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The Use of Polymer Admixtures for Concrete Quality 45 Mpa Using the Combination of Bangkalan and Pandan Aggregate

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Abstract. Madura Island has natural resource potential, one of which is the result of mining excavations, including class C. Bangkalan Regency has aggregates that could be used in concrete mixtures, including fine aggregate (sand) and coarse aggregate (gravel). The compressive strength of concrete using Bangkalan aggregate, on the other hand, is just 20 MPa, or the regular concrete category. High quality concrete is one of the most frequently utilized building materials nowadays. Admixture is required to build high-strength concrete, particularly in Bangkalan Regency. In this research, a polymer admixture was used.

The goal of this study was to determine the proportion of polymer additives used in the concrete mixture when fine aggregate from Lumajang, coarse aggregate 10/20 from Bangkalan, and coarse aggregate 5/10 from Pandaan were used to achieve a concrete compressive strength of 45 MPa.Based on the findings of research on the usage of polymer type additives in concrete mixtures using fine aggregate from Lumajang, 10/20 coarse aggregate from Bangkalan, and 5/10 coarse aggregate from Pandaan, a concrete compressive strength of 0.95% Fc '45 Mpa was obtained from cement weight. At the design concrete quality of Fc '45 Mpa, the average compressive strength of concrete aged 28 days is 45.54 Mpa.

Keywords: High Quality Concrete, Compressive Strength, Polymer Additive.

1. Introduction

The use of concrete on the island of Madura is developing in line with the island's growth, although the coarse and fine aggregates required to make concrete are still predominantly imported from Java, owing to the poor quality of fine and coarse aggregates in Bangkalan Regency. According to the results of a concrete compressive strength test using coarse aggregate from Bangkalan Regency instead of coarse aggregate from Java Island, the maximum concrete compressive strength using coarse aggregate from Java reached 32 MPa, while coarse aggregate from Madura Island reached 28 Mpa. [1]

The study used coarse and fine aggregate from Bangkalan Regency for concrete mixtures with a cement water factor of 0.4, and the compressive strength of concrete reached 14.41 MPa, indicating that the compressive strength of concrete using aggregate from Bangkalan Regency does not reach normal concrete because the fine aggregate grains are too fine. [2] By combining fine aggregate in Bangkalan and Lumajang Regencies with a mixture variation of 10%-50% Lumajang sand and 50%-90% Bangkalan sand for normal concrete, the compressive strength of concrete is obtained with a composition of 10% Lumajang sand + 90% Bangkalan sand with a compressive strength of 21.567 Mpa and 20% Lumajang sand + 80% Bangkalan sand with a compressive strength of 24,120 Mpa. By using a composition of 10%-20% Lumajang sand and 80%-90% Bangkalan sand, it meets the predetermined compressive strength of 20 Mpa. [3]

By performing research on concrete utilizing a mixture of Bangkalan gravel and Lumajang sand against gravel and Bangkalan sand, the gradation or combination of 10/20 with 5/10 gravel from Bangkalan Regency and the use of sand from Lumajang Regency is projected to produce fc' 20 MPa quality concrete. Applying the second and third quartile statistical tests to assess quality management The study was conducted in the laboratory, using cylindrical specimens measuring 15 cm x 30 cm each and 30 variations for fc' 20 MPa quality concrete. Variation 1 combined the use of gravel sizes 5/10 and 10/20 with sand from Bangkalan, whereas variation 2 used Lumajang sand instead of Bangkalan sand. [4]

The results of statistical tests using the second quartile and third quartile tests of concrete using sand and gravel from Bangkalan did not meet the satisfactory concrete quality of 26.70 Mpa because the compressive strength of characteristic concrete only reached 15.62 Mpa. Meanwhile, concrete using sand from Lumajang and gravel from Bangkalan has a 23.79 Mpa. However, when viewed from the characteristic compressive strength of concrete using Lumajang sand and Bangkalan gravel, it has reached a quality of 20 Mpa. [4]

