Tamcem 8R Normet Additive Addition in the use of Concrete Pumps

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Abstract— *The aim of the study was to determine the use of the Additive Normen Tamcem 8R on the compressive strength of concrete and to determine the percentage of the compressive strength of concrete in normal concrete and in concrete with the Additive Normen Tamcem 8R.*

This research was conducted from March to June 2020 at the Laboratory of the Faculty of Engineering, University of 17 August 1945 Samarinda.

The stages of the research are as follows: literature study, preparation, taking samples or test materials in the field, preparing for laboratory testing, making mix designs, making concrete mixes, slump testing, making test materials, treating test objects, compressive strength testing, analysis, and reporting.

The results showed that (1) the average compressive strength of normal concrete was 275.99 kg/cm2 and the compressive strength of mixed concrete was 285.80 kg/cm2 and (2) the percentage ratio of compressive strength of concrete under normal conditions and the use of additive norms Tamcem 8R 400 ml is as big as 1.76%.

Keywords— Additive Normet Tamcem 8R, Concrete Pump, Concrete Compressive Strength.

I. INTRODUCTION

Concrete is a construction that is very important and most dominantly used in building structures. Buildings are constructed using concrete as the main construction material, both buildings, water structures, transportation infrastructure buildings and other buildings.

Concrete is in great demand because it has many advantages compared to others. Concrete technological innovation is always required to develop in order to answer the challenges of concrete needs, the concrete produced should have good qualities such as strength and durability without neglecting economic value (Aman, et al. 2017).

The concrete material used in construction projects consists of fine aggregate, coarse aggregate, cement and water (Mulyono, 2003), these materials are mixed with a certain composition ratio to produce a certain concrete strength.

High rise building construction projects are growing. This development will surely be followed by the implementation of more sophisticated equipment technology which will certainly help the implementation run smoothly. Widely used tool in the current construction project is a concrete pump (Limanto, 2009).

A concrete pump is a casting aid in the form of a pump and pipe that is installed in a vertical and horizontal or oblique combination to pump and distribute concrete to the beams and plates to be cast. Concrete pump is and its function is commonly referred to as a concrete pump. Is one of the heavy equipment that can facilitate the construction process and make work more efficient.

For construction, the contractor chose to use a concrete pump in the casting process. This is due to the large area of the project and the timeframe for completion of the project. In foundry work such as buildings, bridges, ports and others, the use of tools

in one project has advantages and disadvantages. In addition, there are many considerations in choosing the casting equipment used, so that it is expected to get productivity that is in accordance with the best completion time and cost of implementation.

The casting process for these two tools also pays attention to the concrete slump value which is related to the workability of the concrete required. Therefore the contractor uses a different slump value when casting using a concrete pump. The difference in the slump value will affect the proportion of the concrete mix design, so that the costs and quality of the concrete material released are also different.

Along with the development of technology, now there are many admixtures that can improve the quality and workability of concrete. According to Mulyono (2003) there are several advantages of using additives, namely improving concrete workability, reducing hydration heat, reducing concrete work costs, increasing concrete durability, increasing concrete compressive strength, increasing concrete life, reducing shrinkage, making concrete more watertight, and porosity and water absorption in low concrete. Furthermore, Tjokodimuljo (1996) stated that the added material is given in relatively small amounts with strict supervision so that it is not excessive which results in worsening the properties of the concrete.

The availability of materials that must be maintained to meet a certain quality/quality of concrete, apart from that, readymix services usually use materials such as Additive Normen Tamcem 8R / additional superplasticizers in order to maintain the quality/quality of concrete to the field.

The aim of the study was to determine the use of the Additive Normen Tamcem 8R on the compressive strength of concrete and to determine the percentage of the compressive strength of concrete in normal concrete and in concrete with the Additive Normen Tamcem 8R.

II. RESEARCH METHODS

2.1 Time and Location

This research was conducted from March to June 2020 at the Laboratory of the Faculty of Engineering, University of 17 August 1945 Samarinda, which is located at Jalan Ir. H. Juanda, Samarinda Ilir District, Samarinda Municipality, East Kalimantan Province.

