ISSN (*Online*) 2620-7222
ISSN (*Print*) 2503-2399

Available online at
https://jurnaltechnic.unisla.ac.id/index.php/CVL
https://doi.org/10.30736/cvl.v2i2

Analysis of Concrete Strength Analysis K-250 With Additional Asbestos Waste Powder as a Substitute of Fine Aggregate

[1]Ahmad Ridwan, [2]Yosef Cahyo Setianto Poernomo, [3]Edy Garjito, [4]Romadhon
[1]Civil Engineering Study Program, Faculty of Engineering, Lamongan Islamic University
e-mail: [1]ahmadridwan@unisla.ac.id, [2]yosef.cs@unisla.ac.id, [3]edygardjito@unisla.ac.id, [4]romadhon@unisla.ac.id

ARTICLEINFO

Article History :
Article entry : 03-27-2024
Article revised : 03-28-2024
Article received : 04-05-2024

Keywords :
Asbestos Waste, K-250 Concrete, Concrete Compressive Strength

IEEE Style in citing this article:
Ahmad Ridwan, Yosef Cahyo Setianto Poernomo, E. Garjito, and Romadhon, "Analysis of Concrete Strength Analysis K-250 With Additional Asbestos Waste Powder as a Substitute of Fine Aggregate", civilla, *vol. 9, no. 1, pp. 109–118, Mar. 2024.*

ABSTRACT

Concrete is an important component in the manufacture of infrastructure, but in its various advantages, concrete also has deficiencies in the elements of its manufacturing materials, concrete which can cause environmental damage. Not only that, another problem was also found, namely the amount of asbestos waste being wasted. In addition to being difficult to decipher in nature, asbestos also has an impact on human health, namely lung cancer. From there, researchers are interested in conducting research and finding solutions. The purpose of this research is to find out the results of testing the compressive strength of K-250 concrete with the use of asbestos powder waste and to review the use of asbestos powder waste as fine aggregate efficiency.This study uses an experimental method with data analysis to find the results of testing the compressive strength of K-250 concrete. The test will be carried out on 12 specimens with asbestos waste variance of 0%, 10%, 20%, and 30% as a substitute for fine aggregate. From the test results obtained data on the compressive strength of concrete at the age of 28 days, namely: 0% = 217.8 Kg/cm3, 10% = 238.1 Kg/cm3, 20% = 188.7 Kg/cm3, and 30% = 100 ,1 Kg/cm3, which concludes that K-250 concrete with a variance of 10% meets the compressive strength.

1. Introduction

Concrete is an important component in the manufacture of infrastructure because of its strength and durability against loads and natural factors, but in its various advantages, concrete also has shortcomings, for example in the elements of concrete making materials whose extraction can cause environmental damage. Aswan, et al (2020) in their journal entitled Sandstone Mining Business in Lonjoboko Village, Gowa Regency, 2006-2018, mentions several impacts of sandstone mining, such as environmental impacts such as soil pollution and social impacts such as damaged public infrastructure. That's what makes

research on concrete technology needed. Not only that, the researchers also found another problem, namely the amount of asbestos waste that was wasted at the project site that the researchers encountered. On the PUPR ministry's website (kotaku.pu.go.id), Jakarta, February 2, 2010 in his article entitled Asbestos...!!! Really Dangerous..? explained that apart from being difficult to decipher asbestos materials, nature also has an impact on human health, namely lung cancer if particles from asbestos are inhaled by the nose.

From there, the researchers were interested in raising the research title "Analyzing the Compressive Strength of Concrete K-250 With Additional Asbestos Waste Powder As A Mixture Of Fine Aggregate", because the researchers hope that this research can help develop concrete with more compressive strength and also unravel the impact of problems that have occurred. outlined.

2. Research methods

2.1 Research plan

In this study will use a method, namely the experimental method, Sukmadinata (2008: 194) suggests that, "Experimental research is a research approach that is quite typical. This particularity is shown by two things, first, experimental research directly examines the effect of a variable on other variables, secondly tests the hypothesis of a causal relationship.

