The effect of variations in stone ash on the compressive strength of concrete

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Abstract. To fulfill the development of construction technology needed construction materials obtained from the natural result of continuous retrieval. For that, it is necessary Other alternatives by utilizing waste materials. The purpose of this research is to know how strong the value of concrete press normal and concrete with the waste substitution of stone ash as a smooth aggregate with variations, 0% 25%, 50%, 75%, and 100% against the aggregate smooth and to know whether the waste material of DAP stone ash It is used as a material substitute for fine aggregate (sand) in concrete. This research uses experimental methods. The planning proportion of concrete mixture using SNI 03-2834-2000 procedures of making the normal concrete mixture plan. The strong testing of concrete press is each – each variation in stone ash by 0%, 25%, 50%, 75%, and 100% against fine aggregates. The strong result of the concrete press is obtained for strong concrete press normal amounting to 35.99 MPa. While the strong result of concrete press using 25% ash aggregate of stone obtained at 21.58 MPa, decreased by 14.41% of normal concrete press strength, using 50% of ash aggregate stone obtained at 20.10 MPa, decreased by 15.89% of strong concrete press normal, using 75% ash aggregate stone obtained at 16.62 MPa, experiencing a decrease of 19.37% from normal concrete press strength, using 100% ash aggregate stone obtained at 16.64 MPa, decreased by 19.35% da Strong normal concrete press.

1. Introduction
The science of construction technology is growing so rapidly to meet the needs of the building, facilities and human infrastructure. With the development of technology, science produces new more modern construction, to fulfill the development of this construction technology needed construction material obtained from nature, which can damage natural resources due to Continuous retrieval, so there needs to be another alternative by utilizing waste materials. Materials from buildings that are not worthy of function can be reutilized by mixing it with new material.

Stone Ash is the result of the processing of broken stones processing [1]. The ash of the rock is now a byproduct of the stone solving industry. Currently, the stone ash is not so sold out because of its use in the construction industry very little considering the use of sand as a smooth aggregate is still used for concrete mixtures. For that is done testing the normal concrete composition with a strong testing concrete press by using the ash stone as a substitute for sand for the concrete mixture.

Based on the background so that making the authors want to make a study of the stone ash to be a reference of the substitute fine aggregate on concrete reviewed from the strong value of concrete press that will be compared with the strong value of normal concrete press, as an alternative to the high price
of sand material in Merauke Regency because it must bring from outside the area. With the title of research "effect of ash stone as a substitute for smooth aggregate (sand) for strong concrete Press".

2. Methods
The location of this research was conducted in Musamus University Civil Engineering Laboratory. The material of gravel and sand used derived from outside materials, while the waste of stone ash used is derived from the destruction of Stone, Merauke regency.

In the implementation of the research "Overview of waste use of ash stone as a subtle aggregate against strong concrete press" is used the experimental method. Planning the proportion of concrete mixtures using SNI 03-2834 2000 procedures for making the normal concrete mixture plan [2].

The implementation of a strong test of concrete press each – each variation of stone ash towards smooth aggregate and normal concrete is carried out at the time of test objects aged 3 days, 7 days, 14 days and 28 days [3]. In this research, the test objects used are cylindrical diameter (Ø) = 15 cm, and height (t) = 30 cm. Based on SNI 2493:2011 concrete that wants to be tested used are 3 samples of concrete samples for each variation-each mix and age of concrete to be tested [4]. The number of foam test objects is seen in table 1.

| Day (Age) | Concrete normal | Variation of soil cement waste against fine aggregates |
|-----------|-----------------|------------------------------------------------------|
| 3         | 3               | 25% 3 3 3 3 3 3                                      |
| 7         | 3               | 50% 3 3 3 3 3 3                                      |
| 14        | 3               | 75% 3 3 3 3 3 3                                     |
| 28        | 3               | 100% 3 3 3 3 3                                      |
| Number of test items | 12 | 12 12 12 12 12                                      |
| total     |                 | 60                                                    |