FIGURE 1. Research Locations

2.2 Materials and tools

The materials used are: Cement Gresik with type 1 based on SNI 15-2049-2004, Ex hammer sand fine aggregate, Coarse aggregate used in this study is ex hammer stone ½, PDAM water, capping, and Additive Normen TamCem 60 RW. The tools used are: oven, Compression Testing Machine, concrete mixer, electric stove, concrete cylinder capping, soaking tub, Cylinder Forming, Abrams Cone, and measuring cup.

2.3 Research Stages

The stages of the research are as follows: literature study, preparation, taking samples or test materials in the field, preparation for laboratory testing, making mix designs, making concrete mixes, slump testing, making test materials, treating test objects, compressive strength testing, analysis, and reporting.

2.4 Data collection

Primary data collection consists of: cement inspection (SNI 15-2530-1991), water examination (SNI 03-2834-2000), examination of fine aggregate and coarse aggregate such as aggregate gradation, bulk density, specific gravity, aggregate absorption, aggregate wear, special aggregate impurities for fine aggregates.

III. RESULTS AND DISCUSSION

3.1 Test Results for Mixed Concrete Materials

The results of examination of the materials in the manufacture of concrete mixtures, namely Gresik cement and PDAM water are presented in Table 1.

TABLE 1
RESULTS OF TESTING CHARACTERISTICS OF CONCRETE MIXTURES

No	Characteristics	Specification	Results	Note
1	Cement fineness	Maximum 22%	4%	Comply
2	Water	SNI 03-2834-2000		Comply

Source: Calculation Results

Based on the results of tests that have been carried out on cement and water, it shows that the two materials meet the specified Indonesian National Standard (SNI) specifications.

3.2 Results of Testing the Characteristics of Fine Aggregate (Palu Sand)

The results of inspection of fine aggregate material (Ex. Palu sand) are presented in Table 2.

TABLE 2
RESULTS OF TESTING CHARACTERISTICS OF FINE AGGREGATE (EX. PALU SAND)

No	Characteristics	Specification	Results	Note
1	Content Weight	Min. 1,3 g/cm3	1.488 g/cm3	Comply
2	Specific gravity	Min. 2,5	2.647	Comply
3	Absorption	0,2% - 2%	0,783%	Comply
4	Water content	Max. 6%	2.79%	Comply
5	Sludge levels	Max. 5%	3.33%	Comply

Source: Calculation Results

Based on the test results of fine aggregate Ex hammer sand presented in Table 2 shows that the material meets the specified Indonesian National Standard (SNI) specifications, so that Ex hammer sand is suitable for use as a concrete mixture.

3.3 Coarse Aggregate Characteristics Test Results (Palu Stone 1/2")

The results of inspection of the coarse aggregate material (Ex. Palu Stone 1/2") are presented in the table 3.

TABLE 3
COARSE AGGREGATE CHARACTERISTICS TEST RESULTS (EX. PALU STONE ½")

No	Characteristics	Specification	Results	Note
1	Content Weight	Min. 1,3 gram/cm3	1,483gr/cm3	Comply
2	Specific gravity	Min. 2,54	2693	Comply
3	Absorption	0,2% - 4%	12.06	Comply
4	Water content	Max. 1,3%	16.04	Comply
5	abrasion	≤ 40%	20,04%	Comply
6	Sludge levels	Max. 1%	16.47	Does not Comply

Source: Calculation Results

Based on the test results on coarse aggregate in the form of hammer stone presented in Table 3, it shows that the material meets the specified Indonesian National Standard (SNI) specifications, except for the silt content which exceeds the maximum limit of 1%, so that before use the coarse aggregate must be washed first.

3.4 Concrete Mix Design

The planning/design of the concrete mixture is made based on the SNI 03-2834-2000 method. In this research, the compressive strength of concrete is planned 250 kg/cm^2. From the results of planning the concrete mixture, the results for the composition of the concrete mixture are presented in Table 4.

