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The Effect of Limestone Substitution as Cement and Plastic Waste Slike Aggregate Slike on the Compressive Strength of Concrete

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ABSTRACT

With the development of concrete technology in these days, concrete innovation is needed because it does not rule out the possibility of this concrete material, namely fine aggregate, coarse aggregate, cement, and water, which is decreasing over time or thinning. An innovation is needed that can reduce the use of cement by using other materials, so that the amount of cement usage can be reduced. Examples of innovation as a material that can be mixed with concrete include fly ash, palm ash, extinguished lime, bagasse ash and others. This is what drives research for concrete mixtures other than sand, gravel, cement and water, adding materials to the concrete mixture, namely limestone as a substitute for cement and plastic waste as a substitute for coarse aggregate. The use of limestone is expected to reduce cement levels and the use of plastic waste can reduce the use of gravel from river stones so as not to damage the river ecosystem. The addition of limestone and plastic waste is expected without reducing the strength of the concrete. This study uses the percentage of limestone made with a percentage variation from 0% to 15% (0%, 1%, 5%, 10%, and 15%) of the volume of cement based on experiments (mix design calculations) and for plastic waste with a percentage variations from 0% to 10% (0%, 1%, 5%, and 10%) of the crude aggregate volume based on my experiment (mix design calculations). The concrete is molded by using 4 cylindrical molds measuring 15cmx30cm for each test concrete quality. The compressive strength will be tested at the age of 14 and 28 days. The results of the research on concrete with additional substitution in the form of lime which was substituted into cement and plastic waste substituted for crude in coarse agrrates tended to experience a decrease in quality or compressive strength when compared to normal concrete without any added substitute materials. Research on the highest compressive strength value of concrete mixed with substitution material is the mixture or variation A (1% + 1%) with the average results of 20.27Mpa.

Keywords
Compressive Strength.**.** Concrete, Innovation, Limestone, Plastic Waste, Substitution.

1. Introduction

In the field of construction continues to develop technology not only in Indonesia but in various other countries also experienced very rapid development. Almost all buildings are designed using strong concrete quality, durable or durable and efficiency. Of the many buildings, almost all use concrete base materials ranging from foundations, columns, beams, plates, drainage grooves, and architectural combinations. Concrete is one of the most popular construction materials used since hundreds of years ago. Concrete is chosen because it has many advantages over other materials. Concrete is a mixture of portland cement aggregates (fine aggregates and coarse aggregates) of water and is sometimes coupled with the use of varied additional materials ranging from chemical surcharges, fibers to non-chemical building materials at a certain comparison. (Tjokrodimuljo, 2007), But as technology evolves in this day and age, concrete innovation is necessary because it does not close the possibility of concrete material i.e. fine aggregate / sand, rough aggregate / gravel, cement, and water the longer it decreases or thins. It needs innovation that can reduce the use of cement by using other materials, so that the use of cement can be reduced in number. Examples of innovations as materials that can be dried and concrete include fly ash,palm ash, lime extinguished, cane ampas ash and others..This is the driving force for concrete mixture in addition to fine aggregate/ sand, rough aggregate / gravel, cement and water is done the addition of materials in concrete mixture i.e. limestone as substitution to cement and plastic waste as substitution of

coarse aggregate / gravel. The use of limestone is expected to reduce cement levels and the use of plastic waste can suppress the use of gravel from stone times as it does not damage river ecositems. The addition of limestone and plastic waste is expected without reducing the strength of the concrete.

2. Research Materials And Methods

2.1 Materials

a. Semen used for this research in the form of portland cement type I gresikbrand.
b. Afine gregat or sand used for this research is lampung sand.
c. A rough gregat used for this study in the form of gravelresulting from the disintegration of rocks or in the form of broken stones resulting from manual solving or using a breaking machine derived from bogor. .
d. The water used in this study came from the UMB Civil Engineering Laboratotium.
e. The limestone used is obtained from Kelapa Nunggal limestone mining, Bogor Regency.
f. The plastic waste used is obtained from the wreckage of a shell.

2.2 Research Methods

The type of research used is by meode experiments, using additional materials against concrete, additional materials in the form of limestone as subtitution to cement and plastic waste as subtitution to rough aggregates, for this study to obtain data and results conducted testing in the laboratory.Experimental research methods are methods used to look for the influence of certain treatments on others in controlled conditions (Sugiyono, 2009). This research uses mix-design so that fine aggregate values, rough agrega, cement, limestone and plastic waste, can be known from the MS-Excel calculation process.Before conducting this mix-design research materials that will be in concrete making are carried out checks on fine aggregate materials, and rough aggressors, in order to know the karakeristic of each aggregate. After the aggregate inspection stage, the next stage is mix-design. Continue the stage of mixing limestone and plastic waste dangan varying values as a substitute for cement and a replacement of the coarse aggregates used in the concrete mixture. After all the process was completed do the manufacture of concrete test objects and continued with strong testing of concrete press.

