Plagiarism Checker X Originality Report

Similarity Found: 12%

Date: Wednesday, June 17, 2020
Statistics: 318 words Plagiarized / 2688 Total words
Remarks: Low Plagiarism Detected - Your Document needs Optional Improvement.

MORPHOLOGY AND COMPOSITE CHARACTERISTICS OF LIGHTWEIGHT CONCRETE WITH STYROFOAM FILLING MATERIALS

1st Novizal
Faculty of Industrial Engineering
University of Bhayangkara Jaya Raya
Jakarta, Indonesia
novizal@dsn.ubharajaya.ac.id 3rd Fauzi
Faculty of Industrial Engineering
University of Bhayangkara Jaya Raya
Jakarta, Indonesia
fauzi_pf07@yahoo.co.id 2nd Joniwarta
Faculty of Industrial Engineering
University of Bhayangkara Jaya Raya
Jakarta, Indonesia
jonoworto@gmail.com 4thMutia Anissa Marsya
Faculty of Industrial Engineering
University of Bhayangkara Jaya Raya
Jakarta, Indonesia
mutianissya@gmail.com

Abstract - Concrete is made which is a material commonly used for construction and structures in buildings, concrete has many advantages compared to other building materials. However, concrete has one weakness, namely the specific gravity is high enough so that the dead load on a structure becomes large.

Several methods can be used to reduce the concrete density, including using lightweight aggregates. One method to make lightweight concrete is by adding Styrofoam waste materials. However, this specific weight reduction is not followed by the addition of concrete compressive strength, so that until now lightweight concrete using Styrofoam is only used for non-structural parts.

For this purpose, it is made to find out how much the influence of Styrofoam as a substitute for coarse aggregate on Concrete with the addition percentage of Styrofoam by 0%, 15% and 35%, and 50% of the weight of the Concrete mixture. From the results of observations of mixing concrete with styrofoam, the morphology was also performed using SEM Keywords - stryofoam, weight of concrete volume, compressivestrength, morphology INTRODUCTION Concrete is part of the development component in the field of construction, technological progress and the economic crisis that occurred in Indonesia, directing infrastructure development in the use of structures with lightweight materials.

But overall it does not have an impact on increasing the strength of the structure [1]. In the modern era shows the development of the use of lightweight material as a structure-forming material will reduce the total weight of a building, thereby reducing the supporting parts and foundations such as in the construction of housing, offices, hospitals and so on.

The development of building construction at this time is influenced by the high global warming, resulting in issues that require, concrete manufacturing technology innovation to answer the challenges of need, including environmentally friendly, thus making construction experts compete in carrying the green building concept. One way to apply the concept of green building is to reuse used material or waste as building materials. This will reduce costs and increase waste usage.

By using Styrofoam in the concrete mixture, the total weight of the concrete will be lighter and the use value of styrofoam will increase, but this will affect the strength of the concrete or along with the addition of styrofoam to the concrete mixture. Based on the above, experimental research on "MORPOLOGY AND CHARACTERISTICS OF COMPOSITE LIGHTWEIGHT CONCRETE WITH STYROFOAM FILLING MATERIALS" was conducted to evaluate how much influence Styrofoam has in concrete mixes.

The characteristics referred to are morphology from the effect of the mixture with the ratio of styrofoam to the concrete volume which varies from 0%, 15%, 35% and 50%, keeping it analyzed using SEM. LITERATURE REVIEW Definition and Characteristics of Concrete Concrete is a mixture consisting of sand, gravel, broken stone or other aggregates which are mixed together with a paste made of cement and water to form a rock-like mass. (SNI-03-2847-2002).

Some factors that influence the strength of concrete are concrete mix materials, methods of preparation, maintenance and the circumstances at the time of the experiment. Each concrete mix material has a variety of properties that are influenced by several natural factors that cannot be avoided, but by knowing the properties of raw materials, it can be known the needs of each raw material and some of the strengths achieved [4].