2.2 Types of research

In this study the research method used is trial and error with laboratory tests. With the following types of testing:

1. Test of concrete constituents
   a. Portland cement test (PC)
   b. Fine aggregate test
   c. Coarse aggregate test
2. Analysis of cement cement waste as a mixture of fine aggregate.
3. Preparation of job mix design using standard SNI 03-2834-2000 with concrete quality.
4. Compressive strength test based on SNI 03-1974-1990.

2.3 Research sites

This research was conducted at the Civil Engineering Laboratory of the Civil Engineering Study Program, Faculty of Engineering, Lamongan Islamic University.

2.4 Data collection technique

Data collection will be carried out by conducting experimental activities or testing of test objects from conditions or mixtures of materials carried out in the laboratory. For testing materials, secondary data will be used. This secondary data is obtained from testing the materials that will be used to make the test objects. Literature data in this study is data from lecture materials in the form of reports from practicums, consultations with supervisors and laboratory assistants.

2.5 Data analysis technique

Data analysis will be carried out in stages:

1. Fine Aggregate Inspection
2. Concrete Mix Design
3. Concrete works
4. Fresh Concrete Test
5. Concrete Volume Weight Test
6. Concrete compressive strength test

1. Results and Discussion

3.1 Material Test

3.1.1. Testing on Fine Aggregate

1. Sand Moisture Test

From the research results, it is known that the moisture value of sand (ASTM C 566 - 89) is as follows:

Table 1. Sand Moisture Test

TRIAL NUMBER	I	II
Real Sand Weight (w1)-(gr)	1000	1000
Oven Sand Weight (w2)-(gr)	993.78	994.18
Sand Moisture(w1-w2)/w2 x 100%	0.63%	0.59%
Sand Humidity Average	0.61%	

Source: Research Results 2023.

2. Sand Density Test

From the research results, it is known that the specific gravity of sand (ASTM C 128-78 sand density is between 2.4 -2.7 gr/dm3) as follows:

Table 2. Fine Aggregate Density Test

TRIAL NUMBER	I	II
Pumpkin Weight+Sand+Water (w1)-(gr)	850	843.5
SSD Sand Weight (w2)-(gr)	250	250
Pumpkin Weight+Water (w3)-(gr)	715.5	715.5
Density of Sand :w2/(w2+w3)-(w1)	2.16	2.05
Bj Sand Average	2.1	

Source: Research Results 2023.

3. Sand Infiltration Water Test

From the test, the results of the fine aggregate infiltration water value (ASTM C 128-93) are as follows:

Table 3. Sand Infiltration Water Test

TRIAL NUMBER	I	II
SSD Sand Weight-(gr)	250	250
Oven Sand Weight (w1)-(gr)	246.8	245.1
Infiltration Moisture Content : ((500-w1)/w1)x100%	1.30%	2%
Average Infiltration Water Content	1.65%	

Source: Research Results 2023.

4. Sand Volume Weight Test

From the test results obtained the value of the weight of the volume of fine aggregate (SII No.52-1989) as follows:

Table 4. Sand Volume Weight Test

Type Of Experiment	Usual Condition		With Rojokan		With A Tape	
	I	II	I	II	I	II
Cylinder Weight (w1)-(kg)	10.1	10.1	10.1	10.1	10.1	10.1
Cylinder Weight+Sand (w2)-(kg)	16.7	16.5	16.75	16.6	16.1	16.3
Sand Weight (w2-w1)-(kg)	6.6	6.4	6.65	6.5	6	6.2
Cylinder Volume (v)-(liter)	5,299	5,299	5,299	5,299	5,299	5,299
Volume Weight (w2-w1)/v	1.25	1.21	1.25	1.23	1.13	1.17
Average Weight Volume of sand	1,206					

Source: Research Results 2023.