Research on the utilization of Bangkalan aggregate continues to be carried out, to increase the compressive strength of concrete using Bangkalan coarse aggregate and Lumajang fine aggregate, try to add additives type D (0.3%) and F (0.6%) from the weight of cement. The compressive strength of concrete produced for concrete using type D additives (0.3%) at the age of 28 days is 29.44 Mpa, using type F additives (0.6%) is 27.45 Mpa by using a variety of substances additive type D (0.3%) and type F (0.6%)

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of 25.53 Mpa. Thus, concrete using Bangkalan aggregate plus type D and F additives can achieve concrete with a quality of 25 Mpa. [5]

Concrete constructions for both buildings and roads are already made of high-quality concrete, as is the development of Madura Island, especially in Bangkalan Regency, which is the Surabaya-Bangkalan public access via the Suramadu bridge.

In this experiment, we will attempt to build concrete with a quality of 45 MPa by combining Bangkalan coarse material with Pandaan, fine aggregate from Lumajang, using polymer additives.

1.1. Concrete [6]

Concrete is a mixture of Portland cement or other hydraulic cement, fine aggregate, coarse aggregate, and water, with or without admixtures. While the advantages of concrete as a building material include: Concrete has a higher compressive strength than most other materials. 1)Reinforced concrete has a high resistance to fire and water, and is even the best structural material for buildings that come into contact with water a lot. In the event of a fire with an average intensity, the structural members with an adequate thickness of the concrete cover as a reinforcement protection only suffered damage to the surface without collapsing; 2) Reinforced concrete does not require high maintenance costs; 3) Concrete is usually the only economical material for footings, basement walls, and bridge piers; 4) One of the characteristics of concrete is its ability to be molded into various shapes, from simple slabs, beams, and columns to domed roofs and large shells;5) In most areas, concrete is made from inexpensive local materials (sand, gravel, and water) and requires relatively little cement and reinforcement steel, which may have to be imported from other areas.

The disadvantages of using concrete as a structural material are: 1) Concrete has a very low tensile strength, thus requiring the use of tensile reinforcement; 2) Reinforced concrete requires formwork to hold the concrete in place until the concrete hardens; 3) The low strength per unit weight of concrete results in heavy reinforced concrete. This will greatly affect the long span structure where the weight of the large concrete dead load will greatly affect the bending moment; 4) The low strength per unit volume causes the concrete to be relatively large, an important thing to consider for tall buildings and long span structures; 5) The properties of concrete vary widely due to the varying proportions of the mixture and its mixing. In addition, the pouring and curing of concrete cannot be handled as accurately as it is done in the production process of other materials such as steel and plywood.

At the 28 days, the concrete normally hardens and reaches the design strength (fc). Conventional concrete has a compressive strength of between 18 and 32 Mpa and a weight of 2.4 tons/m3, whereas High Performance Concrete has a compressive strength greater than 35 Mpa.

1.2. Concrete Compressive Strength [7]

The compressive strength of concrete depends on the water-cement factor. In addition, depending on the compaction during execution, the compressive strength of concrete fc' is determined from the difference in the standard cylinder (15 cm x 30 cm). Treated under standard laboratory conditions at a certain loading rate (as much as 6 - 4 kg/cm2 per second).

At the age of 28 days. In practice, there are three kinds of test specimens, namely cubes with a size of 100 x 100 mm, 150 x 150 mm, cylinders 150 x 300 mm, 100 x 200 mm. In British Standards it is permissible to use cylinders of 100 x 200 mm if the maximum diameter of the coarse aggregate is 20 mm. [8]

Table 1.
Compressive Strength of Concrete of Various Ages
Source: [7]

Concrete Age (Days)	3	7	14	21	28	90
Conventional Portland Cement	0,40	0,65	0,88	0,95	1	1,20
Portland Cement with high initial strength	0,55	0,75	0,90	0,95	1	1,15

Concrete strength can be determined by equation:

$$fc' = \frac{P}{A} \quad (1)$$

Where: fc' = Concrete compressed strength (MPa)