As the age increases, the concrete will harden and will reach the strength of the plan at 28 days. Concrete can be divided into 3 types based on volume weight, namely: a) Light concrete: volume weight <1,900 kg / m^3 b) Normal concrete: volume weight of 2,200 kg / m^3 - 2,500 kg / m^3 c) Heavy concrete: voume weight> 2,500 kg / m^3: Styrofoam Lightweight Composite Materials The use of other materials that have a light weight in a concrete mixture will reduce the overall weight of the concrete.

The lightweight concrete constituent material used in this study is PCC cement, coarse and fine aggregate, water, and styrofoam with different variations in the ratio of 0%, 15%, 35%, and 50% of the overall concrete volume. Styrofoam or foam plastic is still included in the plastic group. Generally Styrofoam (polystyrene foam) is white.

Styrofoam is a plastic material that has special properties with a structure composed of granules with low density, has a light weight, and there is space between granules that contain air that cannot deliver heat, so this makes it a good heat insulator. Properties of Styrofoam a) Has a relatively light specific gravity. b) Resistant to acids, bases, and corrosive substances. c) Has a melting point at a temperature of 1020-1060 C. d) Able to withstand heat.

e) Can slow the onset of panashidrasi f) Can reduce the earthquake load which works smallerbecause the weight of the concrete structure decreases.[2]. RESEARCH METHODOLOGY Research Flow Chart The experiments carried out in the laboratory with the implementation stages in outline can be seen in the flow chart below, where the experimental steps are described in the form of Fowchart.

The material is prepared for mixing by calculating the volume co-composition of the concrete composition material in cubic by using a volume ratio of 1000 kg / m3, taken from the basic composition of the concrete mix plan. [4]. Table.3.1.Concrete material composition with a composition of weight (kg) No _Type of Material Concrete _Normal concrete _15% Styrofoam Concrete _Styrofoam concrete 35% _50% styrofoam concrete _ _1 _Water (kg) _42,8 _42,8 _42,85 _42,85 _ _2 _Cement (kg) _181,4 _181,4 _181,4 _181,4 _ _3 _Sand (kg) _999,9 _849,9 _649,9 _407,2 _ _4 _Gravel (kg) _257,3 _218,5 _167,1 _128,561128 _ _5 _Styrofoam (kg) _0 _2,87 _6,6 _9,5 _ _ RESEARCH RESULT From the results of testing concrete construction materials obtained data that plays a good role in the calculation of the composition of concrete composers also for the calculation of hardness and pull of concrete .. In table 4.1.

listed concrete construction materials that have been tested: Table 4.1. Test Data for Concrete Composite Testing type _Type of material _ _ _Cemen _Sand _gravel _Styrofoam _Water _ _Specific gravity _3,15 _2,4 _2,49 _0,0236 _1 _ _Volume weight _1,27 _1,4 _1,8 _0,0223 _0,98 _ _ from the results of this test, the required data is obtained as a variable density and volume weight which is the basis of the composition Gradasi GabunganAgregat

Figure 3.1 Flowchart of Research Figure 4.1

Graph of aggregate aggregation gradtions From the results of the combination of mixed materials for concrete production there is a combined gradation that gives effect to the strain value and the compressive strength of the concrete made. Material composition Concrete made for 1 m3 required the composition of materials arranged in a ratio of 1: 5: 1 and 0 as shown in table 4.2 [5].

Table 4.2.

Composition of material requirements for concrete mix for 1 m3

Comparison of composition Concrete mixture _Concrete Mixture Composition (kg) _ _Concrete mass (kg) _ _ _cemen _Sand _gravel _Styrofoam _Water _ _ _ _1 _5 _1 _0 _ _ _ _1 : 5.0 : 1.0 : 0 _181,42 _999,99 _257,13 _0 _42,85 _1481,39 _ _1 : 4,25 : 0,85 : 0,90 _181,42 _849,99 _218,57 _2,87 _42,85 _1295,7 _ _1 : 3,25 : 0,65 : 2,10 _181,42 _649,99 _167,15 _6,69 _42,85 _1048,1 _ _1 : 2,50 : 0,5 : 3,00 _181,42 _407,29 _128,56 _9,55 _42,85 _769,67 _ _

Table 4.3.