TABLE 4
JOB MIX FORMULA

No.	Description	Tables/Graphs / calculation	Description
1	Required compressive strength.	Defined	25 N/mm^2 at 28 days defective part 5 persen
2	standard deviation.	Defined known or PBI	6 N/Mm^2 or without data N/Mm2
3	Value added (margin)	(k = 1,64)	
4	The average strength to be achieved	Calculation	1,64 x 6.0 = 9,8 N/Mm^2
5	cement type..	Defined	25 + 9,8 = 34,8 N/Mm^2 normal cement Tonasa
6	Aggregate type: 1. Sand	Natural	Fine Ex. Palu
	2. Split	Broken	Split Ex. Palu ½
7	Free water-semen factor	Table 5	0,5
		Chart 5	0,6
8	Maximum cement water factor..	Defined	Slump 100 s/d 120 mm
		or PBI	38 mm
9	S l u m p ..	Defined	
		or PBI	
10	Maximum aggregate size	Defined	150 = 68,3 = 218,3 Kg/Cm^2
11	Free water content..	or PBI	218,3 :0,50 = 437 Kg/Cm^2
12	Cement content	Tabel 5	430
13	Maximum cement content.	11 : 8/7	0,5
14	Minimum cement content	Defined	218,3 :0,50 = 437 Kg/Cm^2
15	Adjusted cement water factor.	Defined	Grain Arrangement Zone Area
16	The arrangement of the fine aggregate grains	11 : 14	No
17	Percent of material finer than 4,8 mm	Chart 2.2 s/d 2.5	30 % Ex. Palu Sand
		Chart 5.6/	70 % Split Ex. Palu
18	Rail aggregate specific gravity (surface dry) ..	Calculation	(30 % x 2,647) + (70 % x 2,745)
			2385 Kg/Cm^2
19	Specific gravity of concrete	Chart 5 . 5	2385 – 218 - 437 = 1730,01 Kg/Cm^2
20	Combined aggregate content..	19 - 12 - 11	30 % x 1730.01 = 519,00 Kg/Cm^2
21	Fine aggregate content	Calculation	70 % x 1730.01 = 1211,01 Kg/Cm^2
22	Coarse aggregate content 1- 2		

Source: Calculation Results

Furthermore, the need for mixed materials for 1 cylinder, 3 cylinders and 60 cylinders is presented in the table 5

TABLE 5
NEEDS MIXED MATERIALS FOR 1, 3, AND 60 CYLINDER

Tancem Variation	Material Requirements for Each Variation for 1 Cylinder			
	Cement (kg)	Water (kg)	Stone ½" (kg)	Sand (kg)
0	3,066	1,500	8,566	3,783
14 cc / ml	3,066	1,500	8,566	3,783
Variasi Tancem	**Material Requirements for Each Variation for 3 Cylinder**			
	Cement (kg)	Water (kg)	Stone ½" (kg)	Sand (kg)
0	9,177	4,462	25,663	11,349
40 cc / ml	9,177	4,462	25,663	11,349
	Material Requirements for Each Variation for 60 Cylinder			
	Cement (kg)	Water (kg)	Stone ½" (kg)	Sand (kg)
0	184,000	90,000	227,00	514,000
400 cc / ml	184,000	90,000	227,000	514,000

Source: Calculation Results

3.5 Making Test Differences and Test Slumps and Treatment of Test Differences

After the design of the concrete mix has been made, then the test object is made in the form of a cylinder measuring 15 cm x 30 cm based on the design. In this study, the planned slump was (10 ± 2) mm, using a cement water factor (fas) = 0.47. The results of the slump value test can be seen in the following table: The results of the slump test and concrete specific gravity are presented in Table 6.

TABLE 6
CONCRETE TEST RESULTS AND SLUMP TEST VALUES

No	Variation	Slump (cm)					Average
		3 days	7 days	14 days	21 days	28 days	
1	0	8	9	10	11	13	10
2	80 cc / ml	10	11	8	10	8	9

In this study, the curing of the test specimens was carried out by immersion, the concrete curing aims to ensure the cement hydration process can take place perfectly, so that cracks on the concrete surface can be avoided and the desired concrete quality can be achieved. In addition, the humidity of the concrete surface can also increase the resistance of concrete to weather influences and is more watertight. Treatment (curing) is carried out after the concrete is 1 day old until the day before the compressive strength test is carried out.

3.6 Concrete Compressive Strength Test Results

The compressive strength test of concrete is carried out at the age of the concrete in accordance with predetermined days. The results of testing the compressive strength of concrete under normal conditions and the compressive strength of concrete with the addition of the tancem additive of 40 cc are presented in Tables 7 and 8.

