Compressive Strength and Workability of Normal Concrete Mixed Beton Mix With and Without Water Reduction

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Abstract. The problems of uncontrolled water use in the application of additive use as an additive havebeen significant impact on the strength of concrete and the workability. This paper describes an experimental study of the use of additives, Beton mix, as additive to normal concrete with certain level. Specimens have been made without reduced of water and also by reduced of water. This study focuses on the workability and also the compressive strength of specimens. The results of the compressive strength test at 28 days, showed that the specimens without reduce of water increased for specimens with composition of Beton mix 0.15%, but the specimens that use less 0.15% showed decreased the strength of the concrete linearly. In additional, the slump also increased. In contrast to the specimens by reduced of water, a slump showed decreased with a maximum reduction limit of 20%, and the strength of concrete showed an increase of 5%.

Keywords: concrete, beton mix, slump, compressive strength

1. Introduction

Concrete material is the most widely used material by structural experts to use as building material.This is because the mixture of concrete material is easy to obtain naturally in many places. Furthermore, in terms of implementation of the construction is easy to create and implemented.The more intense the use of concrete materials, demanded to be better in terms of performance and cost, this is evidenced by the many studies conducted to determine the strength and weakness of concrete materials, particularly the main material compilers (cement, water, coarse and fine aggregate) as well as additives on the concrete.

Devo. J. S, (2015), admixture is used on concrete to change some properties of cement. This material refers to a substance added at the stage of the preparation or the mixing of the concrete. Nowadays, the use of Superplasticizer increases more than other chemical mixtures. The use of additives to improve the quality of concrete must consider the availability in the market, not all additives available on the market, such as Bengkalis, additive available there are two namely Sikacim and Betonmix that has a superplasticizer.

The use of additives already has rules written on the brochure, but not all consumers follow the rules, so this causes the problem of uncontrolled use of water on the implementation of the use of additives. Consequently, it has a significant impact on the strength of concrete and the workability. Therefore, in a experimental study of the use of additives, Beton mix, as a normal concrete forming material with a certain level, which is applied to the condition with and without reducing of water.

2. Materials and Methods

2.1 Materials

The concrete forming materials used in this study consist of Portland cement type I, coarse and fine aggregate from TanjungBalaiKarimun, water and additives of Beton Mix products. Specification of Beton Mix according to product rule that 1kg for 2-8 sack of cement (1 sack of cement = 50 kg). The

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use of Beton Mix in mixing process is by mixing the additive and water that used, then put into a mixture of cement, coarse and fine aggregate that has been mixed for ± 3 minutes.

The fine aggregate or sand used was an aggregate with a particle size of less than 4.75 mm but more than 75 µm (mesh size No. 200). The coarse aggregate used was an aggregate with a particle size of more than 4.75 mm but less than 40 mm. The material properties can be seen in Table 1.

Table 1. The results of coarse and fine aggregate properties

Characteristics	Coarse	Sand
Water absorption	0.38%	0.6 %
Specific gravity(SSD)	2.60	2.62
Weight volume	1544.37 kg/m^3	1668.86 kg/m^3
Water content	0.27 %	1.27 %
Organic content	Normal	Normal
Abrasion test	39%	-
Mud level	< 1%	< 3.5%
Fine modulus	7.173	2.943

Figure 1. Figure Beton *Mix*.

2.2. Methods

The planned concrete materials are fc' 20 MPa, 25 MPa, 30 MPa and 35 MPa with w/c plans respectively 0.55, 0.50, 0.45, 0.42. The use of Beton Mix additives of 0%, 0.15%, 0.25%, 0.50% and 0.75% of the weight of Portland cement without reducing of water. As a comparison, was prepared a sample of 1% of Beton Mix by water reduction 0%, 10%, 20% and 30% with strength plans 20 MPa. Testing of compressive strength was done at age 28 day by cylinder test object diameter 15 cm and height 30 cm accordance of SNI 03-1974-1990.The weight of concrete volume test was done simultaneously with concrete compressive strength test. The composition of the material used refers to the SNI 03-2834-2000 which was evaluated due to the use of the additive, the composition of the material when 0% of the additive of the aggregate conditions of the saturated surface dry (SSD) can be seen in Table 2. The level of Beton Mix was obtained by taking the percentage of additive to weight of cement according to the quality of the concrete, while the water reduction was obtained by taking the percentage of water reduction to the total of water requirement on the fc 20 MPa.