The composition of the mixture of concrete constituent materials (kg)

_ _ _ _ _ _ _ _Comparison of composition Concrete mixture _Concrete Mixture Composition (kg) _Concrete mass _ _ _Cemen _Sand _gravel _Styrofoam _Water _(kg) _ _1: 5.0 :1.0 : 0.0 _0,73 _3,99 _1,03 _0 _0,17 _5,92 _ _1 : 4,25 : 0,85 : 0,90 _0,73 _3,39 _0,87 _0,012 _0,17 _5,172 _ _1 : 3,25 : 0,65 : 2,10 _0,73 _2,59 _0,67 _0,027 _0,17 _4,187 _ _1 : 2,50 : 0,5 : 3,00 _0,73 _1,63 _0,51 _0,038 _0,17 _3,078 _ _

To determine the needs of concrete constituent materials per piece of concrete made the concrete shape that we want, and has been done and made with the size of the building and composition with the data below: Dimensions of Concrete: 10 x 10 x 40 cm for Beams with a volume of 4000 cm3 is equivalent to 0.004 m3. For making 12 concrete, the required volume is 0.004 x 12 = 0.048 m3.

So that many needs based on the composition of the concrete mixture per fruit are listed in table 4.4. [5]

Tabel 4.4 Composition of Concrete Mixtures (kg) for 12 concrete Beams.

Comparison of the composition of the Concrete mixture _Cemen _Sand _gravel _Styrofoam _Wate _Massa Beton (kg) _ _1 : 5.0 : 1.0

: 0 _8,76 _47,88 _12,36 _0 _2,04 _71,04 _ _1 : 4,25 : 0,85 : 0,90 _8,76 _40,68 _10,44 _0,144 _2,04 _62,064 _ _1 : 3,25 : 0,65 : 2,10 _8,76 _31,08 _8,04 _0,324 _2,04 _50,244 _ _1 : 2,50 : 0,5 : 3,00 _8,76 _19,56 _6,12 _0,456 _2,04 _36,936 _ _

For 12 pieces of concrete needed to be tested, the volume of constituent material is required = 0.048 m3 and the composition of the requirements is shown in table 4.10.

To determine the needs of concrete constituent materials per piece of concrete made the concrete shape that we want, and has been done and made to the size of the building and composition with the data below: Dimensions of Concrete dimensions: 10 x 20 cm for Cylinders with volume V = 1/4 p D ^ 2 t = 1570 ?cm? ^ 3 is equivalent to 0.001570 m3. For the manufacture of 45 cylindrical concrete, the required volume is 0.001570 x 45 = 0.07065 m3.

So that many needs based on the composition of the concrete mixture per fruit are listed in table 4.6. [6].

Table 4.5. Cylinder Concrete Composition (kg) Comparison of the composition of the Concrete mixture _Cement _Sand _Gravel _Styrofoam _Water _Concrete mass (kg) _ _1 : 5.0 : 1.0

: 0 _0,28 _1,57 _0,40 _0 _0,067 _2,25 _ _1 : 4,25 : 0,85 : 0,90 _0,28 _1,33 _0,34 _0,0045 _0,067 _2,02 _ _1 : 3,25 : 0,65 : 2,10 _0,28 _1,02 _0,26 _0,0105 _0,067 _1,63 _ _1 : 2,50 : 0,5 : 3,00 _0,28 _0,64 _0,20 _0,0150 _0,067 _1,20 _ _ Table 4.6. Cylinder Concrete Composition (kg) for 45 Concrete Comparison of the composition of the Concrete mixture _Cement _Sand _Gravel _Styrofoam _Water _Concrete mass (kg) _ _1 : 5.0 : 1.0

: 0 _12,6 _70,65 _18,0 _0 _3,015 _104,265 _ _1 : 4,25 : 0,85 : 0,90 _12,6 _59,85 _15,3 _0,20 _3,015 _90,965 _ _1 : 3,25 : 0,65 : 2,10 _12,6 _45,90 _11,7 _0,47 _3,015 _73,685 _ _1 : 2,50 : 0,5 : 3,00 _12,6 _28,80 _9,0 _0,67 _3.015 _54,085 _ _