P = Maximum load (N)

A = Sample area (mm^2)

If the concrete production has a record of 30 consecutive test specimens corresponding to similar materials under predicted conditions, the standard deviation is computed using the formula:

The standard deviation is:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(fci - fcr)^2}{n-1}} \quad (2)$$

Where: S = Standard deviation (MPa)

fci = Concrete compressed strength (MPa)

fcr = Average Concrete compressed strength (MPa)

n = Number of samples

After the Standard Deviation is determined, the compressive strength as the basis for selecting the proportion of the concrete mixture must be taken as the largest value from equation 1 or equation 2 as follows: [9]

$$fcr' = fc' + 1{,}34\ S \quad (3)$$

$$fcr' = fc' + 2{,}33\ S - 3{,}5 \quad (4)$$

$$fcr' = 0{,}90\ fc' + 2{,}33\ Sr \quad (5)$$

Table 2. Modification Factors for standard deviation if the number of samples is less than 30
Source: [10]

Number of samples	Modification Factor for Standard Deviation
Less than 15 samples	Refers to Table 3
15 samples	1,16
20 samples	1,06
25 samples	1,03
30 samples	1

Table 3. The average compressive strength is necessary if data are not available to determine the standard deviation
Source: [10]

Required Compressive Strength fc' (MPa)	Average Required Compressive Strength fc' (MPa)
Less than 21 samples	fc' + 7
21 to 35 samples	fc' + 8,5
More than 35 samples	fc' + 10

Table 4. The average compressive strength is necessary when data are available to determine the standard deviation of the samples
Source: [10]

Required Compressive Strength (MPa)	Average Required Compressive Strength (MPa)
fc' ≤ 35	Choose greater value between equation (3) and (4)
fc' ≥ 35	Choose greater value between equation (4) and (5)

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1.3. Admixture [11]

An additive is a substance in the form of powder or liquid which is added to the concrete mixture during mixing, with the aim of changing the properties of the mixture or concrete (Specification for Additives for Concrete). Meanwhile, according to ACI (American Concrete Institute), added materials are materials other than water, aggregates, and hydraulic cement that are mixed in concrete or mortar and are added before or during mixing. Referring to the ASTM C494-82 classification, there are 7 types of admixtures as follows:

1) Type A: Water Reducer (WR) or plasticizer.
   Chemical additives to reduce the amount of water used. With the use of this material, a mixture with a lower water-cement factor is obtained at the same mortar viscosity value, or a thinner mortar viscosity is obtained at the same water-cement factor.
2) Type B: Retarder
   Chemicals to slow down the concrete bonding process If it takes a considerable time between mixing the concrete and pouring the mortar, this ingredient is required. Or when the distance between the place where the concrete is mixed and the place where the mixture is poured is relatively long.
3) Type C: Accelerator
   Chemicals used to accelerate the bonding and hardening of concrete. This substance is utilized for putting mortar beneath the water's surface or in concrete structures that require immediate hardening.
4) Type D: Water Reducer Retarder (WRR)
   Chemical additives have two purposes: It reduces water and slow down the bonding process.
5) Type E: Water Reducer Accelerator
   Chemical additives have two purposes: It reduces water and speed up the bonding process.
6) Type F: High Range Water Reducer (Superplasticizer)
   Chemicals that function to reduce water to 12% or even more.
7) Type G: High Range Water Reducer (HRWR)
   Chemical additives have a dual function, namely to reduce high amount of water and speed up the bonding and hardening process of concrete.

Because additional chemicals are frequently added to the concrete mixture in relatively tiny proportions in comparison to the major elements, the level of control must be higher than in regular concrete production. This is to prevent overdose, since excessive doses can lead to a decline in concrete performance and, in extreme cases, damage to the concrete.

