WIREMESH REINFORCEMENT CONTRIBUTED FLEXURAL STRENGTH ON WALL PANELS

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by:

NABELLA MAHARANI

D100 122 002

CIVIL ENGINEERING DEPARTMENT

ENGINEERING FACULTY

UNIVERSITY OF MUHAMMADIYAH SURAKARTA

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APPROVAL SHEET

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Has been checked and approved to be tested by:

Supervisor	Co. Supervisor
Muhammad Ujianto, S.T., M.T.	**Yenny Nurchasanah, S.T., M.T.**
NIK. 728	**NIK. 921**

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Hasbeen defended in front of Examiner Council
Faculty of..Engineering.....
University of Muhammadiyah Surakarta
On the day..11th, August.. 2016
and otherwise been eliglible

Examiner :

1.Muhammad Ujianto, S.T. M.T. (.....)
(Supervisor)

2.Yenny Nurchasanah, S.T. M.T. (.....,)
(Co. Supervisor)

3.Budi Setiawan, S.T. M.T. (.....)
(Member)

Dean,

UNIVERSITAS MUHAMMADIYAH SURAKARTA FAKULTAS TEKNIK

Ir. Sri Sunarjono, M.T., Ph.D

NIK. 682

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Surakarta, 11th August 2016

Author

NABELLA MAHARANI

D100 122 002

WIREMESH REINFORCEMENT CAN RISE FLEXURAL STRENGTH ON WALL PANELS

Abstract

Wall is one of the important elements of the building and serves to separate and form a space in residential buildings or storied. After brick and lighweight cooncrete walls to the current development of construction projects have come the use of wall panels. Wall panels are generally made using a concrete mixture like usual (water, fine aggregates, coarse aggregates, cement) and given reinforcement inside. Reinforcement used in this research is wiremesh. The aims of this research are to analizing the value of compressive strength of concrete cylinder, to analyzing flexural strength of wall panels without wiremesh reinforcement, and to analyzing value flexural strength of wallpanels with wiremesh reinforcement The specimen is made with dimension width 50 cm, length 100 cm, and a height of 7 cm for flexural strength testing. Life of concrete that is planned is 28 days. The purpose of this research is to analyze the flexural strength of wall panels with wiremesh reinforcement. In this research there are several stages. The first step is preparation of equipment and materials. The second stage includes the examination of materials, mix design and manufacture of concrete mix. The third stage is the manufacture and maintenance of the test specimen. The fourth stage is testing of compressive strength concrete and flexural strength wall panels. The fifth stage is the data analysis, discussion, and conclusion. Results of lightweight concrete compressive strength is 21, 18 MPa, flexural strength panel walls without reinforcement wiremesh is 3.293 MPa, flexural strength while the wall panels with wiremesh reinforcement is 5.694 MPa.

Keywords : wall panels, wiremesh, flexural strength

Dinding merupakan salah satu elemen penting dari bangunan dan berfungsi untuk memisahkan dan membentuk ruang pada bangunan tempat tinggal atau bertingkat. Setelah batu bata dan dinding beton ringan untuk perkembangan konstruksi telah menggunakan panel dinding. Dinding panel umumnya dibuat menggunakan campuran beton seperti biasa (air, agregat halus, agregat kasar, semen) dan ditambah perkuatan. Perkuatan yang digunakan dalam penelitian ini adalah wiremesh. Tujuan dari penelitian ini adalah untuk menganalisa nilai kuat tekan beton silinder, untuk menganalisis kuat lentur dinding panel tanpa penguatan wiremesh, dan untuk menganalisis nilai kuat lentur dari dinding panel dengan perkuatan wiremesh. Benda uji dibuat dengan dimensi lebar 50 cm, panjang 100 cm, dan tinggi 7 cm untuk pengujian kuat lentur. Umur beton yang direncanakan adalah 28 hari. Tujuan dari penelitian ini adalah untuk menganalisis kekuatan lentur panel dinding dengan tulangan wiremesh. Dalam penelitian ini ada beberapa tahapan. Langkah pertama adalah persiapan peralatan dan bahan. Tahap kedua meliputi pemeriksaan bahan, perencanaan campuran beton. Tahap ketiga adalah pembuatan dan perawatan benda uji. Tahap keempat adalah pengujian kuat tekan beton dan kuat lentur dinding panel. Tahap kelima adalah analisis data, diskusi, dan kesimpulan. Hasil kuat tekan beton ringan adalah 21, 18 MPa, dinding panel kekuatan lentur tanpa tulangan wiremesh adalah 3,293 MPa, kekuatan lentur sedangkan panel dinding dengan tulangan wiremesh adalah 5,694 MPa.