3. Result and discussion

3.1. Mix design
The need for stone ash and fine aggregate for each variation based on the percentage of ash stone against the rough aggregate [5], can be seen in table 2:

| Percentage of Abu Batu | Aggregate (Kg) | Abu Batu |
|------------------------|----------------|----------|
| BN                     | 100%           | 0%       |
| 25%                    | 75%            | 25%      |
| 50%                    | 50%            | 50%      |
| 75%                    | 25%            | 75%      |
| 100%                   | 0%             | 100%     |

Testing of concrete compressive strength was carried out using the Electric Compression Machine 2000 KN [6]. From the results of concrete compressive strength test, the maximum load value for each specimen is obtained, then the concrete compressive strength is calculated using the equation:

\[ f'c = \frac{P}{A} \] (1)
Based on the calculation and testing of concrete compressive strength that has been carried out in the laboratory, the values of concrete compressive strength can be seen in table 4, table 5 and table 6.

**Table 3. Test results for concrete compressive strength**

| Code sample | Date Printed | Date Tested | Age (Day) | Large (cm²) | Press Strength (MPa) |
|-------------|--------------|-------------|-----------|-------------|----------------------|
| BN          | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 36.15                |
| 25%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 23.58                |
| 50%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 22.15                |
| 75%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 16.97                |
| 100%        | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 15.56                |

The strong result value of concrete press obtained according to table 3 can be depicted in the form of Chart in figure 1.

![Concrete press result graph 3 days to 28 days](image)

**Figure 1.** Concrete press result graph 3 days to 28 days

**Table 4. Test results for concrete compressive strength**

| Code sample | Date Printed | Date Tested | Age (Day) | Large (cm²) | Press Strength (MPa) |
|-------------|--------------|-------------|-----------|-------------|----------------------|
| BN          | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 37.71                |
| 25%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 20.60                |
| 50%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 18.86                |
| 75%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 17.69                |
| 100%        | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 15.08                |

The value of the concrete compressive strength obtained following the above table can also be illustrated in graphical form in figure 2.
Figure 2. Concrete press result graph 7 days to 28 days

### Table 5. Test results for concrete compressive strength

| Code sample | Date Printed | Date Tested | Age (Day) | Large (cm²) | Press Strength (MPa) |
|-------------|--------------|-------------|-----------|-------------|---------------------|
| BN          | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 35.14               |
| 25%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 20.58               |
| 50%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 19.28               |
| 75%         | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 15.21               |
| 100%        | 17/03/2019   | 14/04/2019  | 28        | 176.71      | 13.28               |

The compressive strength produced from the concrete obtained in the table above can also be explained in graphical form in figure 3.

Figure 3. Concrete Press Result 14 days to 28 days
The results of the concrete compressive strength obtained for normal concrete compressive strength were 35.99 MPa. While the results of concrete compressive strength using 25% aggregate Stone ash was obtained at 21.58 MPa, decreased by 14.41% from the compressive strength of normal concrete, using 50% aggregate Stone ash was obtained at 20.10 MPa, decreased by 15.89% from normal concrete compressive strength, using 75% aggregate Stone ash was obtained at 16.62 MPa, decreased by 19.37% from normal concrete compressive strength, using 100% aggregate Rock ash obtained at 16.64 MPa, decreased by 19.35% of normal concrete compressive strength.

Based on the test results of concrete compressive strength, the use of aggregate Rock ash with a content greater than 14.41% makes the decrease in concrete compressive strength greater than required.

4. Conclusions
The results of testing and discussion of concrete compressive strength using stone ash as fine aggregate, it can be concluded that the results of testing the concrete compressive strength obtained is the use of rock ash aggregate as a substitute for fine aggregate in concrete which causes concrete compressive strength to decrease from the normal concrete compressive strength. The results of the concrete compressive strength obtained for normal concrete compressive strength are 35.99 MPa. Whereas the results of concrete compressive strength using 25% aggregate Ash stone obtained at 21.58 MPa, decreased by 14.41% from the compressive strength of normal concrete, using 50% aggregate Stone ash obtained at 20.10 MPa, decreasing 15.89% from concrete normal. compressive strength, using 75% aggregate, stone ash was obtained at 16.62 MPa, down 19.37% from the compressive strength of normal concrete, using 100% aggregate, Stone ash was obtained at 16.64 MPa, decreasing by 19, 35% from normal concrete compressive strength.

References
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