1.4. Superplasticizer as Additive Polymer

Superplasticizer is an extremely powerful water-reducing additive. The usage of these additives results in a mixture with a lower water-cement factor at the same mortar viscosity value or a mixture with a thinner viscosity at the same water-cement factor, resulting in a higher compressive strength of the concrete. Superplasticizer also has a significant impact on this material's workability as a means of producing flowing concrete without segregation (bleeding), which commonly occurs in concrete with large amounts of water, making this material useful for molding concrete in difficult places such as on densely packed reinforcement bar. [11]

Superplasticizer doses typically vary from 1-3 liters per cubic meter of concrete to improve the workability of the concrete mix. The superplasticizer solution contains 40% active material. When using superplasticizer to lower the amount of water, the dose will be higher, ranging from 5 to 20 liters per cubic meter of concrete. [11]

A superplasticizer works by eliminating surface forces from cement particles, allowing them to spread out further and releasing water attached to groups of cement particles, resulting in a viscosity lower than that of cement paste or new concrete mix. The ability of fresh concrete to superplasticizer are: 1) Increase slump and workability; 2) Utilize less water; 3) Cutting down on the use of cement.

In general, the usage of superplasticizers is intended to achieve the following goals:

1) Obtaining a difficult-to-compact casting location with a vibrator because it can produce fresh concrete that flows better.
2) Produce high-quality concrete by minimizing water by ensuring that the water-cement factor, which is the primary determinant of concrete quality, can be decreased as much as possible, using only the water required for the cement hydration reaction.
3) Creating concrete with a lower permeability (more waterproof), lower water consumption, and the ability to disperse cement particles in fresh concrete mix can result in a higher density of concrete that would be more impermeable.
4) Creates concrete of equal quality with a reduced cement water factor, reducing the usage of cement; however, cement for this purpose is not used frequently since the minimum amount of cement necessary for particular concrete must be satisfied.

Meanwhile, the disadvantage of utilizing a superplasticizer is the relatively rapid loss of slump, which means that, while workability increases significantly, processing time decreases. The workability will be considerably lost one hour after the addition of the superplasticizer due to the rapid slump loss.

Slump loss is not the same as concrete setting time. Although it is commonly stated in the field that adding a superplasticizer can shorten the setting time, this is not the case due to the very rapid fall in slump value, both visually and in terms of workability. The character conveys the perception that the concrete has hardened, indicating that it has entered the setting time. [12]

1.5. High Strength Concrete

High-strength concrete is concrete that has a higher compressive strength than normal concrete. According to PD T-04-2004-C concerning Procedures for Making and Implementing High-strength Concrete, concrete that is classified as high-quality concrete has a compressive strength between 40 and 80 MPa. Concrete can be classified into three types based on its strength, namely1. normal quality concrete or normal strength concrete (NSC), namely concrete that has a strength of 200–500 kg/cm2.2. high-quality concrete or high-strength concrete (HSC), namely concrete that has a strength of 500-800 kg/cm2.3. Very high-quality concrete (VHSC), namely concrete with a strength of more than 800 kg/cm2.High-quality concrete can be used for precast and prestressed structures. In tall buildings, it will reduce the dead load. The weakness of high-quality concrete is that it is brittle. To produce high-quality concrete, suppliers must optimize three factors that influence concrete strength: cement paste, aggregate, and cement bond. For this reason, attention is needed on all aspects of production, namely material selection, mix design, handling, and pouring. Quality control is an essential part of the process and necessitates complete cooperation from suppliers, planners, and contractors. [13]

Table 5. Various Type of High Strength Concrete
Source: [13]

Type	Water-Cement Ratio	Compressive Strength 28 Days (MPa)	Note
Normal Consistency	0,30 - 0,40	35 - 80	Slump 50 -100 mm,
No - Slump	0,30 – 0,45	35 - 50	Slump < 25 mm
Low water-cement ratio	0,20 – 0,35	110 - 170	Admixture added
Compacted	0,05 – 0,30	70 – 240	Compressed > 70 MPa

2. Methods

This section begins with a review of research journals and literature. The research was conducted in the laboratory using experimental approaches. A sand and gravel material test were performed in the original deployment to verify that the material fulfilled the requirements for a concrete mixture. If the sand and gravel fulfill the requirements, the data is applied to calculate the concrete mix composition with fc' = 45 MPa. Horizontal lines should be placed above and below table headings, above the subheadings and at the end of the table above any notes. Vertical lines should be avoided. If a Table is too long to fit onto one page, the table number and headings should be repeated on the next page before the table is continued.