Kata kunci : dinding panel, wiremesh, kuat lentur

1. INTRODUCTION

In the development of more advanced and sophisticated, concrete technology has extensive potential in the field of construction. Concrete is widely used for the construction of buildings, bridges, docks and others. Because the importance of the concrete in construction and therefore a civil engineering is required to be able to create a better concrete innovation.

Making concrete actually quite simple merely mixing the materials to form a mixture which is essentially plastic, as is often seen in the construction of simple buildings. But if you want to make

good concrete and qualify, then it must be considered carefully ways to obtain good fresh concrete mix and produce a good hard concrete as well. A good fresh concrete is fresh concrete that can be stirred, can be transported, pourable, can be compacted, no separation of aggregat and water separation in the mortar. Good hard concrete is concrete that is strong, durable, waterproof, and resistant to wear.

Lightweight concrete is one of the new alternative in concrete technology. Not like regular concrete lightweight concrete has a specific gravity (density) is lighter than concrete in general that weighs less than 1800 kg / m^3 (Tjokrodimuljo, 1996). Because the main advantages of lightweight concrete is in weight, so that when used in high rise building projects will be able to significantly reduce the weight of its own building, which in turn have an impact on the calculation of foundation.

After the brick and lightweight concrete walls to the current development of construction projects have come to the use of panels wall. At the present time more panels wall used in construction compared with the use of a brick wall because of the characteristics of the panel which has a relatively light weight so it is not a heavy load to a construction. The development of wall panels in the world and in Indonesia is characterized by the release of a wide range of products wall panels, precast wall either through fabrication or cast in situ with concrete as the main material. With the characteristics of wall panels that have a relatively light weight will be very useful for areas prone to earthquakes such as in Indonesia, but it also can save costs in construct of a construction. Wall panels are very useful for building a factory where if buildings need expansion, wall panels can be disassembled and reassembled.

Wall panels are generally made using a mixture of normal concrete (water, fine aggregate, coarse aggregate and cement) and given reinforcement inside. Reinforcement used in this research is wiremesh reinforcement. In principle the installation of wiremesh are not much different from the installation of steel reinforcement in general, because of the already woven the more practical installation. Wiremesh reinforcement same strength as compared with conventional steel reinforcement depending on the type and quality used. Treatment and transport processes using wall panels are also easier and lighter, easier to work even with simple equipment and reduce fatigue in the workplace.

Research on the wall flexural strength of this panel aims to analyzing the value of compressive strength of concrete cylinder, analyzing value of compressive strength wall panels without wiremesh reinforcement, and to analyzing value of flexural strength wall panels with wiremesh reinforcement.

2. RESEARCH METHODS

In this research there are 5 stage that is stage one, preparation equipment and material supply.This stage is the stage where the equipment, places and provision of materials to be well prepared in the laboratory so that later do not disrupt research done.

Then Stage two, examination of materials Before mixing the mixture should be made of all materials must be tested according to the specified requirements. Materials fine aggregate, water and cement should be tested properly before mixing the mortar mix to be created At this stage examination is an examination specific gravity and absorption of sand, mud content of sand, fine gradation inspection.

Stage three, mix design and making of test specimens this stage is used for design and making mortar cube wall panels are expected to be eligible. Making the mortar cube is done by trial error to find a mortar expected.

Next Stage four, specimen test this Stage testing samples of the specimen. Tests done is test cube compressive strength testing, the density of mortar, mortar cube compressive strength and flexural strength wall panel at 28 days.

The last is Stage five, analysis and discussion from the results of tests carried out in stage four, then carried out the data analysis. The value of flexural and compresive strength drawn from an average of 5 samples test specimen. The analysis is a discussion of the research results, which can then be made several conclusions from this research.

