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Effect Of Grading On Differences Using Mixed Concrete Aggregate Rough And Fine Aggregate Concrete Compressive Strength Of Natural

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Abstract— **The use of concrete is widely used because of its superiority among other ze strong in press conditions and weak in tensile conditions, and also the structural elements of the most widely used in building, because the material is easy to obtain and easy to make or easy to do. In the first experiment with a mixture of coarse and fine aggregate gradation naturally obtained an average compressive strength of 88.61 kg / cm3. In a second experiment with a mixture of coarse aggregate and fine aggregate gradation modification of the natural gradations obtained an average compressive strength of 103.31 kg / cm3. In the third experiment with a mixture of coarse aggregate and fine aggregate gradation modification of 50% and 50% natural materials sand material origin Mount Sugih obtained an average compressive strength of 121.24 kg / cm3**

Keywords— compressive strength, natural gradation, gradation modification

1. INTRODUCTION

background In the world of construction, the research to get the products better construction continues. Concrete is widely used because of its superiority among other ze strong in press conditions and weak in tensile conditions, a structural element that is most widely used in the building because the material is easy to obtain, easy to make and cheap. This research attempts to utilize the natural condition of Indonesia has many local rivers have sources coarse aggregate and fine aggregate are plentiful, especially the area of the river Way Balak contained in the City

Great, Tanggamus, Lampung. But not many are used to mix concrete because the surface is smooth, minimal pores and unevenness gradation. Research effort should be made to obtain a new alternative in concrete technology, using local materials Way Balak river located in the Great City, Tanggamus, Lampung.

problem Formulation
Formulation of the problem for testing the strength of concrete is how much the strength of concrete due to variation in the difference fine and coarse aggregate gradation origin rivers Way Custody, City Attorney of compressive strength of normal concrete limitation.Problem To facilitate the implementation of this study, the boundary problem in this study,asfollows: Concrete mix design in this study using SNI.T-15- 1990-03 with compressive strength (fc) of 25 MPa concrete plan. Using materials, coarse aggregate and fine aggregate origin of River Way and sand Balak Tanggamus Mount Sugih origin. The cement used cement PCC Rock Raja.Pengujian brand strength of concrete is done at the age of 7, 14 and 28 days previously done soaking the specimen to specimen treatment with the hope of hydration of cement concrete is going well.

Research Objectives The purpose of this study was to determine differences in the strength of concrete produced with a variety of aggregate mixture.Benefits of Research Adding the value of coarse aggregate functions and fine aggregate origin rivers Way Balak contained in City Attorney, Tanggamus, Lampung as the material for the manufacture of concrete structures with a certain quality.

2. LITERATURE

Concrete is a material made from a mixture of fine aggregate (sand), coarse aggregate (gravel), water and Portland cement or other hydraulic binders similar, by using or not using the other added ingredients.

(SK.SNI T-15-1990-03: 1). The compressive strength of concrete is relatively high compared to its tensile strength, concrete is a brittle material. Nawy (1985) in the book Mulyono (2003) defines concrete as a set of mechanical and chemical iteraksi of its constituent materials. To achieve the compressive strength of concrete need be concerned density and mass violence, generally more dense and hard aggregate mass will be higher strength and durability of its (resistance to deterioration and under the influence of the weather). It required agraded composition of good grain. The compressive strength of concrete is achieved is determined by the quality of this granular material (Dipohusodo, 1994).

The parameters that most affect the strength of concrete is:

a) The quality of the cement,

b) The proportion of the mix,

c) The strength and cleanliness of the aggregate,

d) The interaction or adhesion between the cement paste with aggregate,

e) sufficient mixing of concrete-forming materials, f) correct placement, settlement and compaction of concrete,

g) Maintenance of concrete, and

h) the chloride content does not exceed 0.15% in the exposed concrete and 1% for concrete not exposed (Nawy, 1985) In the book Mulyono (2003).

Besides the quality of the constituent materials, the quality of implementation becomes important in the manufacture of concrete. The quality of the construction work is strongly influenced by the implementation of concrete work (Jackson, 1977) in Mulyono (2003), as well as Murdock and Brook (1991) who said: "The skills of labor is one of the important factors in the production of a quality building, and the key to success to obtain skilled labor is for knowledge and appeal to the work that is being done ".

MaterialsConcreteMakers

1. Portland Cement Cement is an essential connective material and widely used in the physical development in the civil construction sector. If you add water, cement will be the cement paste. If plus fine aggregate, cement paste mortar that will be combined with the coarse aggregate will be a mix of fresh concrete after the concrete hardens will be hard (concrete)(Mulyono,2003).