Table 4.7 Average Concrete Unit Weight Test Results Styrofoam Volume (%) _Mass of Average Beam Concrete Unit (kg / m3) _Average Cylinder Concrete Unit mass (kg / m3) _Reduction (%) _ _ _ _ _Balok _Silinder _ _0 _5,920 _2,25 _0 _ _ _15 _5,172 _2,02 _0,12 _0,10 _ _35 _4,187 _1,63 _0,29 _0,27 _ _50 _3,078 _1,20 _0,48 _0,46 _ _

Compressive Strength of Concrete Testing the compressive strength of concrete using UTM machines with a capacity of 1000 KN.

The results of the calculation of the average concrete strength can be seen in Table 4.8 Table 4.8 Calculation Results of Concrete Strength (MPa) Styrofoam volume (%) _Test Age (Days) _Average Concrete Strength (MPa) _ _0 _14 21 28 _20,94 24,25 27,74 _ _15 _14 21 28 _12.69 15.10 17.76 _ _35 _14 21 28 _8.21 11.03 13.12 _ _50 _14 21 28 _4.75 4.94 5.26 _ _ The weight inspection of concrete units is carried out when the concrete is 28 days old. Results4.3.

Morphological Results from SEM From the morphological results of the SEM results from Styrofoam mixing of the supporting components of concrete sand and gravel, this material has an effect on the composition composition of the material as shown in figures 4.16, 4.17, 4.18, and 4.19. EDX results from the concrete constituent material show that Styrofoam which amounts to 50% of the overall concrete volume looks more stiff.

[7] Thus the results of 50% styrofoam mixture showed that morphology from mixing concrete supporting groups and styrofoam was more dominant. Thus a mixture of 355% styrofoam is seen that the composition of the mixture for 35% styrofoam is seen to occupy less quantity as seen by figure 4.3.

Figure 4.2 Mixing Styrofoam with a composition of 50% Figure 4.3 Styrofoam mixture with a composition of 35% Figure 4.4

Styrofoam mixture with a composition of 15 % Thus a mixture of 15% styrofoam is seen that the composition of the mixture for 15% styrofoam is seen to occupy less quantity as seen by Figure 4.4. Figure 4.5 Styrofoam mixture with a composition of 0 % From the results of SEM, the Styrofoam composition has not played a role in the constituent components of concrete, so there is no morphology of Styrofoam in Figure 4.22. that. CONCLUSIONS AND RECOMMENDATIONS 5.1.

Conclusion The addition of 35% styrofoam from the volume of concrete can be categorized as lightweight concrete with a maximum weight range of 1900 kg / m3. The compressive strength of concrete is influenced by the volume of styrofoam in the concrete mixture. Where the greater the volume of styrofoam, the lower the compressive strength produced.

The compressive strength values ??with 0%, 15%, 35%, and 50% styrofoam volume on average at 28 days were 27.74 MPa, 17.76 MPa, 13.12 MPa, and 5.26 MPa. From the results of the split tensile test, it was found that the greater the volume of styrofoam the lower the split tensile strength produced by the maximum reduction of normal concrete by 62.46% in the volume of 50% styrofoam.

For flexural strength test, the percentage decrease in flexural strength at 15%, 35%, and 50% of styrofoam volume increase on normal concrete blocks was 18.76%, 30.83%, and 44.54% respectively. So that the greater the volume of styrofoam added to the concrete, the lower the value of the flexural strength produced. Morpolgi from styrofoam I concerete constituent material can be seen that styrofoam which amounts to 50% of the overall concrete volume looks more stiff.