5. Fine Aggregate Sieve Analysis Test

From the test results, it is known that the value of fine aggregate sieve analysis (ASTM C 136 – 95a) is as follows:

Table 5. Fine Aggregate Sieve Analysis Test

Filter		Left behind on the Sieve		% cumulative	GET AWAY
Number	Mm	gram	%	left behind	%
4	4.75mm	15	1.50	1.50	98.50
8	2.36 mm	24	2.41	3.91	96.09
16	1.18 mm	46	4.61	8.53	91.47
30	0.6mm	148	14.84	23.37	76.63
50	0.3mm	273	27.38	50.75	49.25
100	0.15mm	352	35.31	86.06	13.94
Pan	Pan	139	13.94	100.00	0.00
Amount		997.00	100.00	274.12	
			FM Sand =2.74		

Source: Research Results 2023.

4.1.2. Testing On Gravel

1. Gravel Moisture Test

From the research results, it is known that the moisture value of gravel (ASTM 566-89) is as follows:

Table 6. Gravel Moisture Test

TRIAL NUMBER	I	II
Original Gravel Weight (w1)-(gr)	3000	3000
Oven Gravel Weight (w2)-(gr)	2937	2953
Gravel Moisture(w1-w2)/w2 x 100	2.15%	1.59%
Average Gravel Humidity	1.87%	

Source: Research Results 2023.

2. Gravel Specific Gravity Test

From the research results, it is known that the specific gravity of gravel (ASTM C 128-78) is as follows:

Table 7. Gravel Specific Gravity Test

TRIAL NUMBER	I	II
Weight of Gravel in Air (w1)-(gr)	3000	3000
Weight of Gravel in Water (w2)-(gr)	1838	1781
Gravity of Gravel = w1/(w1-w2)	2,582	2,461
BJ Gravel Average	2.521	

Source: Research Results 2023

3. Gravel Infiltration Water

From the research results, it is known that the value of gravel infiltration water (ASTM C 127-88-93) is as follows:

Table 8. Gravel Infiltration Water Test

TRIAL NUMBER	I	II
Original Gravel Weight (w1)	3000	3000
Oven Gravel Weight (w2)	2893	2939
Infiltration Moisture Content : (w1-w2)/w2 x 100%	3.7%	2.1%
Average Infiltration Water Content	2.9%	

Source: Research Results 2023.

4. Gravel Volume Weight

From the results of the study, it is known that the volume weight of crushed stone (ASTM C 29-91) is as follows:

Table 9. Gravel Volume Weight Test

TYPE OF EXPERIMENT	USUAL CONDITION		WITH ROJOKAN		WITH A TAPE	
	I	II	I	II	I	II
Cylinder Weight (w1)-(kg)	10.6	10.6	10.6	10.6	10.6	10.6
Cylinder Weight+Gravel (w2)-(kg)	17.7	17.8	18.55	18.7	18.5	18.45
Gravel Weight (w2-w1)-(kg)	7.1	7.2	7.95	8.1	7.9	7.85
Cylinder Volume (v)-(liter)	5,299	5,299	5,299	5,299	5,229	5,299
Volume Weight (w2-w1)/v	1,340	1,359	1,500	1,529	1.511	1.481
Average Gravel Volume Weight	1,453					

Source: Research Results 2023.

5. Gravel Sieve Analysis Test

From the results of the study, obtained the value of the Analysis of the Coarse Aggregate Sieve (ASTM C 33-93) as follows:

Table 10. Coarse Aggregate Sieve Analysis

Filter		Left behind on the Sieve		% cumulative
Number	Mm	gram	%	Left behind
1”	25.4 mm	29	1.04	0.00
3/4”	19 mm	713	25.59	19.55
1/2”	12.7 mm	867	31,12	64.14
3/8”	9.5mm	867	19.99	95.22
No.4	4.75mm	368	13.21	100.00
Amount		2534	91	345.08
		FM Gravel = %/100 =		3.45

Source: Research Results 2023.

4.1.3. Testing on Asbestos Powder Waste

1. Asbestos Waste Testing

The results of the study, it is known that the moisture value of asbestos waste (ASTM C 566-89) as follows:

Table 11. Asbestos Waste Moisture Testing

TRIAL NUMBER	I	II
Heavy asbestos waste Original (w1)-(gr)	250	250
Heavy asbestos waste Oven (w2)-(gr)	216	215.5
Humidity asbestos waste :(w1-w2)/w2 x 100%	15.74%	16.01%
Asbestos waste humidity Average	15.88%	

Source: Research Results 2023.

