STUDY OF UTILIZATION WASTE LATHE ON INCREASING COMPRESSIVE STRENGTH AND TENSILE STRENGTH CONCRETE

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ABSTRACT

Concrete is a building material that is widely used as a structural material, because the material is easy to obtain, the composition of the mixture can be easily adapted to the needs and desired quality, relatively easy to implement and does not require ongoing treatment after the concrete hardens. In terms of strength, compressive strength of concrete has a fairly large, but very low tensile strength of concrete. Provision allowing the concrete to steel reinforcement increases the tensile stress. Along with the development of technology, the research conducted to improve the properties of concrete, among others, with the addition of fiber. Several studies have shown that the addition of steel fibers in concrete can improve the properties of concrete. The addition of fibers to concrete, mortar and cement paste can raise concrete structural properties such as plasticity, flexural strength and resistance to fracture, shock forces, heat and expansion. The properties of concrete are affected by time as creep, shrinkage and durability will also be influenced by the addition of fiber. The degree of increase in these properties will be affected by the type, size, shape, concentration and fiber aspect ratio (Sudarmoko, 1993). The purpose of research is to analyze and assess the increase in compressive strength of concrete between normal concrete with the addition of waste concrete given lathe. The research method is eksperimetal study, the conduct of research by making the specimen normal concrete and concrete with mixed waste lathe with variation 0.5%, 1% and 2%. The results showed for the compressive strength test on day 28 obtained the following results: normal concrete 296.354 kg/cm^2, the addition of 0.5% waste lathe is 309.825 kg/cm^2, the addition of 1.0% waste lathe is 321.371 kg/cm^2 and the addition of 2.0% waste lathe is 354.086 kg/cm^2. And for tensile strength test on day 28 obtained the following results: normal concrete: 93.660 kg/cm^2, the addition of 0.5% waste lathe is 95 170 kg/cm2, the addition of 1.0% waste lathe is 110. 277 kg/cm^2 and the addition of waste lathe 2.0% is 125.383 kg/cm^2.

Keywords: waste lathe, compressive strength, tensile strength, normal concrete

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1. INTRODUCTION

The basic idea to provide additional fiber reinforcement in concrete with steel fibers are distributed evenly into the concrete so as to prevent the occurrence of cracks in concrete is too early, either due to heat of hydration or due to loading (Soroushian and Bayasi, 1987) in Sudarmoko (1993), which is expected to increase ductility, tensile strength, flexural strength, abrasion resistance, resistance to shrinkage, fatigue and flaking. Waste lathe generated in the form of shavings from the automotive industry has the potential to be used as fibers in concrete, steel shavings waste has a low price so that when used as fibers in concrete can reduce the price of an expensive fiber concrete. According to Hendra (2006), compressive strength and tensile strength fiber concrete fiber shavings that use iron as a substitute for coarse aggregate in concrete with a certain mixture composition has a value greater than the normal concrete with improvement of 31.23% and 49.37%. Mortar flexural strength of fiber metal shavings with 50% fiber composition variation on the standard test specimen beam flexural strength of normal concrete boost by 93%. Seeing this fact further research on the reuse of waste in the form of shavings steel lathe as fibers in concrete or mortar especially for concrete construction applications.

2. RESEARCH OBJECTIVES

The objectives of this research are as follows:

1. Analyze the effect of the addition of waste lathe on the concrete.
2. Assessing the strength of concrete increased between normal concrete with the addition waste lathe on concrete.

3. REVIEW LITERATURE

3.1. Aggregate

Aggregate largely determines the quality of the concrete strength. Aggregate in concrete serve as fillers and reinforcing concrete and affect the durability and compactness of the structure. Assessment of, among others, the aggregate size, gradation, cleanliness, hardness, smoothness, grain shape and surface texture. Hygiene can affect the strength of concrete aggregate. Aggregate should not contain ingredients such as clay, silt, coal, plastic, wood fragments, organic matter and organic salts. Stronger bond generated when the surface area of the vast and heterogeneous material. General classification in terms of shape and size of the aggregates. Natural aggregates, while a round-shaped crushed stone aggregate sharp and pointy. Based on aggregate grain size can be distinguished on the coarse aggregate and fine aggregate

3.1.1. Coarse aggregate

Coarse aggregate used in this study was stone broke. Where crushed stone obtained from stone milled with a stone crusher. With a rough surface, crushed stone ensure a solid bond with the cement paste. Aggregate of stone crusher machine is good for concrete because of gradation and size can be planned wearer.

3.1.2. Fine aggregate

Fine aggregate used in this study is is sand.