Table 1. specimen specification

Specimen	Qty	Dimension	Testing
S1	5	D = 15 cm , h = 30 cm	Compressive
SW1	3	(100x50x7)cm	Flexural
SW2	5	(100x50x7)cm	Flexural

. Description : S1 = Concrete cylinder

SW1 = Wall panels without wiremesh reinforcement

SW2 = Wall panels with wiremesh reinforcement

Count of flexural panels to get maximum deflection at load level of two points based on the following equation:

$$\mathrm{MOR} = \frac{\mathrm{PL}}{\mathrm{bh}^2}$$

Description :

MOR = Modulus of Rapture (MPa)

P = Maximum load (N)

L = Length (mm)

b = Width of specimen (mm)

h = Height of specimen (mm)

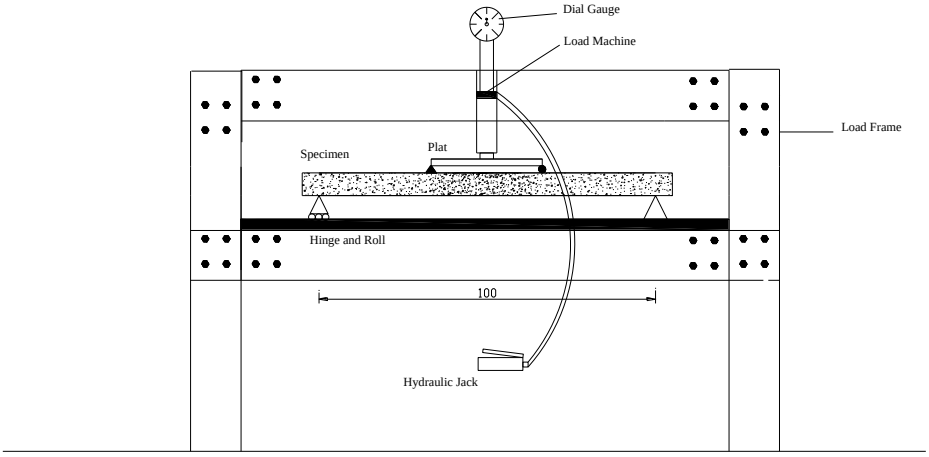

Figure 1. Setting up

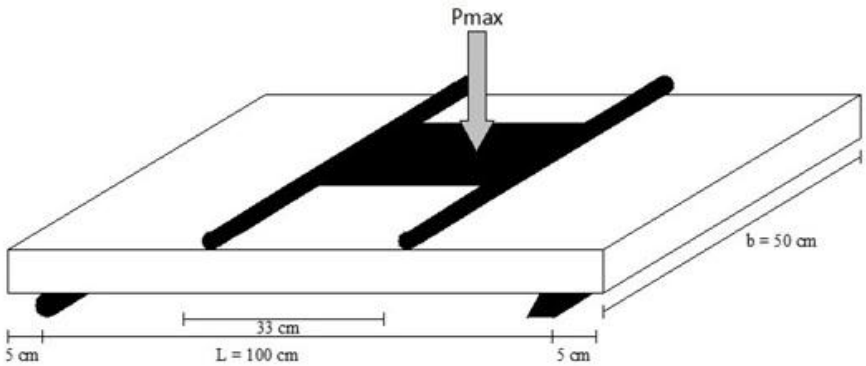

Figure 2. Flexural strength loading

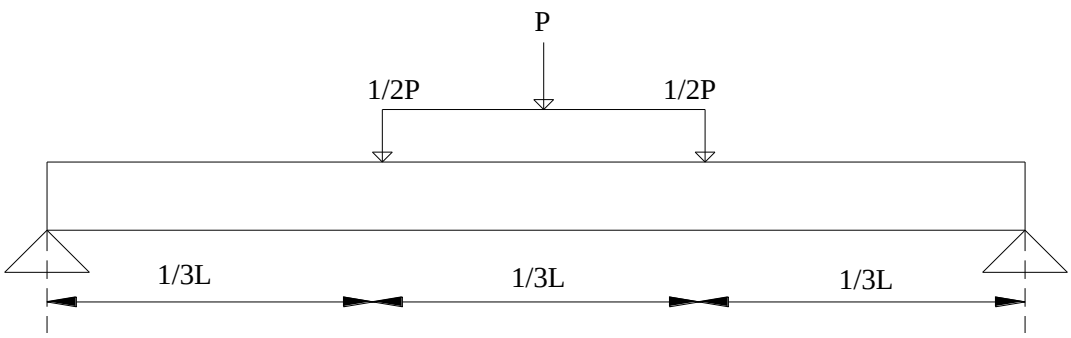

Figure 3. Flexural strength loading test

3. RESULT AND DISCUSSION

Research was conducted to obtain data that is used to discuss the formulation of the problem. Based on the formulation of the problem, then retrieved data compressive strength and flexural strength

wall panels at 28 days. The data is used to determine whether the use of reinforcement in the wall panels will improve the quality.