2. Aggregate Aggregate is the main ingredient in addition to the concrete forming the cement paste. Levels of aggregate in the mixture ranges from 60-80% of the total volume of concrete. Therefore the quality of the aggregate effect on the quality of concrete (Nugroho, 1983). The use of aggregate aims to give shape to the concrete, giving the violence that can support the weight, scratch and weather, control the workability, as well as to be more economical because it saves the use of cement. Aggregate concrete mix used dibadakan into two types of fine aggregate and coarse aggregate.

3. Water Water is an ingredient in concrete that is very important. To react with the cement, the water is only required 25%oftheweightofcementalone. How to Test Fresh Concrete Testing Slump, truncated cone-shaped creation "Abrams" to dilute concrete.Planning Mixed Concrete The plan aims to determine the mix of the number of parts of each ingredient, inthiscase of cement,sand and coral.

Calculation of Proportion of Concrete

1. Average Compressive Strength The Targeted Required concrete compressive strength (f'c) is the compressive strength specified by the planner while the compressive strength of concrete structures targeted (f'cr) is the average compressive strength is expected to be achieved and the value is greater than f'c. Steps to determine the average compressive strength of targeted are as follows:

a. Determine the standard deviation Standard deviation values obtained from the test results of concrete by using the following formula:

$$s = \sqrt{\frac{\Sigma_1^N (f_c - f_{cr})^2}{N-1}}$$

where:

s = standard deviation

fc = compressive strength of each test results (MPa)

FCR = concrete compressive strength average (MPa)

N = number of compressive strength test results (minimum of 30 specimen).The data of the test results will be used to calculate the standard deviation should be:

• Representing the materials, quality control procedures, and conditions similar to the production of the proposed work.

• Representing the required concrete compressive strength f'cwhose value is within ± 7 F'c MPa from the value specified.

• At least consist of 30 consecutive test results or test results of two groups for a period of not less than 45 days.

• When a concrete production does not have the data of 30 test results, but only as much as 15 to 29 test results in a row, then the standard deviation is multiplicative standard deviation values calculated from the data of the test results by a factor of Table2.1.

• If the field test data to calculate the standard deviation is less than 15, then the average compressive strength of the targeted f'cr should be taken not less than (f'c + 12) MPa.

Table 2.1 Standard Deviation Multiplier Factor

Number of Tests	Multiplier factor deviation satndar
15	1,16
20	1.08
25	1.03
30 or more	1,00

Source: Table

1. SK.SNI.T-15-1990-03

b. DeterminingValueAdded(Margin) The added value is determined using the following formula:

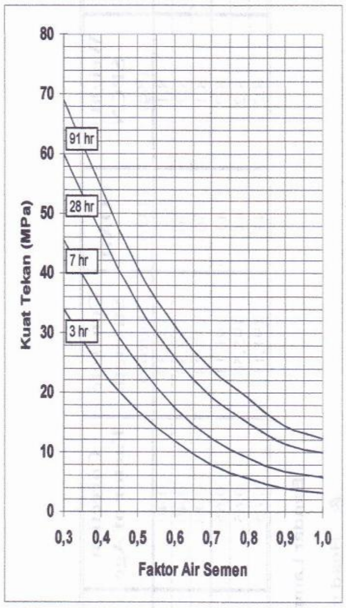
M = kxs ....(2.2) Where:
M = value added (margin)
k = statistical constant whose value depends on the percentage of test results were more lower than f'c, in this case taken 5% so that the value of k = 1.64 s = standard deviation

c. Determining Average Compressive Strength The Targeted Average compressive strength of the targeted determined by the following formula:

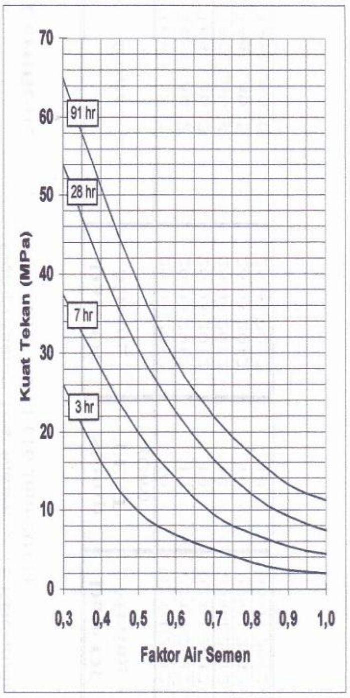
f'cr = f'c + M .... (2.3)

f'cr f'c = +1.64. s .... (2.4)