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Table 2. Proportion of 1 m^3 of concrete 0% additives with slump 10 ± 2 cm

Concrete compressive strength, fc' (MPa)	Cement (kg)	Sand (kg)	Coarse (kg)	Water (kg)
20	336.60	675.12	1174.52	185
25	370.00	653.04	1160.96	185
30	411.11	629.38	1143.50	185
35	440.00	612.00	1137.00	185

During the process of mixing in a concrete mixer it was observed that the level of workability of fresh concrete was expressed by slump. Slump testing was performed by using a device shaped cone with procedure referring to SNI 03-1972-1990.After obtaining the slump as planned, then further put fresh concrete into the cylinder mold as much as three layers up to full. Each layer was compacted by being impact on the outside of cylinder mold using a rubber hammer.The curing of the specimen started after the fresh concrete was put on the cylinder mold, i.e. by closing the surface of fresh concrete that was directly related to the environment using plastic to prevent excessive evaporation. After 24 hours the mold was opened, the next curingwas to put the sample into the water.The process of weight volume test and compressive strength of concrete was done in the MaterialsTestingof Laboratory, Civil Engineering Department PoliteknikNegeriBengkalisThe test was done after the concrete test sample reaches the determined age. The compressive strength of the concrete was obtained by the Compression Testing Machine (CTM).

3. Results and Discussion

3.1. Results

The slump was required to know the level of workability of concrete. The lower slump indicates that the concrete waslow level of workability. The slump test results can be seen in Figure 2 and Figure 3.

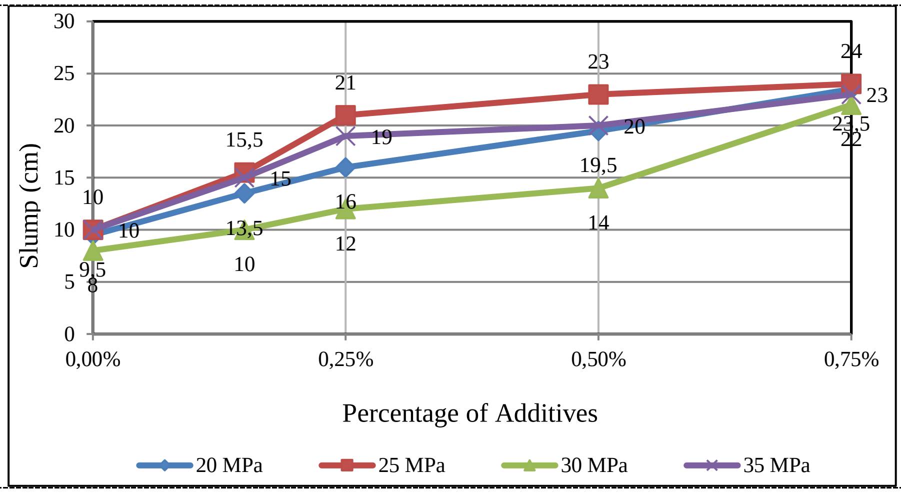

Figure 2. Figure The relation of slump to percentage of additives of concrete at various concrete strentgh