3.2. Cement

Cement is an adhesive material in the concrete mix, because it has the properties of adhesion and cohesion that can bind the material items into a single unit. Raw materials of cement are limestone, clay, silica sand, iron sand and gypsum. Cement is the result of a very complex industry, with mixed and varying composition, cement divided into two groups, namely non-hydraulic cement and hydraulic cement (natural cement, portland cement, hydraulic lime, pozollan cement, white cement, alumina cement and slag cement). Portland cement is a construction material most widely used in concrete work. According to ASTM C-150 1985, portland cement is defined as a hydraulic cement produced by grinding clinker consisting of hydraulic calcium silicates, which generally consist of one or more forms of calcium sulfate as an additive are ground together with its main ingredient.

3.3. Testing Test Objects

3.3.1. Compressive strength testing

Loading on uniaxial compressive strength testing including the type of loading static, monotonic (relatively constant load, is not too varied) by using a multi-purpose testing machine (Universal Testing Machine). Compressive strength testing using standard ASTM C 39-94 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen. The work load will be distributed continuously through the cross section along the axis of gravity longitudinal with a voltage of:

$$fc = \frac{\text{P}}{\text{A}} \tag{1}$$

Where : fc = cylinder compressive strength of concrete [MPa]
P = maximum compressive load [N]
A = cross-sectional area of objects [mm]

Objects cylindrical compressive strength test with size d = 150 mm and t =300 mm. To control the quality of concrete is achieved, it can be testing at age: 28 days with the use of crushed concrete comcompressiveion test tool. Comparison of the compressive strength of concrete at various ages by using cement to concrete aged 28 days.

3.3.2. Tensile strength testing

Loading on tensile strength testing sides including the type of loading static, monotonic (relatively constant load, is not too varied) using the multi-purpose testing machine (Universal Testing Machine). Tensile strength testing using standard ASTM C 39-94 "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens". The work load will be distributed continuously through the cross section along the axis of gravity longitudinal with a tensile of:

$$\text{Tensile strength} = \frac{2\text{P}}{\text{LD}} \tag{2}$$

wherea: P = Maksimum load [kg]

L = High cross-section specimen (cm^2)

D = Cross-sectional diameter of objects [mm]