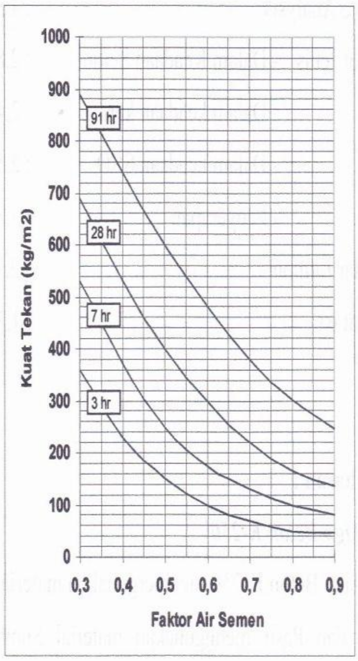
2. TheWaterFactorCement Factor is the number of water-cement ratio between the weight of free water content and weight of cement content in concrete. Factors water cement required to achieve an average compressive strength were targeted based on:



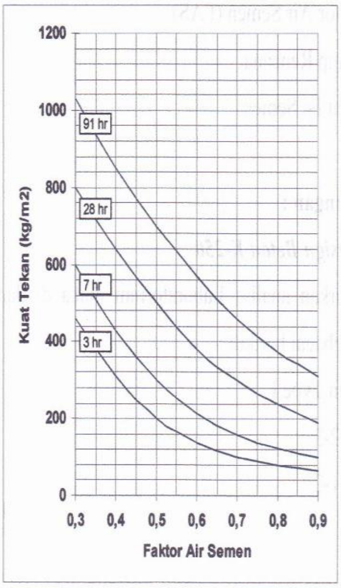
Gambar 2.2 Grafik Nilai Faktor Air Semen Untuk Benda Uji Berbentuk Silinder Dan Jenis Semen Tipe III (Sumber: Grafik 1, SK.SNI.T-15-1990-03)



Gambar 2.1 Grafik Nilai Faktor Air Semen Untuk Benda Uji Berbentuk Silinder Dan Jenis Semen Tipe I / II / V (Sumber: Grafik 1, SK.SNI.T-15-1990-03)



Gambar 2.3 Grafik Nilai Faktor Air Semen Untuk Benda Uji Berbentuk Kubus Dan Jenis Semen Tipe I / II / V (Sumber: Grafik 2, SK.SNI.T-15-1990-03)



Gambar 2.4 Grafik Nilai Faktor Air Semen Untuk Benda Uji Berbentuk Kubus Dan Jenis Semen Tipe III (Sumber: Grafik 2, SK.SNI.T-15-1990-03)

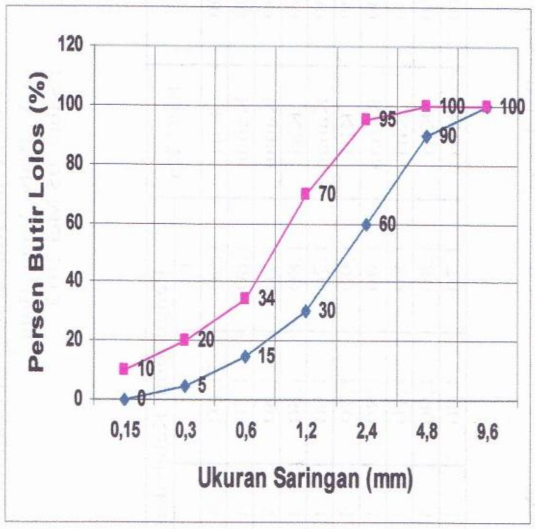
3. Values Slump The use of concrete is very popular nowadays used for a variety of constructions such as the manufacture of floor plates, columns, foundations, dams and others. In the implementation, these sections do not have the same level of workability, therefore, the more dilute the concrete is often used for a variety of constructions that have reinforcement spacing or distance between the reference mold narrow, with the intention that the concrete fills the entire mold with solid the help of vibrator. On the contrary conditions can be used more viscous slurry. In general, normal concrete workability of cement is influenced by water. If a high water-cement factor is high but the workability of concrete quality is reduced, whereas when a low water-cement factor becomes lower with the workability of concrete quality increases.

Slump is a measure of the viscosity of the concrete, which is expressed in mm and was determined using the cone Abram. Slump is set in accordance with the conditions of implementation of the work in order to obtain easy-poured concrete, compacted and leveled (Mulyono, 2004, P88). In addition, the slump is also often used as a reference in determining the level of workability.