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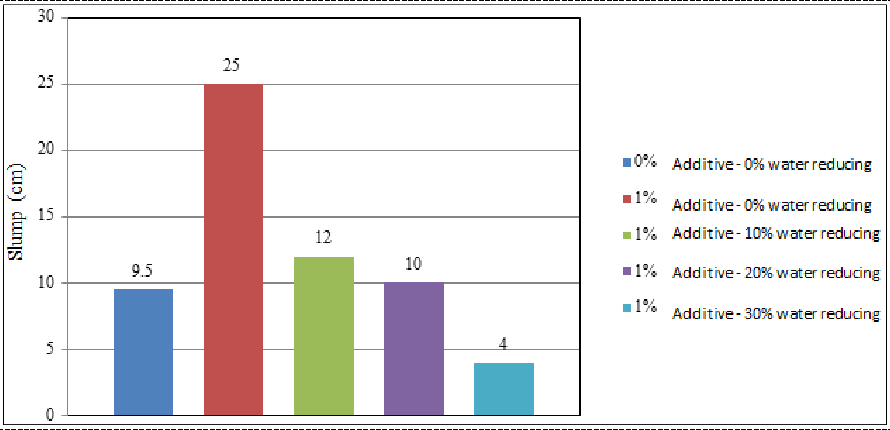

Figure 3. Figure The relation of slump to variation of water on the concrete strength fc'20 MPa

Figure 2 shows, the sample without water reduction, it was found that the higher percentage of Beton Mix used will increase the slump. This was seen in concrete without Beton Mix (0% additive) slump obtained by 8 cm to 10 cm. Furthermore, in sample with the additive percentage of 0.15%, 0.25%, 0.50% and 0.75% there was a rise in slump. This was different if the concrete was done in the sample with reduction ofwater, such as fc' 20 MPa with 1% Beton Mix addition decreased slump along with the water reduction percentage increase, as shown in Figure 3.The reduction of water can be done at a percentage of 20%. In contrast, on percentage 30% of water reduction the concrete will have low level of workability, where the slump obtained 4 cm.

Shah (2014), using the ASTM method, the addition of superplasticizer additives at 0%, 0.5%, 1.0%, 1.5% and 2.0% in fc'20 MPa, with target slump of 1cm to 3 cm, obtained slump of 2 cm, 10 cm, 17 cm, 22 cm, and 25 cm. The addition of superplasticizer additive can increase the slump. Similarly, Salahaldein (2015) adds additive brand Liboment-163 at 0%, 0.6%, 0.8%, 1.2%, 1.8% and 2.5% of fc' 30 MPa, with 6 cm target slump obtained each slump of 6.5 cm, 7 cm, 9.5 cm, 12.5 cm, 13 cm and 14 cm. The increase of concrete workability was due to the characteristic of the superplasticizerto push out the water that bound to the cement particle group, to produce viscosity of cement paste or fresh concrete to be lower[5].

3.2. Weight volume

The data of weight volume test for various additives of concrete to the strength of concrete was shown in Figure 4 and Figure 5.

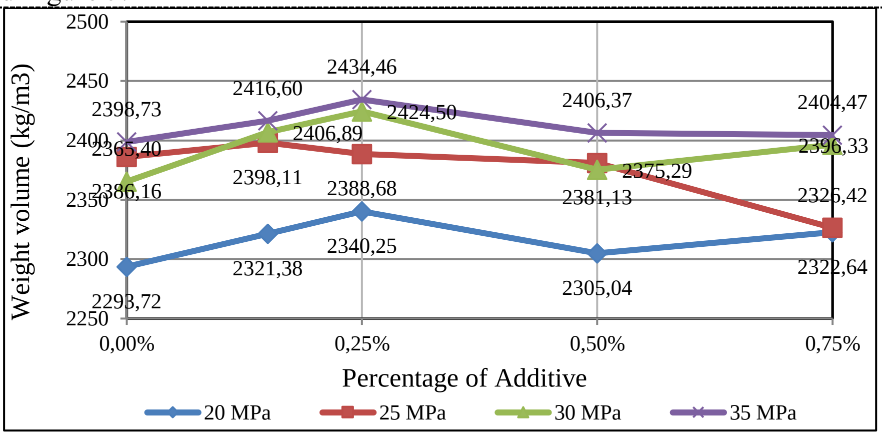

Figure 4. Figure The Relatition of weight volume to percentage of BetonMix on the various concrete strength