In the following stage, trial and error is evaluated to determine the percentage of polymer-type additives that will be used in a concrete mixture of fc '45 MPa using the slump flow method. Then, create a 15 cm x 30 cm concrete sample. Immersion is used to treat the test object. Concrete's compressive strength was evaluated at 7, 14, and 28 days of age. Figure 1 depicts the research workflow.

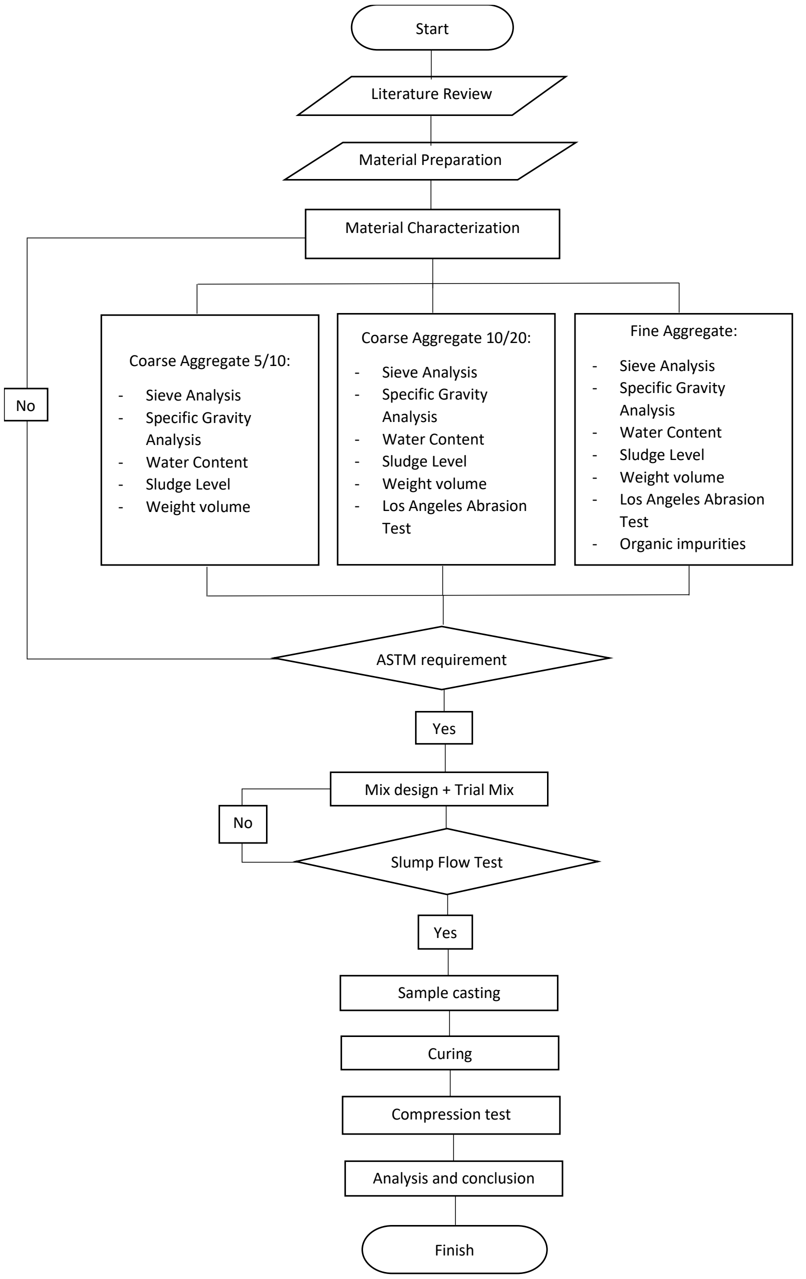

Fig. 1 Research Workflow

Literature Review: In this literature study, the researcher studied reference books and journals related to the research to be carried out.