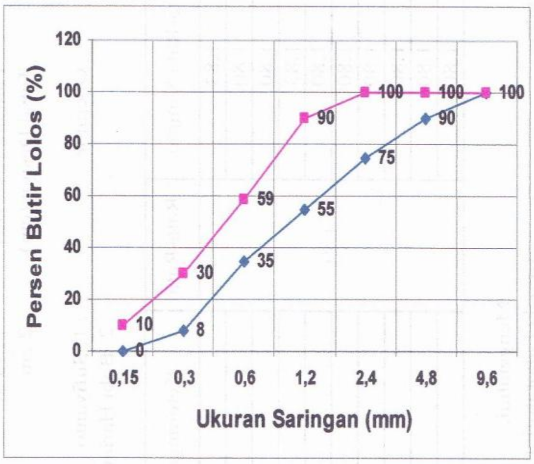
Great value in the design slump grouped into four, namely:
a. 0-10 mm (very low workability)
b. 10-30 mm (low workability) c. 30-60 mm (medium workability) d. 60-180 mm (high workability)
In the design of the concrete mix, a big slump value needs to be planned carefully as it affects the quality of concrete is also the ease of workmanship (workability). The determination is based on consideration of the slump value manufacturing operation, modes of transport, pouring and compacting concrete.

4. Maximum Aggregate Size The maximum aggregate size are grouped into three, namely:
   a. The maximum aggregate size of 10 mm.
   b. The maximum aggregate size of 20 mm.
   c. The maximum aggregate size of 40 mm.

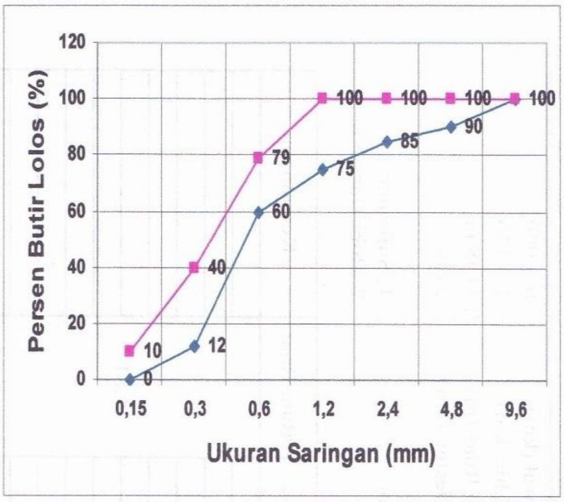
5. Regional Fine Aggregate Gradation SK.SNI.T-15-1990-03 provide gradation requirements for fine aggregate were adopted from the British Standard (BS 812). Gradation of fine aggregate gradation grouped into four areas, namely area 1, area 2, area 3 and area 4.



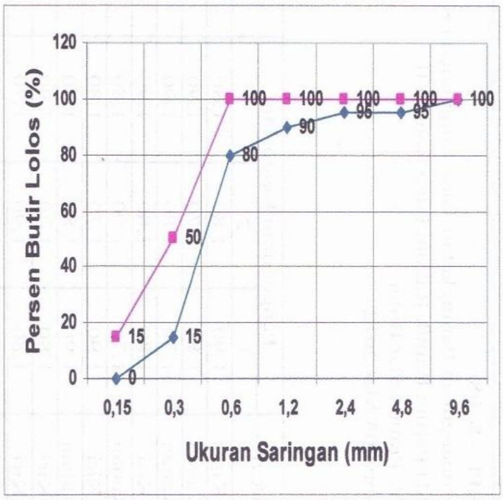
Gambar 2.5 Kurva Gradasi Agregat Halus Daerah 1 (Sumber: Grafik 3, SK.SNI.T-15-1990-03)



Gambar 2.6 Kurva Gradasi Agregat Halus Daerah 2 (Sumber: Grafik 4, SK.SNI.T-15-1990-03)



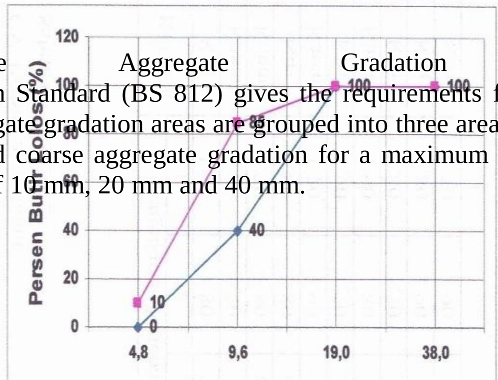
Gambar 2.7 Kurva Gradasi Agregat Halus Daerah 3 (Sumber: Grafik 5 SK.SNI.T-15-1990-03)

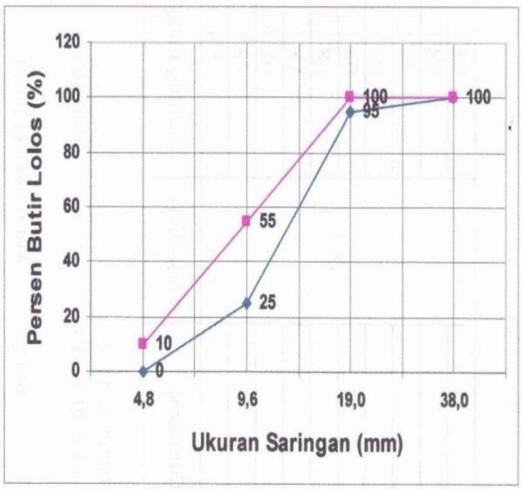


Gambar 2.8 Kurva Gradasi Agregat Halus Daerah 4 (Sumber: Grafik 6, SK.SNI.T-15-1990-03)