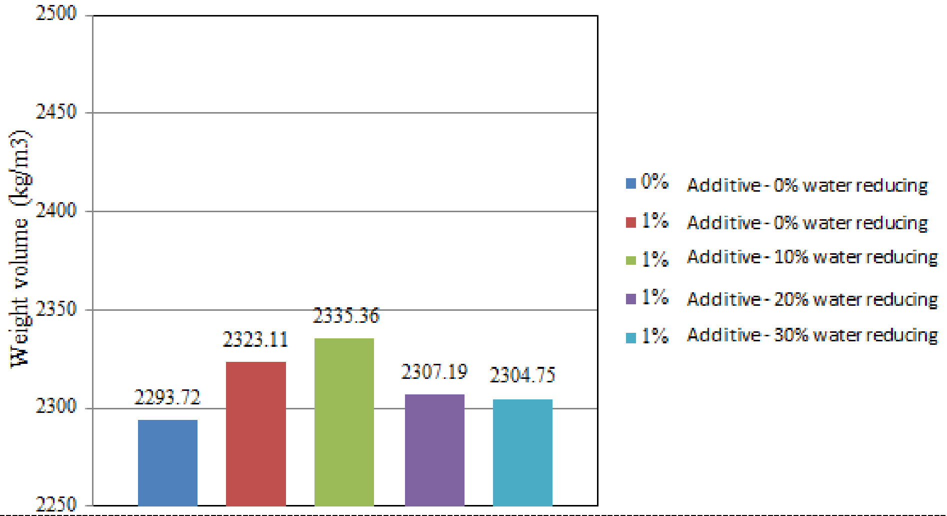

Figure 5. Figure Slump relation to water conditions on fc' 20 MPa

Figure 4 shows , the weight of concrete volume with additive of Beton Mix at certain percentage for various strength of concrete with or without water reduction was in the range 2293 - 2435 kg/m^3.For concrete with strength of 20 MPa, 30 MPa, and 35 MPa, maximum weight of volume occurred in addition of 0.25% additives, while for 25 MPa maximum weight content at additive of 0.15%. In concrete strength fc' 20 MPawith water reduction, the maximum of weight volume was on the percentage of additive 1% with a water reduction of 10%.

3.3. Compressive strength

The results of compressive strength at 28 days are shown in figure 6 and figure 7.

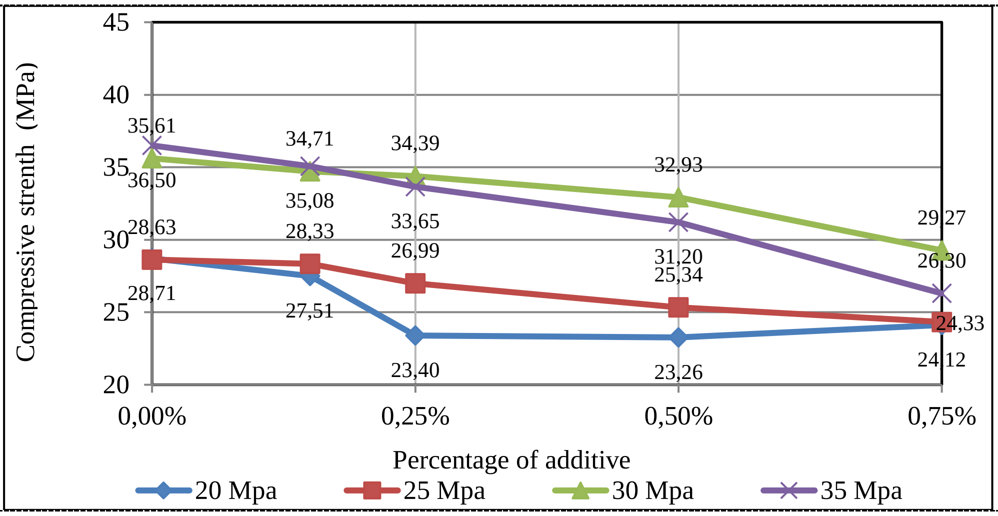

Figure 6. Figure the relation of compressive strength to the percentage of additives on various strength