Material Characterization: Fine and coarse aggregates that will be used for concrete mix are tested first to find out whether the aggregate meets the requirements for concrete mix. Aggregate test result data will be used for mix design analysis. Aggregate testing includes:

1. Aggregate moisture analysis based on (ASTM C 556 – 89)
2. Aggregate Specific Gravity Analysis, based on (ASTM C 127 – 93) [14]
3. Analysis of aggregate absorption water content, based on (ASTM C 127 – 93) [14]
4. Aggregate Volume Weight Analysis, based on (ASTM C 29 / C 29 M – 91) [15]
5. Analysis of Aggregate Cleanliness of Sludge by Washing, based on (ASTM C 117 – 95) [16]
6. Aggregate sieving analysis, based on (ASTM C 136 – 95A)

Mix Design + Mix Trial: Mix design analysis using steps in accordance with SNI 03--2000. used to obtain a concrete mix composition of 45 MPa quality.

Sample Casting: After the composition of the concrete mixture is obtained, the next step is to make cylindrical test objects measuring 15 cm by 30 cm, as many as nine in all. The next step is to do the casting, or the process of making concrete. The steps for making concrete are:1. Weigh the material according to the results of the mix design calculation.2. Prepare a cylindrical mold with a diameter of 15 cm and a height of 30 cm.3. Make concrete mixture.4. Put water and polycarboxylate into the mixer.5. After the mixing is complete, a slump flow test is carried out with the target of reaching a diameter of 60 + 5 cm.6. After the fresh concrete reaches the desired slump flow, it is poured into the mold.7. Leave the concrete mix in the mold for 24 hours.8. Removing formwork and curing concrete.

Curing: Following the implementation of the test object's manufacture, the concrete test object is treated to maintain a constant concrete temperature of 25 °C.

Compression Test: This test was carried out based on SNI 03-1974-1990. Samples will be made with cylinders measuring 15 cm x 30 cm. The purpose of this experiment is to determine the compressive strength of concrete.

Analysis and Conclusions: From the test results, further analysis was carried out, including:
1. Physical properties of the concrete mix material
2. Analysis of concrete mix design data (Mix Design)
3. Analysis of the compressive strength of concrete.
4. The results of the analysis of the compressive strength of concrete have been concluded.

3. Result And Discussion

3.1. Fine Aggregate Characterization

Table 6. Fine Aggregate analysis
(Source: *Laboratory Test,2022)*

No	Parameter	Lumajang Sand	Requirement	Grade	Standard
a	Water Content	1,50 %	1 - 5%	Pass	ASTM C 556 – 89
b	Specific Gravity	2,70 gr/cm³	1,60 – 3,30 gr/cm³	Pass	ASTM C 127 – 93 [14]
c	Absorption Level	2,36 %	Max. 5%	Pass	ASTM C 127 – 93 [14]
d	Volume weight (loose)	1,45 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 / C 29 M – 91
	Volume weight (compressed)	1,56 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 / C 29 M – 91
e	Sludge Level	2,5 %	Max. 5%	Pass	ASTM C 117 – 95
f	Organic Impurities	No.3	No.6	Pass	ASTM C 40 – 92 [17]
g	Sieve Analysis	Zone 2 (Fm = 2,37)	2,0 < Fm <3,1	Pass	ASTM C 136 – 95A (ASTM C 33) [18]

The fine aggregate testing results in a humidity of 1.50%, a specific gravity of 2.70 gr/cm³, absorption level of 2.36%, a loose volume weight of 1.45 kg/dm³, a compressed volume weight of 1.56 kg/dm³, sludge level of 2.5%, organic matter content according to no. 3, filter analysis entered Zone 2 with an Fm of 2.37.