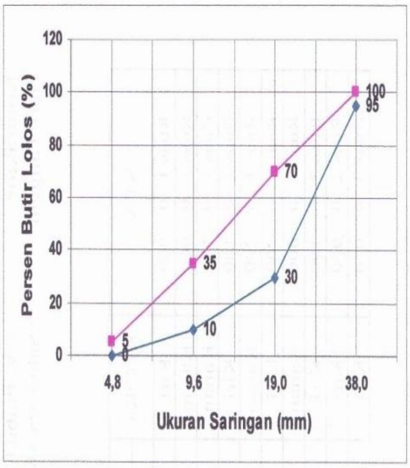
Coarse Aggregate Gradation area

British Standard (BS 812) gives the requirements for coarse aggregate gradation areas are grouped into three areas, namely graded coarse aggregate gradation for a maximum aggregate size of 10 mm, 20 mm and 40 mm.



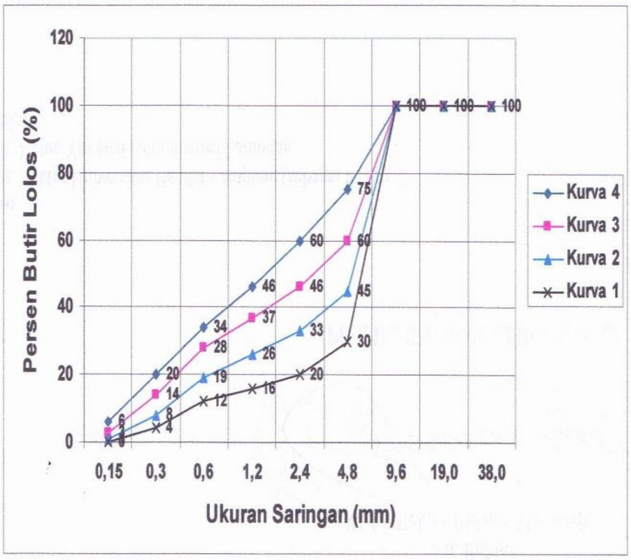


Gambar 2.10 Kurva Gradasi Agregat Kasar Untuk Ukuran Agregat Maksimum 20 mm (Sumber: BS 812)

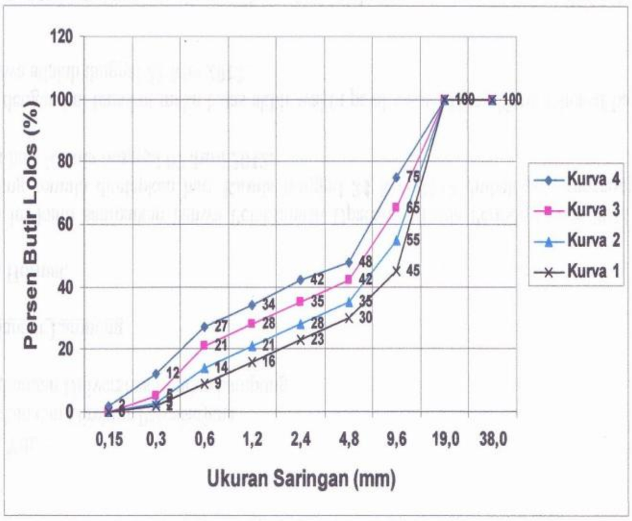


Gambar 2.11 Kurva Gradasi Agregat Kasar Untuk Ukuran Agregat Maksimum 40 mm (Sumber: BS 812)

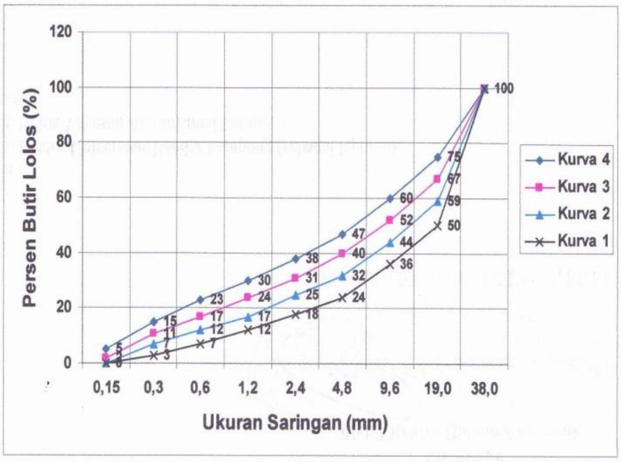
7. Regional Aggregate Gradation Mixtures The area is a mixture of aggregate gradation of the combined aggregate gradation areas of fine and coarse aggregate according to the maximum aggregate size. Standard-15- 1990-03 SK.SNI.T provide local requirements for aggregate gradation mix adopted from the British Standard (BS 812). Mixture aggregate gradation areas are grouped into 3 regions, namely graded aggregate gradation mixture to a maximum aggregate size of 10 mm, 20 mm and 40 mm.