2. Asbestos Waste Specific Gravity Test

From the results of the study, it is known that the specific gravity value of asbestos waste (ASTM C 128-78 sand density is between 2.4 –2.7 gr/dm3) as follows:

Table 12. Testing the Specific Gravity of Asbestos Waste as Fine Aggregate

TRIAL NUMBER	I	II
Pumpkin Weight+ asbestos waste +Water (w1)-(gr)	850	843.5
Heavy asbestos waste SSD (w2)-(gr)	250	250
Pumpkin Weight+Water (w3)-(gr)	715.5	715.5
Specific gravity asbestos waste :w2/(w2+w3)-(w1)	2.16	2.05
Bj asbestos waste Average	2.11	

Source: Research Results 2023.

3. Asbestos Wastewater Infiltration Test

From the test, the results of the asbestos waste water absorption as fine aggregate (ASTM C 128-93) are as follows:

Table 13. Sand Infiltration Water Test

TRIAL NUMBER	I	II
Heavy asbestos waste SSD-(gr)	250	250
Heavy asbestos waste Oven (w1)-(gr)	221.5	219
Infiltration Moisture Content : ((500-w1)/w1)x100%	12.9%	14.2%
Average Infiltration Water Content	13.5%	

Source: Research Results 2023.

4. Asbestos Waste Volume Weight Test

From the test results, the value of the volume weight of asbestos waste as fine aggregate (ASTM C 188-89) is as follows:

Table 14. Asbestos Waste Volume Weight Test

TYPE OF EXPERIMENT	USUAL CONDITION		WITH ROJOKAN		WITH A TAPE	
	I	II	I	II	I	II
Cylinder Weight (w1)-(kg)	10.1	10.1	10.1	10.1	10.1	10.1
Cylinder Weight+ asbestos waste (w2)-(kg)	15.4	15.3	16.2	16.2	16	16.1
Heavy asbestos waste (w2-w1)-(kg)	5.3	5.2	6.1	6.1	5.9	6
Cylinder Volume (v)-(liter)	5,299	5,299	5,299	5,299	5,299	5,299
Volume Weight (w2-w1)/v	1.00	0.98	1.15	1.15	1.11	1.13
Average Volume Weight asbestos waste	1.088					

Source: Research Results 2023.

5. Asbestos Waste Filter Analysis Test

From the test results, it is known that the analysis value of the asbestos waste filter (ASTM C 136 – 95a) is as follows:

Table 15. Asbestos Waste Filter Analysis Test

Filter		Left behind on the Sieve		% cumulative	GET AWAY
Number	Mm	gram	%	Left behind	%
4	4.75mm	23.5	2.35	2.35	97.65
8	2.36 mm	663	66.30	68.65	31.35
16	1.18 mm	147	14.70	83.35	16.65
30	0.6mm	63.4	6.34	89.69	10.31
50	0.3mm	36	3.60	93.29	6.71
100	0.15mm	24.6	2.46	95.75	4.25
Pan	Pan	35.2	3.52	99.27	0.73
Amount		992.70	99.27	532.35	
			FM Sand =5.32		

Source: Research Results 2023.

4.2. Mix Design

In the manufacture of test specimens, a material mixture design plan is needed so that the test objects can be made in accordance with the concrete testing standard with K-250 quality. In this mix design process, the formulation of the concrete mixing plan with the quality of K-250 will be presented to be tested for compressive strength. The formulation will be presented in table 4.21, as follows:

Table 16. Composition of the Test Object Concrete Material

No.	Percent	V. Cylinder	Noes	Total	Cement (kg)	Sand (kg)	Gravel (kg)	Water	bh. Plus (kg)
1	0%	0.0053	4	0.0212	9.15	15.41	22.18	4.35	0.00
2	10%	0.0053	4	0.0212	9.15	13.87	22.18	4.35	1.54
3	20%	0.0053	4	0.0212	9.15	12.33	22.18	4.35	3.08
4	30%	0.0053	4	0.0212	9.15	10.79	22.18	4.35	4.62

Source: Research Results 2023

4.3. Test Slup Test

The results of the slump test obtained the following values:

Table 19. Slump Tes Test Results

No	Asbestos Waste Mix Variations	Slump Value
1	0%	13
2	10%	11
3	20%	11
4	30%	10

Source: Research Data 2023.