3.2. Coarse Aggregate Characterization

Table 7. Bangkalan Coarse Aggregate analysis 10-20
(Source: *Laboratory Test,2022)*

No	Parameter	Bangkalan Coarse	Requirement	Grade	Standard
a	Water Content	1,95 %	1 - 5%	Pass	ASTM C 556 – 89
b	Specific Gravity	2,97 gr/cm³	1,60 – 3,30 gr/cm³	Pass	ASTM C 128 – 93 [19]
c	Absorption Level	1,06 %	Max 4%	Pass	ASTM C 128 – 93 [19]
d	Volume weight (loose)	1,32 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 /C 29 M – 91
	Volume weight (compressed)	1,54 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 /C 29 M – 91
e	Sludge Level	1,75 %	Max 5%	Pass	ASTM C 117 – 95
f	Sieve Analysis	Fm = 7,97	6,5 < Fm <8,0	Pass	ASTM C 33
g	Los Angeles Abrasion test	31,54 %	Max 40%	Pass	SNI 2417: 2008

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The water content is 1.95%, the specific gravity is 2.97 gr/cm3, the absorption level is 1.06%, the loose volume weight is 1.32 kg/dm3, the compressed volume weight is 1.54 kg/dm3, the sludge content is 1.75%, the filter analysis has Fm 7.97, and the wear rate is 31.54%, according to Table 6.

Table 8. Pandaan Coarse Aggregate analysis 5-10
(Source: *Laboratory Test,2022)*

No	Parameter	Pandaan Coarse	Requirement	Grade	Standard
a	Water Content	2,0 %	1 - 5%	Pass	ASTM C 556 – 89
b	Specific Gravity	2,63 gr/cm³	1,60 – 3,30 gr/cm³	Pass	ASTM C 128 – 93 [19]
c	Absorption Level	3,72 %	Max 4%	Pass	ASTM C 128 – 93 [19]
d	Volume weight (loose)	1,28 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 /C 29 M – 91
	Volume weight (compressed)	1,45 kg/dm³	0,4 - 1,9 kg/dm³	Pass	ASTM C 29 /C 29 M – 91
e	Sludge Level	2,35 %	Max 5%	Pass	ASTM C 117 – 95
f	Sieve Analysis	Fm = 5,99	4,0 < Fm < 6,0	Pass	ASTM C 33 [18]

From Table 7, the results of the Pandaan Coarse Aggregate analysis 5–10 above, it is known that the water content is 2.0%, specific gravity is 2.63 gr/cm3, absorption level is 3.72%, loose volume weight is 1.28 kg/dm3, compressed volume weight is 1.45 kg/dm3, sludge level is 2.35%, sieve analysis has Fm 5.99.

3.3. Mix Design fc'= 45 MPa (9 samples)

Tabel 9. Mix Composition Fc =45 Mpa
(Source: *Laboratory Test,2022)*

Material	Proportion	kg/m³	9 samples portion	Unit
Portland Cement	100%	472,22	27,53	kg
Water		177,85	10,37	lit
Fine Aggregate	28%	495,08	28,86	kg
Coarse Aggregate 10 -20	58%	1010,15	58,89	kg
Coarse Aggregate 5 – 10	14%	244,69	14,26	kg
Polymer ***Superplasticizer***	*x%*	*X*	*x*	lit

From Table 8, it is known that for the casting of 9 specimens of fc '45 Mpa concrete, the following amounts of material are needed, namely: cement as much as 27.53 kg; water as much as 10.37 liters; fine aggregate as much as 28.86 kg; coarse aggregate 10-20 as much as 58.89 kg; and coarse aggregate 5-10 as much as 14.26 kg.

3.4. With addition of Polymer fc'= 45 Mpa

The use of polymer type additives for 45 MPa quality concrete is by trial and error using the Slump test tool until it reaches a slump flow value of 60 + 5 cm. The percentage of use of polymer-type additives is based on the amount of cement used. The test results for the need for additives can be seen in Table 9.