Gambar 2.12 Kurva Gradasi Agregat Campuran Untuk Ukuran Agregat Maksimum 10 mm (Sumber: Grafik 7, SK.SNI.T-15-1990-03)



Gambar 2.13 Kurva Gradasi Agregat Campuran Untuk Ukuran Agregat Maksimum 20 mm (Sumber: Grafik 8, SK.SNI.T-15-1990-03)



Gambar 2.14 Kurva Gradasi Agregat Campuran Untuk Ukuran Agregat Maksimum 40 mm (Sumber: Grafik 9, SK.SNI.T-15-1990-03)

Concrete Compressive Strength Concrete compressive strength, among others, depends on: water-cement factor, graded rock, rock shapes, the maximum size of the rock, the way it (the mix, transport, compaction and maintenance) and the age of the concrete (Tjokrodimuljo, 1996). Under Indonesian Rule Reinforced Concrete (PBI, 1989),the magnitude of the compressive strength of concrete can be calculated by the formula:

f'c = P / A
by: f'c = compressive strength of concrete
P = maximum compressive load
A = surface area of the test specimen

Research methodology The research was carried out experimentally, which is conducted at the Laboratory of Civil

Engineering University of Bandar Lampung. Tests performed after the concrete compressive strength was 7.14 and, 28 days with the implementation of the research:

Examination Levels of Mud Sand This examination is intended to determine the content of the mud in the sand aggregate experience both before and after washing.

Examination of fine grainmo dulus This examination is intended to determine the distribution of aggregate coarse grain and fine aggregate by using a sieve.

Examination of Specific Gravity and Absorption of Aggregate This examination is intended to determine the weight of saturated surface dry (SSD) and absorption of the aggregate.

Examination of Aggregate Volume Weight This examination aims to determine the aggregate weight per unit volume.

Slump Tests Slump Tests performed using the Abrams cone test is done to determine the level of workabilitas (ease of workmanship) of concrete mix that has been made. Abrams cone inner tube moistened with water and put on top of the steel plate. Fresh concrete cone is inserted into the tube and 1/3 volume each pierced 25 times with a steel pestle until the full contents of the Abrams cone. Leveled concrete surface and allowed to stand for 0.5 minutes, then funnel cone slowly lifted vertically with no horizontal force. Conical tube placed next to it, the measurement is performed from the highest slump of fresh concrete to the upper end of the Abrams cone. The value obtained is the value of the slump, slump depiction of test values in Figure 3.2.

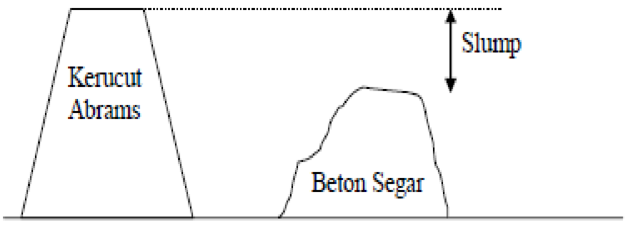


Figure 3.2 Measurement of the value of the slump Preparation of Tes tObjects In this research a 36 cube-shaped specimens using a cylindrical mold with a size of φ 15 - h 30 cm, with the details as shown in Table 3.2 Table 3.2 Number of test specimens

age Testing (days)	**Sample code**	amount Test objects	Size Test Objects
7	BN	3	Φ 15 – h 30 cm
	BM1	3	Φ 15 – h 30 cm
	BM2	3	Φ 15 – h 30 cm
14	BN	3	Φ 15 – h 30 cm
	BM1	3	Φ 15 – h 30 cm
	BM2	3	Φ 15 – h 30 cm
28	BN	3	Φ 15 – h 30 cm
	BM1	3	Φ 15 – h 30 cm
	BM2	3	Φ 15 – h 30 cm
Test object total		36	

Nursing Test Objects Treatment is intended that the specimen surface is always moist fresh concrete until the concrete is considered quite hard. Humidity is maintained to ensure the cement hydration process went perfectly.Testing Compressive Strength Test Objects Tests performed after the specimen reaches the age of 7, 14 and 28 days.

