | - |
| 6. | Gradation | Zona IV | 38,1-4,76 |
| 7. | Smooth modulus granule | 0,879 | 6,998 |
| 8. | Los Angeles | - | 35% |

### *3.1.2. Mix design*

In planning normal concrete mixtures with cylindrical specimens using the calculation of the Indonesian National Standard (SNI-03-2834-200). From the results of calculations that have been made obtained material requirements:

a. Water = 175 Kg
b. Cement = 341,13 Kg
c. Fine aggregate = 431,26 Kg
d. Coarse aggregate = 1427,61 Kg

For the needs of one cylinder material obtained based on material requirements per cubic are as follows: Cylinder = $\pi \times 0{,}075^2 \times 0{,}3 = 0{,}00529875\ m^3$

a. Water = 175 × 0,0529875
   = 0,93 Kg
b. Cement = 341,13 × 0,0529875
   = 1,81 Kg
c. Fine aggregate = 431,26 × 0,0529875
   = 2,29 Kg
d. Coarse aggregate = 1427,61 × 0,0529875

= 7,56 Kg

### *3.1.2. Concrete compressive strength*

From the calculation of the concrete compressive strength the average is obtained for the age of 3 days, which is 14.27 MPa, for the age of 7 days which is 15.58 MPa. From the calculation results of the compressive strength of the concrete obtained it can be concluded as in Figure 1.

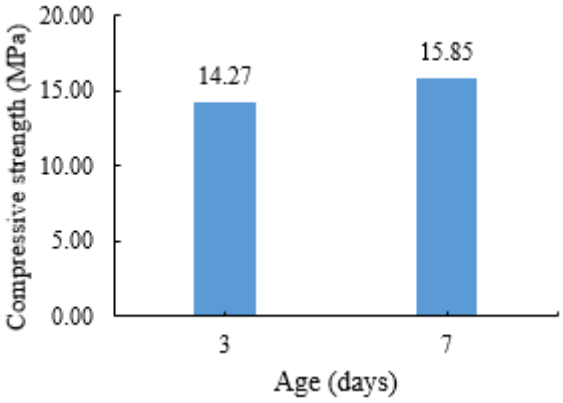


**Figure 1.** Results of compressive strength

## 3.2. Discussion

The test results on the fine aggregates carried out in this study were testing the moisture content of 0.37%, mud content 1.1%, dark organic content, specific gravity 2.58, absorption 1.87%, sieving obtained gradations enter zone IV, and fine modulus of the item 0.897. Whereas testing on coarse aggregates, ie unbreakable stones obtained by testing the moisture content of 0.71%, 0.23% sludge content, test results for specific gravity is 2.59, absorption 2.1%, sieve analysis obtained in maximum gradation of 40 mm or entered in zone 3 with a fine modulus of 6.998. From the results of laboratory tests carried out, the compressive strength of concrete obtained at the age of 3 days, obtained a value of fc = 14.27 MPa and for a period of 7 days the value of fc = 15.85 MPa was obtained.

# 4. CONCLUSION

From the results of testing the results on fine aggregates carried out in this study were testing moisture content = 0.37%, sludge content = 1.01%, dark organic content, specific gravity = 2.58, absorption = 1.87%, analysis sieve = zone 4, and fine modulus of item 0.897. From the results of material testing that the characteristics of the aggregate are smooth, which contains high levels of sludge, organic content that exceeds the requirements, and very fine grains. Testing on coarse aggregates namely natural stone gravel test results moisture content = 0.71%, sludge content = 0.23%, specific gravity = 2.59, absorption = 1.97%, filter analysis obtained gradations = zone 3, fine modulus grain = 7.99, and wear testing = 36.62%. From the results of material testing that the characteristics of coarse aggregate are high sludge content, slippery surface, and many fragile aggregates. From the results of laboratory tests

carried out, the compressive strength of concrete obtained at the age of 3 days, obtained a value of fc = 14.27 MPa and for a period of 7 days the value of fc = 15.85 MPa was obtained.

## REFERENCES


[1] Anonymous, 1990, SNI 03-1974-1990. Metode Pengujian Kuat Tekan Beton.

[2] Anonymous, 200, SNI 03-2834-2000. Tata Cara Pembuatan Rencana Campuran Beton Normal.

[3] Anonymous, 2002, SNI 03-2491-2002. Metode Pengujian Kuat Tarik Belah Beton.

[4] Anonymous, 2008, SNI 2471-2008. Cara Uji Keausan agregat dengan mesin abrasi *los angeles*

[5] Dina Limbong Pamuttu and Hairulla, 2018. Coral Material Characteristics of Kampung Matara of Merauke District as a Concrete Coarse Aggregate, International Journal of Civil Engineering and Technology, 9(9), pp. 708–712.

[6] Herbin F. Betaubun and Philipus Betaubun, 2018. Evaluation of the Performance of Traffic Signs for Vehicle Speed Limits in Merauke District. International Journal of Civil Engineering and Technology, 9(8), pp. 568-573.

[7] Manalu F. Donny, 2016, *Kuat Tekan Kuat Tarik Belah Dan Modulus Elastisitas Beton Dengan Bahan Tambah Serat Mengkuang*, Skripsi, Universitas Bangka Belitung.

[8] Mulyono Tri, 2004, *Teknologi Beton*, Penerbit Andi, Surabaya.

[9] Mulyono Tri, 2004-2005, *Teknologi Beton*, Penerbit Andi, Yogyakarta

[10] Nugraha Paul, Antoni, 2007, *Teknologi Beton*, Penerbit Andi, Yogyakarta

[11] Rukhiat Komala, 2015, *Studi Eksperimen Pemanfaatan Limbah Batu Bata sebagai Pengganti Agregat Halus Terhadap Kuat Pada Benda Uji Silinder*, Skripsi, Universitas Musamus, Merauke.

[12] Ponraj Sankar L, Shanmugasundaram M, Karthiyaini S, Andal L, An Experimental Study on Compressive Strength of Fine Grinded Flyash Admixed Concrete, International Journal of Civil Engineering and Technology (IJCIET) 9(13), 2018, pp. 1138–1141.

[13] Samsudin Ali, 2011, *Analisis Kuat Tekan Dan Tarik Belah Beton Dengan Abu Tempurung Kelapa Sebagai Bahan Tambah*. Skripsi, Universitas Muhammadiyah, Surakarta.

[14] Sedayu, A. and S. Mangkoedihardjo. 2018. Performance Evaluation of Housing Contractor by Applying the Principles of Environmentally Friendly Infrastructure, International Journal of Civil Engineering and Technology, 9(4), 1014–1022.

[15] Suratno, 2015, *Studi Eksperimental Pemanfaatan Limbah Batu Bata Sebagai Pengganti Agregat Dalam Pembuatan Beton*, Skripsi, Universitas Musamus, Merauke.

[16] M.S. Vijaykumar and Dr. R. Saravanan. Analysis of Epoxy Nano Clay Composites Compressive Strength during Tropical Exposure Test. International Journal of Mechanical Engineering and Technology, 8(5), 2017, pp. 1101–1104.

[17] Tanditasik Griya Stanislaus Happy, 2015, *Studi Kuat Tekan Dan Tarik Belah Beton Menggunakan Limbah Ban (TIRE) Sebagai Agregat*, Skripsi, *Universitas Hasanuddin, Makassar*.