4.4. Concrete Compressive Strength Test

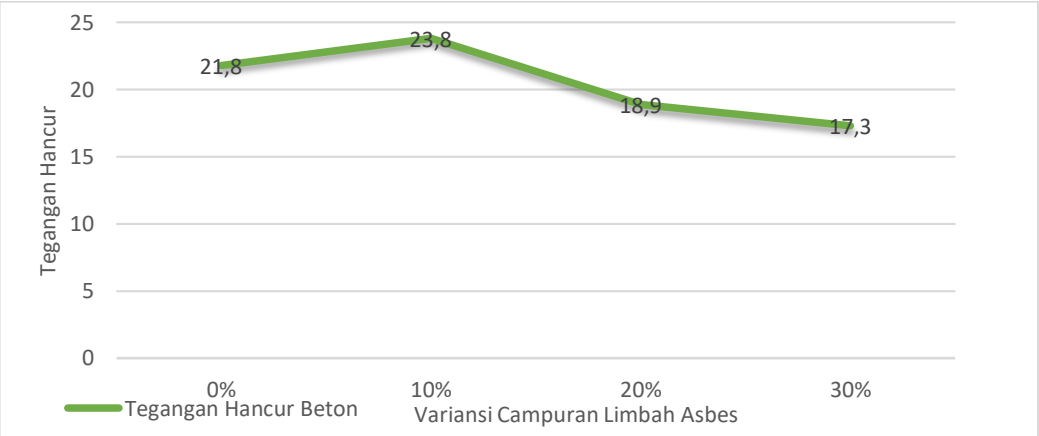
The compressive strength test of concrete is carried out when the concrete is 7 days old and to take the compressive strength of the 28 day old concrete, the concrete will be correlated by multiplying it by the correlation fartor of 0.65 to get the compressive strength of

the 28 day old concrete. The results of the compressive strength test will be presented in tabular form, as follows:

Table 20. Compressive Strength Test Results of Test Objects.

No.	age (day)	concrete code	Size (cm)	Heavy (kg)	Crushed pressure (tons)	Breaking Voltage 7 days (kg/cm2)	Bj Concrete (kg/m3)	Crushing Voltage (kg/m3)
1	7	N1	15 x 30	13	25	141.54	2453	217.8
2	7	N2	15 x 30	12.9	25	141.54	2434	217.8
3	7	N3	15 x 30	12.9	25	141.54	2433	217.8
		Average		**12.93**	**25.00**	**141.54**	**2440**	**217.8**
1	7	1(10%)	15 x 30	12.9	28	158.53	2434	243.9
2	7	2(10%)	15 x 30	12.9	28	158.53	2434	243.9
3	7	3(10%)	15 x 30	12.3	26	147.20	2321	226.5
		Average		**12.70**	**27.33**	**154.75**	**2396**	**238.1**
1	7	1(20%)	15 x 30	12.6	20	113.23	2377.36	174.2
2	7	2(20%)	15 x 30	12.3	20	113.23	2320.75	174.2
3	7	3(20%)	15 x 30	12.2	25	141.54	2301.89	217.8
		Average		**12.37**	**21.67**	**122.67**	**2333.33**	**188.7**
1	7	1(30%)	15 x 30	12.3	17	96.25	2320.75	78.4
2	7	2(30%)	15 x 30	12.1	13	73.60	2283.02	92.2
3	7	3(30%)	15 x 30	12.1	12	243.45	2283.02	55.3
		Average		**12.17**	**14.00**	**137.77**	**2295.60**	**75.3**

Source: Research Results 2023



Source: Research Results 2023.

Figure 1. Graph of the Crushing Stress of the Test Object.