TABLE 7
DATA ON NORMAL CONCRETE COMPRESSIVE STRENGTH TEST RESULTS

No	Normal concrete manufacture date	Normal concrete inspection date	Strength Press	Amount Overall compressive strength Strength (kg/cm2)	*f'c* (MPa)
1	01 June 2021	4 June 2021**(date changed)**	101.345	305.255	25.336
2	01 June 2021	4 June 2021	95.683	288.202	23.921
3	01 June 2021	4 June 2021	107.006	322.308	26.752
4	01 June 2021	4 June 2021	101.345	305.255	25.336
5	01 June 2021	4 June 2021	95.683	288.202	23.921
6	01 June 2021	4 June 2021	107.006	322.308	26.752
7	02 June 2021	9 June 2021	137.297	254.488	21.123
8	02 June 2021	9 June 2021	131.522	243.784	20.234
9	02 June 2021	9 June 2021	143.071	265.193	22.011
10	02 June 2021	9 June 2021	137.297	254.488	21.123
11	02 June 2021	9 June 2021	148.846	275.897	22.899
12	02 June 2021	9 June 2021	160.396	297.306	24.676
13	03 June 2021	17 June 2021	189.271	259.133	21.508
14	03 June 2021	17 June 2021	189.271	259.133	21.508
15	03 June 2021	17 June 2021	195.046	267.040	22.164
16	03 June 2021	17 June 2021	200.821	274.947	22.821
17	03 June 2021	17 June 2021	200.821	274.947	22.821
18	03 June 2021	17 June 2021	183.496	251.227	20.852
19	04 June 2021	25 June 2021	218.146	276.659	22.963
20	04 June 2021	25 June 2021	212.371	269.335	22.355
21	04 June 2021	25 June 2021	212.371	269.335	22.355
22	04 June 2021	25 June 2021	218.146	276.659	22.963
23	04 June 2021	25 June 2021	212.371	269.335	22.355
24	04 June 2021	25 June 2021	218.146	276.659	22.963
25	05 June 2021	3 July 2021	218.146	262.826	21.815
26	05 June 2021	3 July 2021	223.921	269.784	22.392
27	05 June 2021	3 July 2021	229.696	276.742	22.970
28	05 June 2021	3 July 2021	218.146	262.826	21.815
29	05 June 2021	3 July 2021	229.696	276.742	22.970
30	05 June 2021	3 July 2021	235.471	283.700	23.547
Amount / Average				275.99	22.90

Source: Calculation Results

TABLE 8
COMPRESSIVE STRENGTH TEST RESULT DATA WITH ADDITION ADDITIVE NORMET TANCEM 8R

No	Concrete Manufacturing Date	Concrete Inspection Date	Strength Press	Amount Overall compressive strength Strength (kg/cm2)	f'c (MPa)
1	05 June 2021	08 June 2021	112.668	339.362	28.167
2	05 June 2021	08 June 2021	112.668	339.362	28.167
3	05 June 2021	08 June 2021	107.006	322.308	26.752
4	05 June 2021	08 June 2021	101.345	305.255	25.336
5	05 June 2021	08 June 2021	95.683	288.202	23.921
6	05 June 2021	08 June 2021	107.006	322.308	26.752
7	06 June 2021	13 June 2021	148.846	275.897	22.899
8	06 June 2021	13 June 2021	148.846	275.897	22.899
9	06 June 2021	13 June 2021	154.621	286.601	23.788
10	06 June 2021	13 June 2021	154.621	286.601	23.788
11	06 June 2021	13 June 2021	148.846	275.897	22.899
12	06 June 2021	13 June 2021	160.396	297.306	24.676
13	07 June 2021	21 June 2021	200.821	274.947	22.821
14	07 June 2021	21 June 2021	200.821	274.947	22.821
15	07 June 2021	21 June 2021	206.596	282.853	23.477
16	07 June 2021	21 June 2021	212.371	290.760	24.133
17	07 June 2021	21 June 2021	200.821	274.947	22.821
18	07 June 2021	21 June 2021	206.596	282.853	23.477
19	08 June 2021	29 June 2021	218.146	276.659	22.963
20	08 June 2021	29 June 2021	212.371	269.335	22.355
21	08 June 2021	29 June 2021	212.371	269.335	22.355
22	08 June 2021	29 June 2021	218.146	276.659	22.963
23	08 Juni 2021	29 June 2021	212.371	269.335	22.355
24	08 June 2021	29 June 2021	218.146	276.659	22.963
25	09 June 2021	07 July 2021	218.146	262.826	21.815
26	09 June 2021	07 July 2021	223.921	269.784	22.392
27	09 June 2021	07 July 2021	229.696	276.742	22.970
28	09 June 2021	07 July 2021	223.921	269.784	22.392
29	09 June 2021	07 July 2021	229.696	276.742	22.970
30	09 June 2021	07 July 2021	235.471	283.700	23.547
Amount / Average				285.80	23.721