3.RESULTS

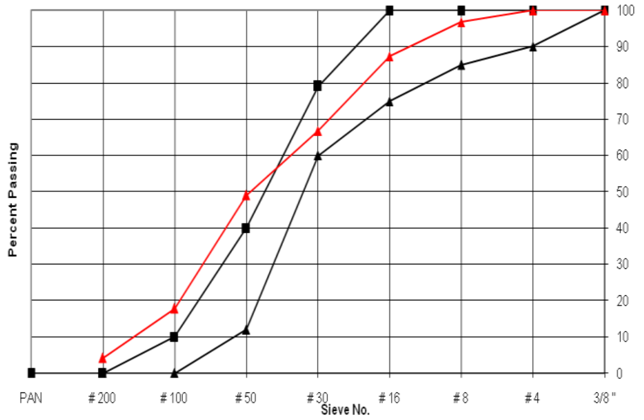
test Materials Test material is intended to determine the initial data regarding the material to be used. The types of tests performed include:

1. Testing the specific gravity and absorption of coarse aggregate and fine aggregate,
2. Testing the heavy volume of coarse aggregate and fine aggregate,
3. Testing gradation of coarse aggregate and fine aggregate,
4. Testing mud levels of coarse aggregate and fine aggregate,
5. Testing the wear of coarse aggregate.

type Testing	Sand	coral
type Testing density Absorption (%) Fill Weight (kg / cm3)	2,45 2,38	2,59 0,40
type Testing density	1,48	1,49
type Testing density Absorption (%) Fill Weight (kg / cm3)	3,72 -	- 20
type Testing density	2,74	1,73
type Testing density	-	11,34

Aggregate Testing Results

Source: Research



Fine Aggregate Gradation curves of Origin Mount Sugih

In the image above, the grading of sand does not meet the requirements of a concrete mixture regional group III

Table. 4.4. Gradation mixture of 50% river sand and 50% Balak Way Sand Mount Sugih

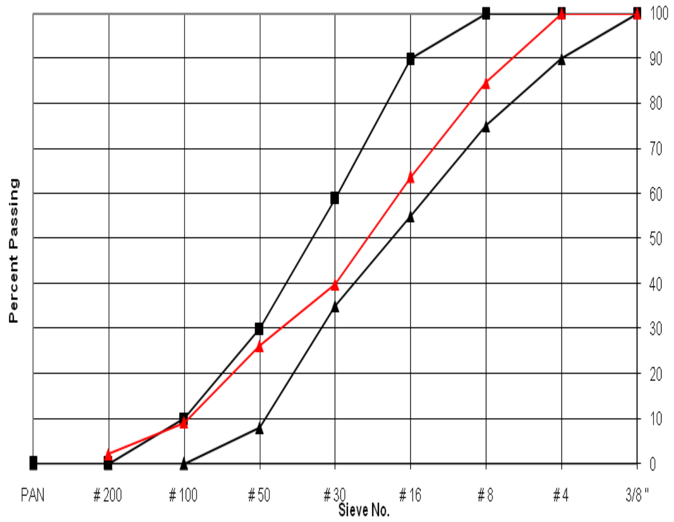
Filter		weight restrained	accumulation weight restrain	accumulation weight restrain	percentage weight get	Spesification	
Inch/No.	mm	(gr)	(gr)	(%)	(%)	Min	Max
3/8 "	9,5	0	0	0,0	100,0	100,0	100,
# 4	4,75	0	0,0	0,0	100,0	90,0	100,
# 8	2,36	230,13	15,4	15,4	84,6	75,0	100,
# 16	1,18	312,37	20,9	36,3	63,7	55,0	90,0
# 30	0,60	355,80	23,8	60,1	39,9	35,0	59,0
# 50	0,30	204,99	13,7	73,8	26,2	8,0	30,0
# 100	0,15	254,66	17,0	90,9	9,1	0,0	10,0
TOTAL		1494,7		276,5			

Calculation of Modulus Fine Grain =

$$\frac{\%\ Komulatif\ Berat\ Tertahan}{\%\ Berat\ Tertahan}$$

$$= \frac{276{,}5}{100} = 2{,}76$$

Gradation curve graph mixture of 50% river sand and 50% Balak Way Sand



Mixture Gradation curves River Way 50% sand and 50% of custody Sand Mountain Sugih

According to Figure 4.3 above, the gradation of the sand meets the requirements of the concrete mix group II areas.