5.1. Conclusion

From various tests carried out at the UNISLA Civil Engineering Laboratory to obtain results and discussions that will be used as the basis for research conclusions, namely:

1. Based on the compressive strength test of K-250 concrete with the substitution of asbestos waste as fine aggregate with variances of 0%, 10%, 20% and 30%, it produces data on the compressive strength of concrete at the age of 28 days, namely: 0% = 21.78 Mpa, 10% = 23.81 Mpa, 20% = 18.87 Mpa, and 30% = 10.01 Mpa. Of the four test

objects with mixed proportions and asbestos waste substitution variance, the largest value was obtained, namely the test object with asbestos waste substitution value with a variance of 10% with a compressive strength of 23.81 MPa.

2. From the discussion carried out, the use of asbestos waste as a substitute or substitute for fine aggregate in the K-250 concrete mixture with a variance of 10% can be used because it meets or exceeds the compressive strength of K-250 concrete only in concrete with a 10% variance asbestos waste substitution. with a compressive strength value of 23.81 Mpa.

5.2. Suggestion

1. It is recommended for further research that this thesis research can be continued with different concepts and variances.
2. In the manufacture of concrete the materials used must go through a material test first, in order to obtain concrete that is in accordance with the standard or can evaluate the material if there is a discrepancy.
3. In this study, the results of the asbestos waste substitution concrete data can be used as an alternative in adding strength and also utilizing asbestos waste.
4. It is necessary to do research, focusing on asbestos waste material as a substitute for fine aggregate, to get a more detailed effect of the substitution of concrete waste itself.

References

[1] Aswan, A., Najamuddin, N., & Bahri, B. (2020). Sandstone Mining Business in Lonjoboko Village, Gowa Regency, 2006-2018. Attoriolong, 18(1)

[2] ASTM C 128 – 93. Specific Gravity and Absorption of Fine Aggregates.

[3] ASTM C 128-78, Standard Test Method For Density, Relative Density (Specific Gravity), And Absorption Of Fine Aggregate.

[4] ASTM C 150 – 85 Standards Specification For Portland Cement,

[5] ASTM C 187-86, Normal Consistency Of Hydraulic Cement.

[6] ASTM C 188-89, Standard Test Method For Density Of Hydraulic Cement. United States: Association Of Standard Testing Materials.

[7] ASTM C 191-92, Time Of Setting Of Hydraulic Cement By Vicat Needle.

[8] ASTM C 29-91, Standard Test Method For Bulk Density (“Unit Weight”) And Voids Aggregate.

[9] ASTM C 566-89, Standard Test Method For Total Evaporable Moinsture Content Of Aggregate By Drying.

[10] ASTM, Designation: C 136-95a, 1996. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. Annual Book of ASTM Standards, section 4, Construction, Vol. 04.02, Concrete and Aggregates, pp. 78-82, 1996

[11] Lisa, S. (2015). Occupational Diseases Due to Asbestos Fiber Exposure. Syiah Kuala Medical Journal Volume 15 Number 1 April 2015.

[12] Praise Fauziah. February 18, 2019. BSN Will Review Asbestos with SNI. (http://inaban.org/bsn-akan-kaji-ulang-asbes-ber-sni/) accessed on 12 February 2021. INA-BAN (Indonesian Ban Asbestos Network). Jakarta.

[13] SNI 03-2834-2000. “Procedures for Making Normal Concrete Mixture Plans”

[14] SNI 03-1974-1990. "test method for compressive strength of concrete"

[15] Praise Fauziah. February 18, 2019. KLHK will reduce the use of asbestos. (http://inaban.org/klhk-akan-kurangi-gunakan-asbestos/) accessed on 12 February 2021. INA-BAN (Indonesian Ban Asbestos Network). Jakarta.

[16] Praise Fauziah. February 18, 2019. KLHK will reduce the use of asbestos. (http://inaban.org/klhk-akan-kurangi-gunakan-asbestos/) accessed on 12 February 2021. INA-BAN (Indonesian Ban Asbestos Network). Jakarta.

[17] Concrete Structures Module Chapter 1. (2020). Reinforced Concrete Composition Material. Accessed on February 7, 2021. http://staffnew.uny.ac.id/upload/132256207/ Pendidikan/modul-ktur-beton-bab-1_0.pdf .State University of Yogyakarta, Yogyakarta.