3.1 Examination of Cement

The cement used in this study is that Holcim cement type I with a size of 40 kg/sack produced by PT. Holcim Indonesia Tbk. In the examination the quality of cement is good condition, do not clot, both in storage and packaging perfectly sealed**.**

3.2 Examination of Fine aggregate

For fine aggregate testing conducted several tests such as organic matter content, mud content, finenes modulus testing, fine aggregate gradation, specific gravity and absorption. Can be seen in table 2:

Table 2. Fine aggregate testing

Examination Testing	Result	Requirement	Description
Organic matter content	No.3 (Orange)	1-5	Recomended by SNI 03-2816-1992
Mud Content	4,2 %	< 5%	Recomended by SNI 03-2816-1992
Specific Gravity of Bulk	2,28	-	
Saturated Surface Dry	3,77	-	
Specific Gravity of Apparent	2,56	-	
Absorption	4,71 %	< 5%	Recomended by SNI 03-1970-2008
Gradation	Area II		Recomended by SNI 03-1968-1990
Finenes Modulus	2,88	1,5-3,8	Recomended by SNI 03-1749-1990

From the result, fine aggregate recomended for a mortar mixture.

3.3 Examination of coarse aggregate

For fine aggregate testing conducted several tests such as Los Angeles test, absorption test, finenes modulus test. Can be seen in table 3:

Table 3. Coarse aggregate testing

Examination	Result	Requirement	Description
Los Angeles test	36,34 %	< 40 %	Recomended by SNI 2417-2008
Density of bulk	1,9	-	
Density of SSD	2,01	-	
Density of apparent	2,08	-	
Absorption	2,8 %	-	Recomended by SNI 1969-2008
Finenes Modulus	7,8 %	5 - 8	Recomended by SNI 03-1968-1990

3.4 Tensile strengthtest of wiremesh

This test is done to determine how is tensile strength wiremesh reinforcement. Result of tensile strength of wiremesh can be seen on Table 4. as follows :

Table 4. Tensile strength of wiremesh

Sample	A (mm2)	Pmax (N)	fs (MPa)	fs average (MPa)
1	22,8906	12077,24	527,607	
2	22,8906	12850,15	561,3724	548,079
3	22,8906	12710,17	555,2572	

From the table above obtained f'_s of wiremesh is 548,079 MPa. This value will contributed to the strength of wall panels that can rise the strength of wall panels.

3.5 Mix Design

In this research is using a mix design with a mix design method in laboraorium. This method is a combination of the way "Road Note 4" and by trial and error. The composition of materials for concrete can be seen in Table 5.

Table 5. Material of mix design

Specimen	Qty	f.a.s	Cement (kg)	Coarse Aggregates (kg)	Fine Aggregates (kg)	Water (lt)
Cylinder	5	0,5	5,9	0,99	0,66	3
Wall panels	8	0,5	14,9	6,65	4,44	7,5

From the table above shown that there were 2 types of speciment, cylinder concrete amount 5 speciment and wall panels amount 8 sample. Materials need for every speciment were explained on the table.

3.6 Slump test

Result of slump test can be seen on Table 6. as follows

Table 6. Slump test

No	Type of concrete	Slump value (cm)
1	Concrete cylinder	10
2	Panels wall without wiremesh reinforcement	10
3	Panels wall with wiremesh reinforcement	10

Speciment with water cement ratio of 0.5 obtained slump test of 10 cm.

3.7 Result of Compressive Syrength of Concrete Cylinder

3.7.1 Density test of concrete cylinder.

Result of density test of concrete cylinder can be seen on Table 7.

