WIREMESH REINFORCEMENT CONTRIBUTED FLEXURAL AND COMPRESSIVE STRENGTH ON BRICK WALL PANELS

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APPROVAL SHEET

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On the day 11th August **2016**
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Statement

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Abstract

Wall is one of the important elements of the building and serves to separate and form a space in residential buildings or storied. In the development of the world very rapidly and building construction technology advances, many new innovations are found on the walls of one of them is a precast wall panels with reinforcement.Wall panels have a high quality and provide convenience in workability and structural systems efficiently determine the construction budget, the concrete in the wall panels were replaced by bricks coated mortar to become the cheaper alternative, and required a different method, namely red brick mounted horizontally for creating a thinner wall and efficiently. The test object is created with a size of 50 cm width, 100 cm length and 10 cm height for testing compressive strength and flexural strength, the lifes of the specimen are planned up to 28 days. On specimen maintained by way of watered.Tests performed at this research is testing the compressive and flexural stress at 28 days. At the lifes of 28 day compressive stress values obtained without wiremesh reinforcement of 1,878 MPa and compressive stress with wiremesh reinforcement at 2.10 MPa, for flexural stress without reinforcement wiremesh obtained a value of 1.493 MPa and with wiremesh reinforcement of 3,800 MPa. In this case the visible increase in the compressive strength and flexural due wiremesh reinforcement.

Keywords: Wall panels, Brick, Wiremesh, Reinforcement, Compressive Strength, Flexural Strength

Dinding merupakan salah satu elemen penting dari bangunan dan berfungsi untuk memisahkan dan membentuk ruang di bangunan tempat tinggal atau bertingkat. Dalam perkembangan dunia yang sangat cepat dan kemajuan teknologi konstruksi bangunan, banyak inovasi baru yang ditemukan di dinding salah satunya adalah dinding pracetak panel dengan tulangan. Dinding panel memiliki kualitas tinggi dan memberikan kemudahan dalam pengerjaan dan struktur sistem efisien menentukan anggaran konstruksi, beton di panel dinding digantikan oleh batu bata dilapisi mortar menjadi alternatif yang lebih murah, dan diperlukan metode yang berbeda, yaitu bata merah dipasang horizontal untuk menciptakan dinding tipis dan efisien. Benda uji dibuat dengan ukuran lebar 50 cm, panjang 100 cm dan tinggi 10 cm untuk pengujian kuat tekan dan kuat lentur, yang lifes dari spesimen yang direncanakan sampai dengan 28 hari. Pada spesimen dipelihara dengan cara watered.Tests dilakukan pada penelitian ini adalah pengujian tegangan tekan dan lentur pada 28 hari. Pada umur nilai tegangan tekan 28 hari diperoleh tanpa penguatan wiremesh dari 1.878 MPa dan tegangan tekan dengan tulangan wiremesh di 2.10 MPa, untuk stres lentur tanpa penguatan wiremesh diperoleh nilai dari 1,493 MPa dan dengan tulangan wiremesh dari 3.800 MPa. Dalam hal ini peningkatan terlihat dalam kuat tekan dan lentur karena tulangan wiremesh.

Kata kunci: Dinding panel, Bata merah, Wiremesh, Tulangan, Kuat Tekan, Kuat Lentur

1. INTRODUCTION

Wall is on of the important elements of the buildings and serve to seperate form a space in building and residence, in the development of rapid an all powerful, especially for the progress of the construction technology. Currently many discovered new innovation about the walls, one of these innovations is a wall panels precast trough fabrication or cast in situ with the main material is concrete, wall panels used to alternative for conventional wall because wall panels has a high quality and provide convenience in progress, as well as if the system very efficient in the structures that determine the construction budget. In this case should be done in construction cost is the use of materials or used lowest cost alternative materials.

Required methods and materials has advantages of better than already exist such as the selection materials like the brick as alternative of concrete and the manufacture of wall panels with brick that is placed differently is mounted horizontally to create a characteristic wall panels more lighter, and the dimension of the wall is thinner so that from the side of the form will be more efficient and effective.

The main types of material used in research is a brick because brick is a new alternative in wall panels technologies, not as with concrete, brick has lighter density than concrete in general density is 2000-2400 kg/m^3. Because the brick main advantages exist on weight, so that used in high rise project will be able to significantly reduce of its weight, which can give impact on calculation of the foundation.