[7] ACKNOWLEDGMENTS Experimental work carried out by civilian laboratories assisted by physics and civilian undergraduate students work together in this independent research 2017. BIBLIOGRAPHY [1] K N Lakshmikandhan et al 2017 IOP Conf. Ser .: Mater. Sci. Eng. 225 012275 [2] X Ma University of South Australia J E. Mills University of South Australia [3] Ma, X, Mills, JE 2014, 'Structural performance of composite panels filled with light-weight crumb rubber concrete', in ST Smith (ed.), 23rd Australasian Conference on the Mechanics of Structures and Materials (ACMSM23), vol.

II, Byron Bay, NSW, 9- 12 December, Southern Cross University, Lismore, NSW, pp. 669-674. ISBN: 9780994152008. [4] Eldin, N. and Senouci, A. (1992) "Engineering Properties of rubberized concrete", Canadian Journal of Civil Engineering, Vol. 19, No. 5,

pp. 912-923. [5] Hyder 2012, 'Study into domestic and international fate of end-of-life Tires - Final Report', Hyder Consulting Pty Ltd. Pacheco-Torgal, F., Ding, L.

and Jalali, S. (2012) "Properties and durability of concrete containing polymeric wastes (tire rubber and polyethylene terephthalate bottles): An overview", Construction and Building Materials, Vol. 30, pp. 714- 724. Standards Australia (2011) Structural design actions - wind actions, AS / NZS 1170.2: 2011, Standards Australia.

[6] Pacheco-Torgal, F., Ding, L. and Jalali, S. (2012) "Properties and durability of concrete containing polymeric wastes (tire rubber and polyethylene terephthalate bottles): An overview", Construction and Building Materials, Vol . 30, pp. 714-724. Standards Australia (2011) Structural design actions - wind actions, AS / NZS 1170.2: 2011, Standards Australia. [7] Egerton, R.

F. (2005) Physical principles of electron microscopy: an introduction to TEM, SEM, and AEM. Springer, 202.

INTERNET SOURCES:

---

https://www.researchgate.net/publication/248541980_Influence_of_volume_fraction_and_characteristics_of_lightweight_aggregates_on_the_mechanical_properties_of_concrete
<1% -
http://www.styreneproducts.com/media/files/Expanded%20Polystyrene%20Foam%20(EPF).pdf
<1% -
https://www.govregs.com/regulations/expand/title29_chapterXVII_part1926_subpartD_section1926.50
<1% - https://quizlet.com/231236061/cgs-2060-programming-flash-cards/
<1% - https://precast.org/wp-content/uploads/2015/05/EPD-Wall-Panel.pdf
<1% -
https://www.researchgate.net/publication/272349957_Mechanical_enhancement_of_cement-stabilized_soil_by_flax_fibre_reinforcement_and_extrusion_processing
<1% - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6337087/
<1% - https://thehardhatguy.com/best-cement-mixer/
<1% -
http://journals.tubitak.gov.tr/engineering/issues/muh-04-28-2/muh-28-2-2-0304-5.pdf
<1% -
https://www.researchgate.net/publication/321504928_Estimation_of_Compressive_Strength_of_High_Strength_Concrete_Using_Non-Destructive_Technique_and_Concrete_Core_Strength
<1% -
http://www.tjprc.org/publishpapers/2-11-1394782454-17.%20Civil%20%20-%20IJCSEIERD%20%20--EXPERIMENTAL%20STUDY%20ON%20FOAM%20CONCRETE%20-%20Maheshkumar%20H.%20Thakrele%20-%20Paid%20Copy.pdf
<1% - https://www.sciencedirect.com/science/article/pii/S2352710219324775
<1% - http://people.unisa.edu.au/Julie.Mills
1% - https://epubs.scu.edu.au/acmsm23/39/
1% - https://epubs.scu.edu.au/cgi/viewcontent.cgi?article=1095&context=acmsm23
<1% - https://ce.berkeley.edu/people/faculty/monteiro/publications
<1% - https://www.mdpi.com/2504-477X/3/2/62/htm
1% - https://www.hindawi.com/journals/ace/2020/9693405/
<1% - http://degois.pt/visualizador/curriculum.jsp?key=1300794898489491
1% - https://serc.carleton.edu/research_education/geochemsheets/techniques/SEM.html