Source: Calculation Results

In this study the quality of the design concrete is k-250 kg/cm^2 or equivalent to *f'c* 20,75 MPa. The results of the concrete compressive strength test are collected and arranged in sequence, the compressive strength of concrete is considered eligible if the following two things are met: (1) there is no compressive strength value (the average of the compressive strength of 2 cylinders) which is smaller than f'c - 3.5 MPa. (SNI 2847 Chapter 7.6.3.3) and (2) there is no average compressive strength value of 3 consecutive compressive tests which is less than f'c. The results of the concrete compressive strength test measurements both under normal conditions and with the addition of the Additive Normet Tancem 8R are presented in Table 9. The comparison of normal concrete compressive strength and additive concrete strength is 49.12% : 50.88%, the difference is F'c= 0.82 Mpa or 1.76%

TABLE 9
COMPRESSIVE STRENGTH TEST REQUIREMENTS FULFILLED

No	Concrete Type	Average Concrete Compressive Strength (Mpa)					Average	SNI requirements (chapter 7.6.3.3	
		3 Hari	7 Hari	14 Hari	21 hari	28 Hari		(1)	(2)
1	Normal Concrete	25.34	22.01	21.95	22.66	22.59	22.9	17,25 (Fulfill)	20,75 (Fulfill)
2	Concrete with additives	26.52	23.49	23.26	22.66	22.68	23.72	17,25 (Fulfill)	20,75 (Fulfill)

Source: Calculation Results

Based on the measurement results of the concrete compressive strength test, it shows that in normal concrete it produces an average concrete compressive strength of 22.90 kg/cm^2 and in concrete with the addition of Additive Normet Tancem 8R it produces an average concrete compressive strength of 23,72 kg/cm^2. The two concrete teapot strengths meet the requirements of SNI article 7.6.3.3. Based on the data above, it shows that the use of Additive Normet Tancem 8R can increase the compressive strength of concrete. The results of this study are in line with those reported by Dony (2018), namely the compressive strength of concrete at 28 days of age tends to increase with the addition of 0.1% Tamcem 60 RA of +10.73%, 0.3% Tamcem 60 RA of +9.02 %, and 0.5% Tamcem 60 RA of +4.44%, the addition of 0.7% Tamcem 60 RA decreased the compressive strength of up to 26.60% compared to normal concrete. Judging from the slump value, the higher the percentage of Tamcem 60 RA, the higher the slump value obtained. Mulyono (2003) explained that the use of additives can improve concrete workability, reduce concrete hydration heat, reduce concrete work costs, increase resistance to sulfate attack, increase concrete age, and reduce shrinkage. Added material (Admixture) is a material or material other than water, cement and aggregate added to the concrete during mixing. Admixture is used to modify the properties and characteristics of concrete.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

Based on the test results on normal concrete with a total of 60 cylinders measuring 15 cm x 30 cm, with a design compressive strength of k-250 kg/cm^2 or the equivalent of f'c 20.75 MPa, it is concluded that:

1. The percentage of concrete compressive strength in normal conditions and the use of Additive Normet Tamcem 8R 400 ml is 1.76%.
2. The average compressive strength of normal concrete is 275.99 kg/cm^2 and the compressive strength of mixed concrete is 285.80 kg/cm^2.

4.2 Suggestion

1. In the process of making concrete mixes, especially when mixing, the concrete ingredients must be thoroughly mixed so that the resulting concrete is of high quality.
2. We recommend that the concrete curing process should be checked every day, especially the immersion part, because water can affect the compressive strength of concrete if the water is contaminated with other substances.
3. Further research is needed regarding the compressive strength of concrete by using a normet additive before making a test object.

4. Accuracy is needed in selecting and analyzing samples before being applied to the field.
5. It is recommended not to use manual mixing to avoid an uneven or inhomogeneous mixture that can affect the compressive strength of the concrete.

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