Wall panels generally used a mixture of normal concrete (water, coarse aggregate, fine aggregate, and cement) and include the reinforcement. But in this research the materials used only brick and mortar (water, fine aggregate, and cement) as well as the reinforcement in the form of wiremesh, because can give easly for processing. For the problem of strength wiremesh with normal reinforcement is a same, depend on the quality and type of used.

In this research will test the flexural and compressive strength of brick wall panels aims to find and get the good wall panels as alternative of conventional brick wall. Expected wall panels are commonly used for high rise buildings and can be applicated to residance for resistant by earthquake.

On previous research by Danang Tri Wibowo (2013) concerning a review flexural strength of wall panels using aggregate tile fragment with reinforcement welded mesh, concluded from the test results flexural wall panels obtained flexural stress 2,9 MPa, it can be used as a substitute wall panels for a building. While the research carried out by Barendra Agni Anji Jaya (2013) studied the

flexural strength of review using a woven bamboo wall panels with styrofoam as alternative to aggregate, and get the value 3,6 MPa to wall panels, the value is more than conventional wall.

2. RESEARCH METHODS

In this research there are 5 stage that isstage 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.

ThenStage two,examination of materialsBefore 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.

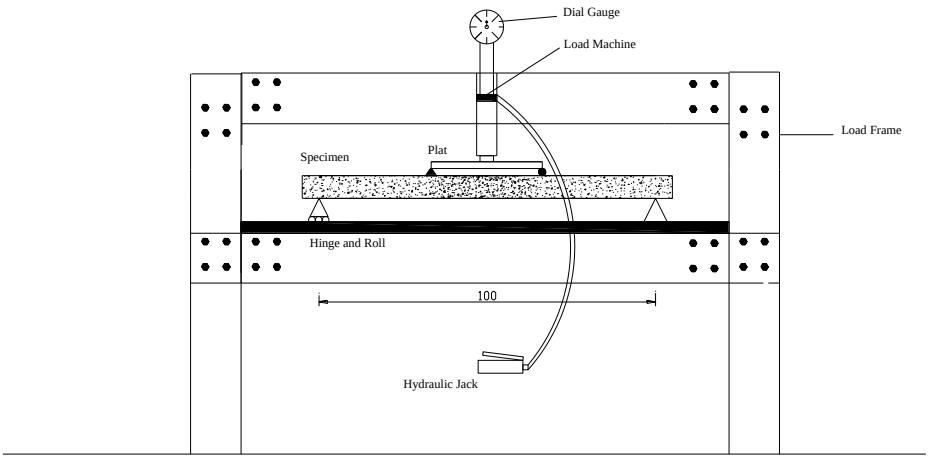


Figure 1. Setting up

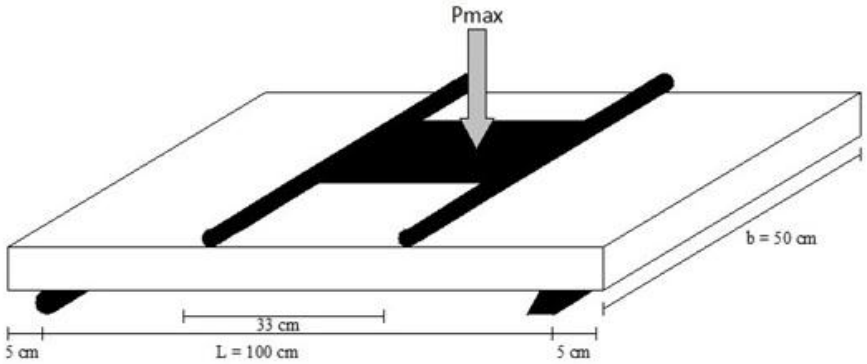


Figure 2. Flexural strength loading

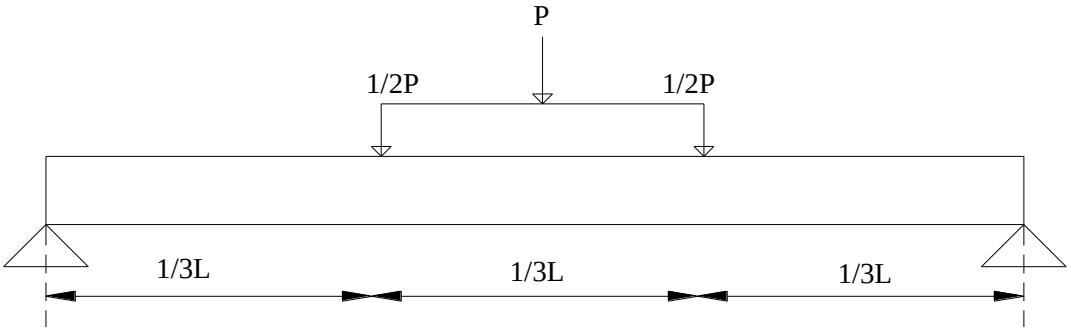


Figure 3. Flexural strength loading test

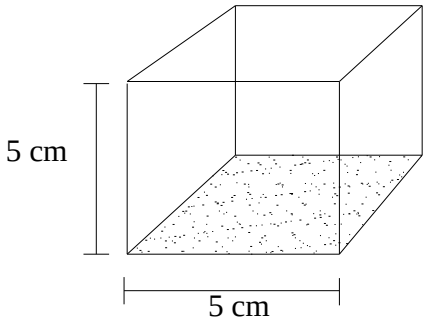


Figure 4. Specimen

Table 1. specimen specification

Specimen	Qty	Dimension	Testing
SM	5	(5x5x5)cm	Compressive
SW1	2	(100x50x10)cm	Compressive
SW2	3	(100x50x10)cm	Compressive
SW1	5	(100x50x10)cm	Flexural
SW2	5	(100x50x10)cm	Flexural

.

Description : S1 = Mortar cube

WPI = Wall panels without wiremesh reinforcement

WP2 = Wall panels with wiremesh reinforcement

The formula for compressive strength is :

$f'c = \frac{P}{A}$

Description :

f'c = maximum compressive strength of concrete (N/mm^2)

P = Maximum Load (N)

A = Area of the surface of the specimen (mm^2)

The formula for felxural strength is :

$MOR = \frac{PL}{BH^2}$

Description :

Mor = Modulus of rupture (MPa)

P = Maximum load (N)

L = Length (mm)

b = Width of specimen (mm)