Table 10. Slump flow analysis fc' 45 Mpa
(Source: *Laboratory Test,2022)*

No	Polymer *Superplasticizer proportion*	Mix design (lit/m3)	9 samples (lit)	*Slump Flow* (cm)
1	0,70 %	3,31	0,193	45
2	+ 0,15%	+ 0,71	0,041	55
3	+ 0,10%	+ 0,47	0,027	61
Σ	0,95%	4,49	0,261	

From Table 9, it is obtained that the slump flow value of 60 + 5 on the use of polymer-type additives is 0.95% of the cement weight.

3.5. Compression Test Analysis

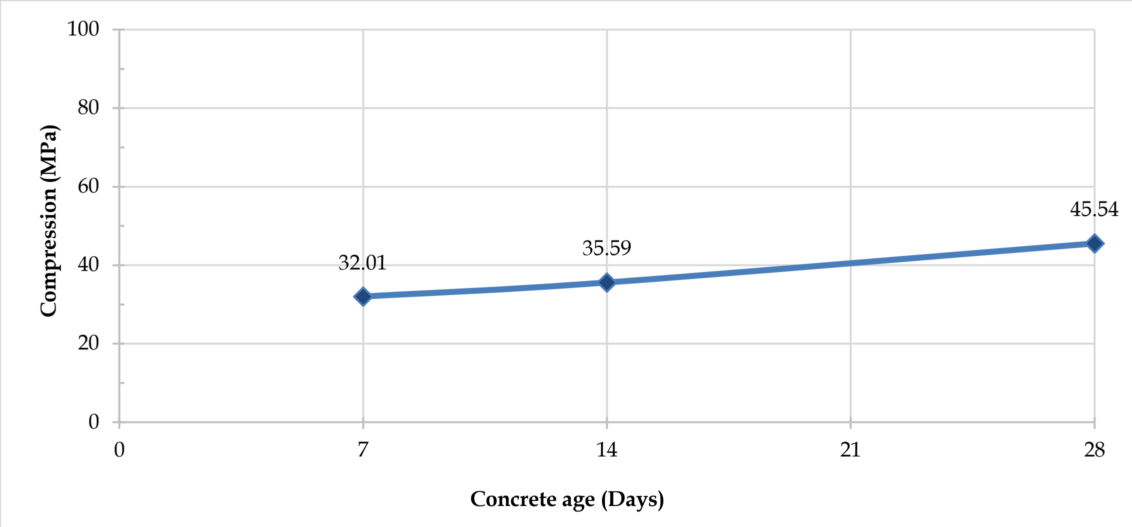

Figure 2. Compression Test

Figure 2 shows that the compression strength of concrete has increased at various ages. At the age of 7 days, the concrete reaches a compression strength of 70%, at the age of 14 days it is 78%, and at the age of 28 days it reaches 100% of the compression strength of the design concrete. The compression strength of concrete at the age of 28 days is 45.54 MPa, which is higher than the concrete compression strength of 45 MPa. Thus, concrete using a combination of coarse aggregate of 10–20 Bangkalan and 5–10 Pandaan coupled with polymer type additives is able to achieve the compression strength of the design concrete.

4. Conclusion

Based on the results of the study, it can be concluded as follows: 1. The composition of the use of polymer type additives in the concrete mixture using fine aggregate from Lumajang, 10/20 coarse aggregate from Bangkalan and 5/10 coarse aggregate from Pandaan in order to obtain the compressive strength of the concrete plan. The use of polymer superplasticizer is obtained for concrete quality for concrete quality, Fc 45 Mpa is 0.95% by weight of cement. 2. The average compressive strength of concrete seen at various ages is as follows: at 7 years old, 32.01 MPa, 14 days old, 35.59 MPa, and 28 days old, 45.54 MPa

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4.Chairman of the Institute for Research and Community Service Institut Teknologi Adhi Tama Surabaya

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