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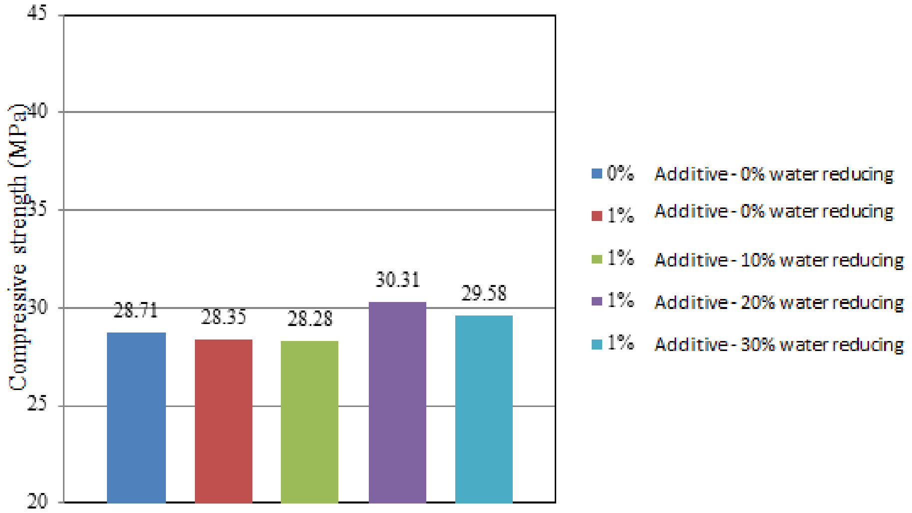

Figure 7. Figure the relation of compressive strength to the condition of water on the fc'20 MPa

Figure 6 shows that compressive strength of concrete with and without additive for sample without water reduction. The compressive strength of concrete has decreased as the percentage of additive of Beton mix was increased. This can be seen on the slope or gradient of the concrete curve containing the additive of the Beton Mix. For all concrete strength (20 MPa, 25 MPa, 30 MPa and 35 MPa) on additive of Beton Mix 0.15% decline below 5%. The decrease exceeds 15% occurs in over 0.15% use of Beton Mix for fc' 20 MPa, and 0.75% Beton mix for 25 MPa, 30 MPa and 35 MPa, therefore the use of concrete additive mix 0.75% without water reduction cannot fulfill the requirements of 0.85fc '.

Salahaldein, (2015) addition of Liboment-163 with percentage0%, 0.6%, 0.8%, 1.2%, 1.8% and 2.5% in fc' 30 MPa, a maximum increase of compressive strength occurs in the use of 0.8% of Liboment-163, whereas in the use of Liboment > 0.8% there was decreased in the strength of concrete.

Lateef, (2016), the use of the superplasticizer type ISOPLAS SP-530, with percentage 0%, 0.5%, 1%, 1.5% and 2% on the fc' 30 MPa, the test results show that the effect of adding additives to the concrete depends on the dose. Optimum compressive strength was generated at a percentage of 1.5% of ISOPLAS SP-530.

On the other hand, different results are shown in Figure 7, for samples with water reduction on the use of 1% Beton Mix for fc' 20 MPa. The decrease occurred in the water reduction of 10% by 1.52%, while in the water reduction of 20% and 30% there was a strength of concrete increase of 5.56% and 3.03% respectively. It can be concluded that 20% water reduction was very effective on 1% Beton Mix.

This was due to the reduction of water so that the water cement ratio which was the main factor determining the strength of the concrete can be minimized as small as possible, so that only water was needed for the cement hydration reaction used [5].

4. Conclusions

The slump of concrete has increased in the sample without water reduction for the use of BetonMix. These results are inversely to the use of Beton Mix by reducing of water, the slump obtained decreases, with a maximum reduction limit of 20%, where a reduction of 30% water reduction produces the fresh concrete with low workability levels.The use of Beton Mix on a normal concrete with a compressive strength at 28 days, without reducing of water shows that concrete strength decreased by <5% in Beton Mix 0.15%, but use of above 0.15% decreased concrete compressive strength linear, where a decreased> 15% occurs in use above 0.15% for fc' 20 MPa and 0.75% for fc' 25 MPa, 30 MPa and 35 MPa.

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