4. RESEARCH METHODOLOGY

4.1. Flowchart of study

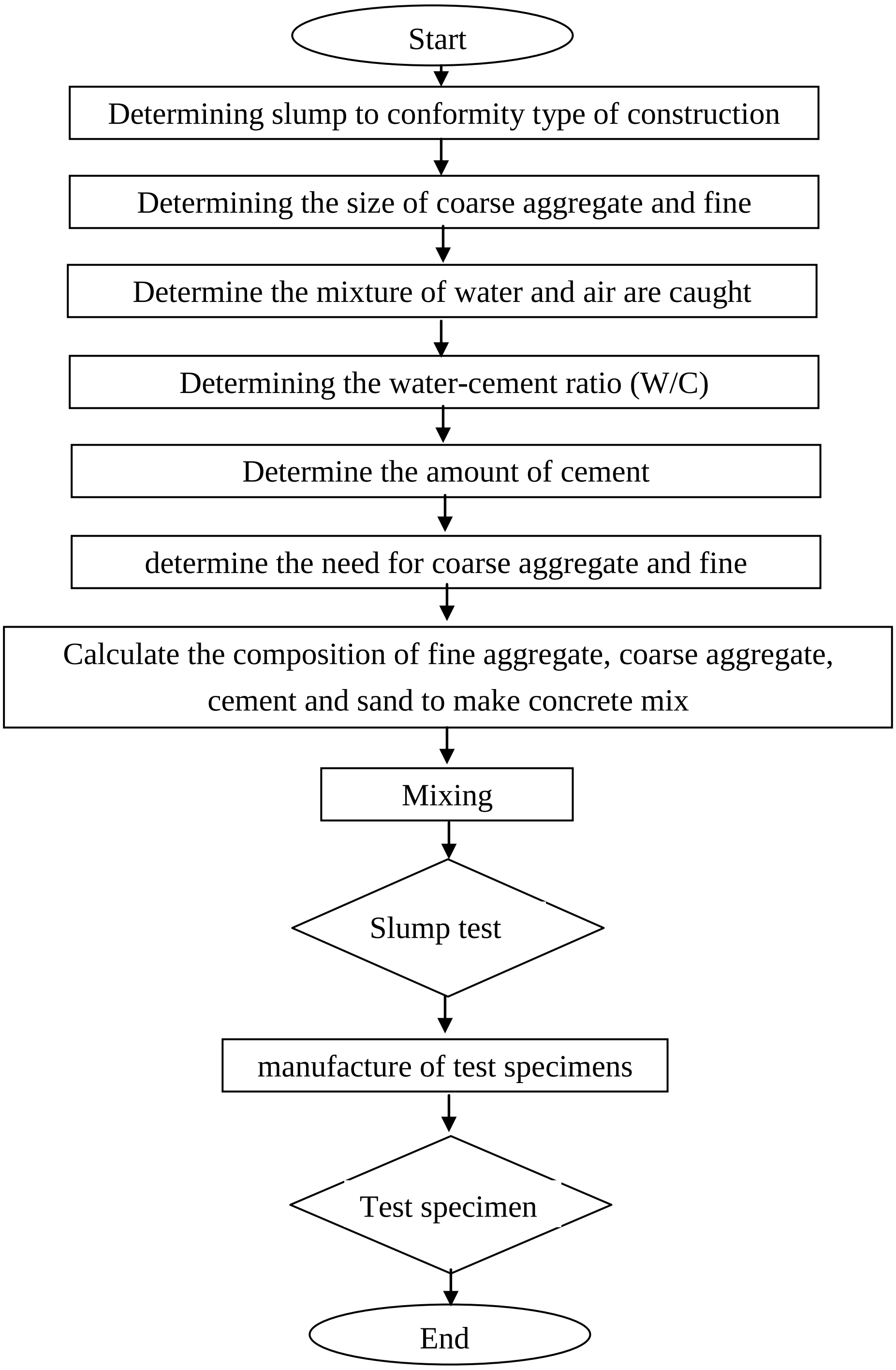

Figure 1. Flowchart of study

4.2. Calculation Methods ACI Concrete Mixture

For the manufacture of concrete samples in the laboratorium, mortar depends on the capacity of the cylinder

$$\text{Volume 1 cylinder} = \tfrac{1}{4}.\pi.d^2.t = \tfrac{1}{4}.*3.14*(0,15)^2*(0,3) = 0.0052988 \text{ m3}$$

Given the capacity of the concrete mixer maximum ± 10 cylinders then the stirring is done with the assumption: Concrete normal total of 18 specimens (stirring I were 9 specimen and stirring II were 9 specimens too). Likewise, the addition of steel fiber concrete with 0.5%, 1% and 2%.

4.2.1 For normal concrete

Volume 9 cylinder = 9 * 0.0052988 = 0.0476892 m^3 taken of factors cylinders = 1.2

So the weight of the concrete elements are:

- Cement = (378.95 x 0.0476892) x 1.2 = 21.686 kg
- Water = (179.153 x 0.0476892) x 1.2 = 10.252 kg
- Course aggregate = (1109.487 x 0.0476892) x 1.2 = 63.493 kg
- Fine aggregate = (602.449 x 0.0476892) x 1.2 = 34.476 kg +

Total weight of the concrete elements for 9 cylinder = 129.908 kg

4.2.2 For concrete with the addition of waste lathe = 0.5 %

a. Unit weight nine of the sample specimen = 129.908 kg
b. Total addition of fiber to 0.5 % = 129.908 x 0.5% = 0.650 kg (for 9 sample)

4.2.3 For concrete with the addition of waste lathe = 1.0 %

a. Unit weight nine of the sample specimen = 129.908 kg
b. Total addition of fiber to 1.0 % = 129.908 x 1.0% = 1.299 kg (for 9 sample)

4.2.4 For concrete with the addition of waste lathe = 2.0 %

a. Unit weight nine of the sample specimen = 129.908 kg
b. Total addition of fiber to 2.0 % = 129.908 x 2.0% = 2.598 kg (for 9 sample)

4.3. Test Results Compressive Strength

Concrete compressive strength testing was conducted in the laboratory of Technology and Materials Engineering Faculty of Civil Engineering Program Universitas Kristen Indonesia Paulus Makassar. Concrete compressive strength test results are shown in Table 1 through Table 4 as follows:

Table 1. Results Test Compressive Strength Normal Concrete

Age (day)	Number Sample	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Compressive Strength (kg/cm^2)	Compressive Strength (Mpa)
28 days	16	12.313	8	176.625	530	305.976	30.007
	17	12.302	8	176.625	500	288.657	28.309
	18	12.315	8	176.625	510	294.43	28.875
Mean		**12.31**	**8**	**176.625**	**513.333**	**296.354**	**29.064**