Table. 4.5. Coarse Aggregate Gradation Natural Origin Balak River Way, City Attorney

Filter		weight	accumulation weight restrained	percentage weight	Spesifcation	
Inch/N	mm	(gr)	(gr)	(%)	min	max
1 1/2 "	38,	0	0	100,0	95,0	100,
1 "	25	73700	73700	79,5	62,0	85,0
3/4 "	19	91000	164700	54,3	30,0	70,0
1/2 "	12,	12220	286900	20,3	20,0	52,0
3/8 "	9,5	45200	332100	7,8	10,0	35,0
# 4	4,7	28000	360100	0,0	0,0	5,0
TOTA		36010				

Sumber: Penelitian

Gradation curve graph coral origin Balak River Way, City Attorney can be seen in Figure 4.2 below:

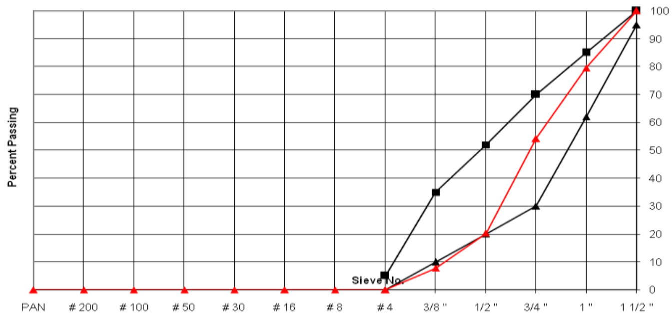


Figure 4.4 Coarse Aggregate Gradation Curve Origin Way Custody

According to Figure 4.4 above, coral gradation does not meet the requirements of the concrete mix to a maximum aggregate of 40 mm.

Table. 4.6. Gradation of coarse aggregates origin Balak RiverWay,Great city which has modified by the addition of filter aggregate 3/8 "and sieve no # 4

Filter		weight restrained	accumulation weight restrained	accumulation weight restrained	percentage weight get away	Spesifcation	
Inch/No.	mm	(gr)	(gr)	(%)	(%)	mi	max
1 1/2 "	38,1	50700	50700	22,7	77,3	62,	85,0
1 "	25	49000	99700	44,7	55,3	30,	70,0
3/4 "	19	50200	149900	67,2	32,8	20,	52,0
1/2 "	12,5	45200	195100	87,4	12,6	10,	35,0
3/8 "	9,5	28000	223100	100,0	0,0	0,0	5,0
# 4	4,75	50700	50700	22,7	77,3	62,	85,0
TOTAL		22310					

Sumber: Penelitian

Gradation curve graph coral origin Balak River Way, City Attorney that has been modified by the addition of filter aggregate 3/8 "and sieve no # 4 can be seen in Figure 4.2 below:

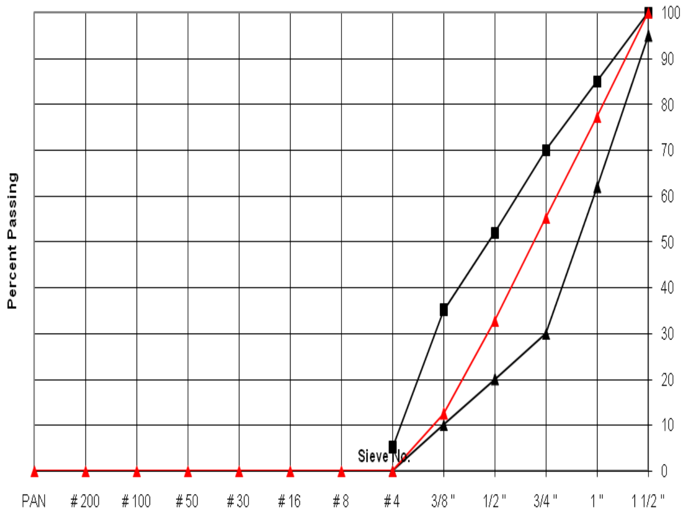


Figure 4.5 coarse aggregate gradation curve origin rivers Way Custody, City Attorney that has been modified with the addition of aggregate sieve 3/8 "& sieve no # 4

4. CONCLUSION

Having held the stage of manufacture of the test specimen, specimen immersion in water, the compressive strength testing of concrete cylinders, as well as the analysis has been done, finally this study several conclusions can be drawn as follows:

1. The addition of finer aggregate in the concrete mix effect on the increase in compressive strength.
2. The fine aggregate used, the smaller the value slumpnya
3. The strength of coarse aggregate in this study can not withstand the compressive load. Because the testing of compressive strength test specimens in this study did not loose coarse aggregate plastered by mortar.
4. Sand smooth the variation of BM 2 improve the quality of concrete because it serves as a pore filler that can not be filled by coarse sand
5. Variations in the concrete mix in this study as a whole did not reach compressive strength plan.

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