Table 7. Density test of concrete cylinder

No.	Weight (gr)	Diameter (cm)	Height (cm)	Volume (cm3)	Density (gr/cm3)	Density average (gr/cm3)
1	10200	15	30,00	5298,75	1,925	
2	10110	15	30,00	5298,75	1,908	
3	9440	15	30,00	5298,75	1,782	1,826
4	9220	15	30,00	5298,75	1,740	
5	9400	15	30,00	5298,75	1,774	

For concrete cylinder speciment obtained the average of density is 1,826 gr/cm^3.

3.7.2 Compressive strength test of concrete cylinder

Result of compressive strength of concrete cylinder can be seen on Table 8. as follows.

Table 8. Compressive strength of concrete cylinder

No.	Load (P)		Area	f'c	f'c average
	(kN)	(N)	mm2	(N/mm2)	(N/mm2)
1	300	300000	17663	21,69	
2	295	295000	17663	21,33	
3	295	295000	17663	21,33	21,18
4	280	280000	17663	20,24	
5	295	295000	17663	21,33	

In this research is used conrete with quality f'c 21,18 N/mm^2 with life of concrete is 28 days.

3.8 Panels Wall Testing Result

3.8.1 Flexural strength test of wall panels without wiremesh reinforcement

Flexural Strength test of wall panels without wiremesh reinforcement can be seen in Table 9.

Table 9. Flexural strength test of wall panels without wiremesh reinforcement

Sampel	B	L	H	Load Max	Flexural Strength	Average Flexural Strength
	(mm)	(mm)	(mm)	(N)	(MPa)	(MPa)
1	500	1000	70	8200	3,347	
2	500	1000	70	7700	3,143	3,293
3	500	1000	70	8300	3,388	

From the table above obtained value flexural strength of wall panels is 3,293 MPa. So if this speciment accept load more than the load above it will be directly broken.

3.8.2 Flexural strength testing panels wall with wiremesh reinforcement

Results of testing the flexural strength of panels wall with wiremesh reinforcement can be seen in Table 10.

Tabel 10. Flexural strength of wall panels with reinforcement wiremesh.

Sample	**B** (mm)	**L** (mm)	**H** (mm)	**Load Max** (N)	**Flexural Strength** (Mpa)	**Average Flexural Strength** (Mpa)
1	500	1000	70	11600	4,735	
2	500	1000	70	11800	4,816	5,694
3	500	1000	70	16200	6,612	
4	500	1000	70	16200	6,612	

From the table above obtained value flexural strength of wall panels with wiremesh reinforcement is 5,694 MPa. If the speciment accept load more than teh load above it will be broken but not direcly broken because of wiremesh reinforcement can retained the load.

Table 11. Percentage Increase in Value of Flexural Strength Panels Wall

No	Types of Panels Wall	Flexural Strength	% increase the wall panel without reinforcement
1	Wall panels without reinforcement	3,293	
2	Wall panels with reinforcement	5,694	72,93 %

The table above shown that the strength of wall panels with wiremesh reinforcement can increase up to 72,93%. Because wiremesh reinfoecement can retain the load its self.

From test result above, the flexural strength wall panels has a bending stress is not small,it is suitable used as an alternative to a brick wall or other building materials. At the time of testing, when the wall panels accepted maximum load , it is not directly broken, only crack and retained by wiremesh reinforcement which adds to the flexural strength of the wall panels.

4. CONCLUSSION AND SUGGESTION

4.1 Conclussion

From the results of research conducted on the panels wall with wiremesh reinforcement can be summarized as follows:

1. Compressive strength of concrete cylinder is 21, 18 MPa.
2. Flexural strength of wall panels without wiremesh reinforcement is 3,293 MPa.
3. Flexural strength of wall panels with wiremesh reinforcement is 5,694 MPa.
4. Compare to the test result refer that wall panels with wiremesh reinforcement has higher value than wall panels without reinforcement due to wiremesh reinforcement that retained the load its self.

4.2 Suggestion

From the research that has been done, researchers expect further research regarding the wall panel. As for suggestions as follows:

1. It is necessary to design the panels wall formwork are more practical, efficient, and easily so that the form of wall panels can be done quickly, because this research is still used manual mold wall panels so that it takes a long time and not having problems in the compaction process.
2. Need for setting the flexural strength test equipment more practical again so that the test specimen can be accomplished in a timely manner.
3. For further research, should be added dimensional variation wall panel to be more practical, efficient and easy in construction and installation.
4. For further research, should be added variation cement water factor (fas) in order to get more diverse.

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