Table 2. Results Test Compressive Strength Adding Waste Lathe = 0.5%

Age (day)	Number Sample	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Compressive Strength (kg/cm^2)	Compressive Strength (Mpa)
28 days	13	13.332	9	176.625	560	323.296	31.706
	14	12.41	9	176.625	520	300.203	29.441
	15	12.42	9	176.625	530	305.976	30.007
Mean		**12.72067**	**9**	**176.625**	**536.667**	**309.825**	**30.385**

Table 3. Results Test Compressive Strength Adding Waste Lathe =1.0%

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Compressive Strength (kg/cm^2)	Compressive Strength (Mpa)
28 days	13	12.249	8	176.625	570	329.069	32.272
	14	12.282	8	176.625	540	311.749	30.573
	15	12.359	8	176.625	560	323.296	31.706
Mean		**12.29667**	**8**	**176.625**	**556.667**	**321.371**	**31.517**

Table 4 Results Test Compressive Strength Adding Waste Lathe = 2.0%

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Compressive Strength (kg/cm^2)	Compressive Strength (Mpa)
28 days	14	12.392	9.5	176.625	630	363.708	35.669
	15	12.228	9.5	176.625	610	352.161	34.536
	16	12.295	9.5	176.625	600	346.388	33.970
Mean		**12.305**	**9.5**	**176.625**	**613.333**	**354.086**	**34.725**

4.4. Result Test Tensile Strength

Testing the tensile strength of concrete sides conducted in the laboratory of Technology and Materials Engineering Faculty of Civil Engineering Program Universitas Kristen Indonesia Paulus Makassar. Tensile strength test results of concrete are shown in Table 5 through Table 8 as follows:

Table 5. Results Test Tensile Strength Normal Concrete

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Tensile Strength (kg/cm^2)	Tensile Strength (Mpa)
28 days	13	12.255	8	450	190	86.106	8.444
	14	12.287	8	450	200	90.638	8.889
	15	12.029	8	450	230	104.234	10.222
Rata-rata		**12.19033**	**8**	**450**	**206.667**	**93.660**	**9.185**

Table 6. Results Test Tensile Strength Adding Waste Lathe = 0.5%

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Tensile Strength (kg/cm^2)	Tensile Strength (Mpa)
28 days	16	12.308	8	450	200	90.638	8.889
	17	12.206	8	450	220	99.702	9.778
	18	12.32	8	450	210	95.17	9.333
Rata-rata		**12.278**	**8**	**450**	**210**	**95.170**	**9.333**

Table 7. Results Test Tensile Strength Adding Waste Lathe =1.0%

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maximum (KN)	Tensile Strength (kg/cm^2)	Tensile Strength (Mpa)
28 days	16	12.215	11	450	220	99.702	9.778
	17	12.364	11	450	250	113.298	11.111
	18	12.43	11	450	260	117.83	11.556
Rata-rata		**12.33633**	**11**	**450**	**243.3333**	**110.277**	**10.815**

Table 8. Results Test Tensile Strength Adding Waste Lathe = 2.0%

Age (hari)	Number Sampel	Weight (kg)	Slump (cm)	Ares Field Compressive (cm^2)	Load Maksimum (KN)	Tensile Strength (kg/cm^2)	Tensile Strength (Mpa)
28 days	17	12.327	10	450	260	117.83	11.556
	18	12.462	10	450	280	126.894	12.444
	2	12.43	10	450	290	131.425	12.889
Rata-rata		**12.40633**	**10**	**450**	**276.6667**	**125.383**	**12.296**

5. ANALYSIS AND DISCUSSION

Test results compressive strength for concrete showed that the addition of concrete compressive strength with the addition of a waste lathe of 0.5% compressive strength increased by 4,038% from 296.354 kg/cm^2 to 309.825 kg/cm^2, the addition of waste lathe 1.0% an increase in compressive strength by 7.784% from 296.354 kg/cm^2 to 321.371 kg/cm^2, the addition of waste lathe an increase of 2.0% compressive strength of 16 .305% from 296.354 kg/cm^2 to 354.086 kg/cm^2.

Test results tensile strength for concrete showed that the addition of concrete tensile strength with the addition of waste lathe an increase of 0.5% tensile strength increased by 1,587% from 93 .660 kg/cm^2 to 95.170 kg/cm^2, the addition of waste lathe 1.0% occurred increase in tensile strength divided by 15.068% from 93.660 kg/cm^2 to 110.277 kg/cm^2, the addition of waste lathe of 2.0% tensile strength increased by 25.301% from 93.660 kg/cm^2 to 125.383 kg/cm^2.

6. CONCLUSION

The results showed that an increase compressive strength of 16.305% and an increase tensile strength divided by 25.301% due to the addition of a waste lathe by 2% compared with normal concrete without the addition of waste lathe.

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