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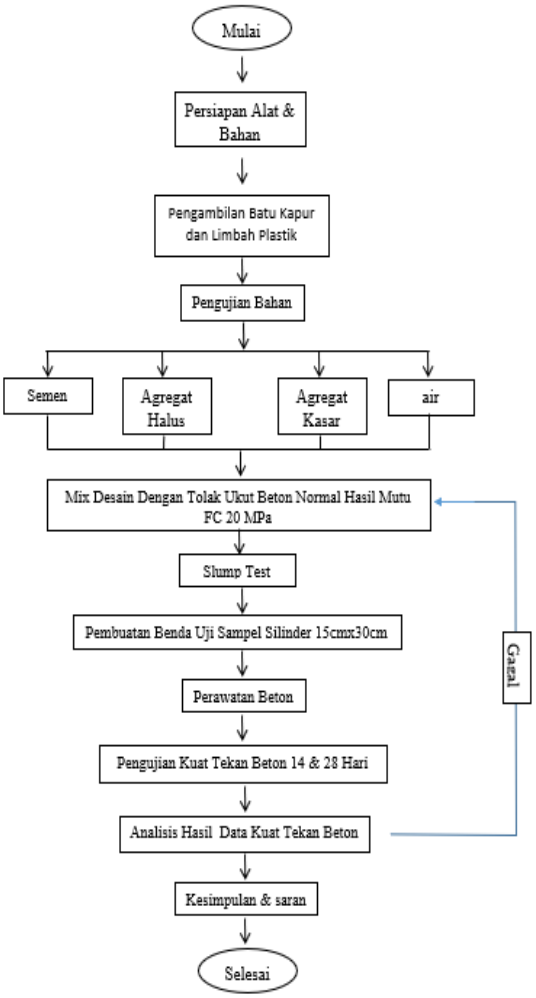

Figure 1. Of the Research FlowchartFlowchart)
Source: Research Data Penelitian

Table 1. Material requirements for 1 concrete withm ^ 3FC-20 MPa quality concrete with FC quality

Materials	**Needs (kg/m^3)**
Cement	427,083
Water	205
Sand	491,53
Gravel	1264,38

The research was conducted as many as 12 variations of the mixture plus normal concrete as control concrete. Each variation per day there are 2 samples for testing. So, the total of all variations plus normal concrete as much as 52 samples. Here is the number of material needs for each cylinder 15x30 cm:

Table 2. Material needs for 1 cylinder 15x30 cm

Presentase Variasi		Semen	Kerikil	Pasir	Air	Batu Kapur	Limbah Plastik
Batu Kapur (Semen)	Limba Plastik (Kerikil)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
0%	0%	2,27	8,04	3,13	1,30	0	0
1%	1%	2,693	7,7970	3,13	1,30	0,0272	0,0804
5%	5%	2,136	7,799	3,13	1,30	0,136	0,402
10%	10%	2,448	7,638	3,13	1,30	0,272	0,804
15%		2,312		3,13	1,30	0,408	
Jumlah		12,309	31,1618	15,65	6,5	0,8432	1,2864

2.2 Research Place and Time

Venue: Laboratotium Structure and Materials
Building Civil Engineering Study Program, Faculty of Engineering, Mercu Buana University Bekasi Campus D.
When : September 2019 to January 2020

3. Results And Discussions

Analysis of the gradation of kapur stone is necessary to know the size of the granules tobe used as a mixture in the test concrete research, limestone is used as a cement substitution material.

Table 3. Limestone gradation gradation testing

Saringan	Berat Tertahan (gram)	Jumlah Berat Tertahan (gram)	Jumlah Persen	
			Tertahan	Lewat
50.80 (2")				
25.40 (1")				
19.10 (3/4")				
6.3 (1/4")	-	-	0.00	100.00
No. 4	0	0.00	0.00	100.00
No. 8	0.00	0.00	0.00	100.00
No. 12	10.00	10.00	1.00	99.00
No. 20	30.00	40.00	4.00	96.00
No. 40	30.00	70.00	7.00	93.00
No. 80	70.00	140.00	14.00	86.00
No. 100	210.00	350.00	35.00	65.00
No. 200	140.0	490.00	49.00	51.00
PAN	10.0	500.0	50.00	50.00

Source: Research Data Penelitian

Analysis of plastic waste gradation is necessary to determine the size of the granules tobe used as a mixture in the test concrete research,usedas a rough aggregate substitution material, granules usedequal to a maximum grained rough aggregate of 4.75 cm, or filter no. 4.

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Table 4. Plastic waste gradation gradation testing

Saringan	Berat Tertahan (gram)	Jumlah Berat Tertahan (gram)	Jumlah Persen	
			Tertahan	Lewat
50.80 (2")	0	0		
36.10 (1 1/2")	0	0		100.00
25.40 (1")	0	0	0.00	100.00
19.10 (3/4")	380	380	38.00	62.00
6.3 (1/4")	350	730	73.00	27.00
No. 4	270	1000	100.00	0.00
No. 8	0	1000	100.00	-
No. 12	0	1000	100.00	-
No. 16	0	1000	100.00	-
No. 30	0	1000	100.00	-
No. 50	0	1000	100.00	-
No. 100	0	1000	100.00	-
No. 200	0	1000	100.00	-
PAN	0	1000	100.00	0.00

Sumner : Research Data

3.1 Slump Testing (Workability)

Testing of slump (workability)is necessary to know the level of fresh concrete kelecakan. The higher the slump value, the more diluted the concrete and easier to work with, and vice versa. In this study, researchers planned a slump value of 6-18 cm.

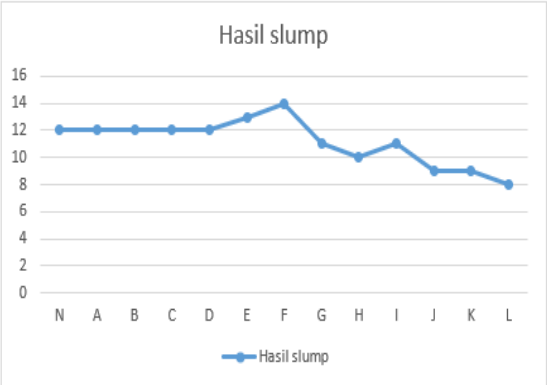

Figure 2. Value of Slump Test Results
Source: Research Data

From the data of the above test results, it can be seen that in this study the more the amount of limestone and plastic waste mixed then the lower the slump value. This can be seen from the graph of the result of the slump that is decreasing.

3.2 Strong Concrete Press Testing

Strong press testing of test objects is performed using 4 samples per variation.. Denag every test 2 samples per day 14, and 2 samples perday28. Here are the results of the powerful test press:

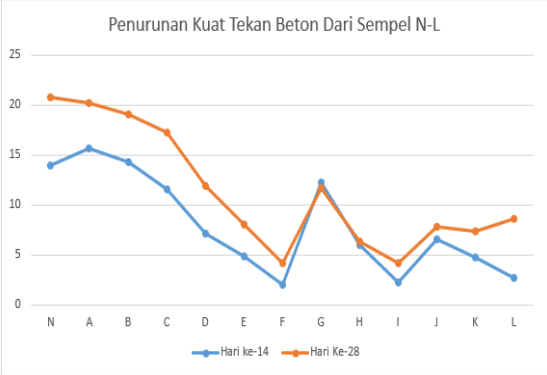

Figure 3 Results of Strong Concrete Press
Source: Research Data Penelitian

Based on the results of the study the highest press strong value of concrete mixed with substitution material is in the mixture or variation A (1% + 1%) with an average yield of 20.27Mpa. Based on the results of concrete extraction mixed with the substitution material of limestone additional material and plastic waste the highest slump value is found in variation C (5 % + 1%) 14 cm, and the lowest slump value is found in the L variation (15 % + 10 %) namely 8 cm, where the result is still in accordance with the calculation of the design mix which is between 80 - 150 mm.

4. Conclusion

Based on didapat limbah the results campuran of testing and analysis on the influence of lime extinguished as cement subtitution material and plastic waste as a rough aggregate subtitution material on concrete mixture against strong concrete press, obtained conclusions as follows:

1. Based on the results of concrete research with additional substitutions in the form of chalk substitused into cement and plastic waste substituted keladalam agrgat rough tends to experience a decrease in quality or strong press when compared to normal concrete in the absence of substitution added material. The larger the mixture of lime bartu and plastic waste in the concrete mixture, the lower the slump value obtained, this is because the weight of the type of lime smaller than cement makes more mixture in the form of limestone making the more water absorption that occurs resulting in bitterness.
2. Based on the results of the study the highest press strong value of concrete mixed with substitution material is in the mixture or variation A (1% + 1%) with an average yield of 20.27Mpa.
3. Based on the results of concrete extraction mixed with the substitution material of limestone additional material and plastic waste the highest slump value is found in variation C (5 % + 1%) 14 cm, and the lowest slump value is found in the L variation (15 % + 10 %) namely 8 cm, where the result is still in accordance with the calculation of the design mix which is between 80 - 150 mm.
4. Based on the results of concrete research with substitution material in the form of chalk as cement substitution material and plastic waste as a substitution material of rough aggregate with substitution variation C can be used in the construction of structures because it has strong results press 28 days still in accordance with the initial planning and for other variations more efficiently used for the manufacture of non-structural concrete.
5. In this study, the effect of plastic waste on concrete mixtures did not experience chemical elements that caused a decrease in the strong press of concrete, but only due to negligence in the manufacture of test objects or commonly referred to as technical problems.

4.1 Suggestion

Based on the results of observations and research, the advice that can be taken from this research, namely as follows:

1. At the time of the research, there needs to be a special thoroughness to the testing of materials materials, testing of additional materials, calculation ofe mix design, curing control, and strong test press, in order to get the maximum results.
2. At the time of the manufacture of test materials that need to be considered a good and homogeneous concrete stirring process, which is then followed by compaction on the mold is done carefully so that the resulting concrete does not suffer damage to the concrete, in the event of a damage to the concrete will affect the result of the strong value of the concrete press.

3. In further research, it is recommended to burn limestone first to rejuvenate the manual refining process, and for plastic waste the melting process is recommended to use open because when done melting resulting in air pollution and poorly obtained results or fragile cenderukng.

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