h = Height of specimen (mm)

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 Steel Strength

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 3. Tensile strength of wiremesh

Sample	A (mm^2)	P max (N)	f'c (MPa)	Average (MPa)
1	22,8906	12077,24	527,607	548,079
2	22,8906	12850,15	561,3724	
3	22,8906	12077,24	555,257	

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.

3.4 Mix Design

In this research, using a mix design with a mix design with method by trial error. This method is another way to obtain the proportion of mortar that is by trial error, this method is based on

experiments to obtain mixtures with pores that minimum or maximum density, this research using water cement ratio (fas) 0,5 and compare for mortar 1:4, the proportion can be seen in table 5.

Table 4. Material of mix design

Material	Design
Cement	15,125 kg/m^3
Fine aggregate	60,5 kg/m^3
Water	7,5 ltr
Total	83,125 kg/m^3

3.5 Slump test

in this study, planned slump value of 10 cm. Slump Tests conducted to determine the level of viscosity of a slurry, so it can be known whether the mixture of water shortages, excess water or sufficient water. From the research can be seen th value of slump in table 6:

Table 5. Slump test

No	Type of Specimen	Slump value (cm)
1	Mortar Cube	10
2	Wall panels without wiremesh reinforcement	10
3	Wall panels with wiremesh reinforcement	10

From the result we get the value of slump is 10 cm.

3.6 Compressive Strength of Mortar cube

Compressive strength test of mortar cube

Compressive strength of mortar cube has been seen in table 6.

Table 6. Compressive strength of Mortar cube

No	Load (P) kN	N	Area mm^2	f'c (MPa)	f'c Average (MPa)
1	5,55	55500	2500	2,220	2,65
2	5,55	55500	2500	2,220	
3	6,5	65000	2500	2,620	
4	6,8	68000	2500	2,720	
5	8,7	87000	2500	3,480	

From the result we get the average value of maximum compressive strength of mortar is 2,65 MPa so this value refer to the quality of mortar.

3.7 Compressive strength of Wall Panels without wirmenesh reinforcement

Compressive strength testing wall panels without wiremesh reinforcement can be seen in table.8.

Table 7. Compressive strength of Wall panels

No	Load (P)			Area cm^2	Average of compresive strength
	kN	N	MPa		
1	180	180000	1,80	1000	1,878
2	195	195000	1,90	1000	

From the result we get the average value of maximum compressive strength of brick wall panels without reinforcement is 1,878 MPa so this value refer to the wall panel can retain the load.3.8Panels Wall Testing Result.

3.8. Compressive strength of Wall Panels with wiremesh reiforcement

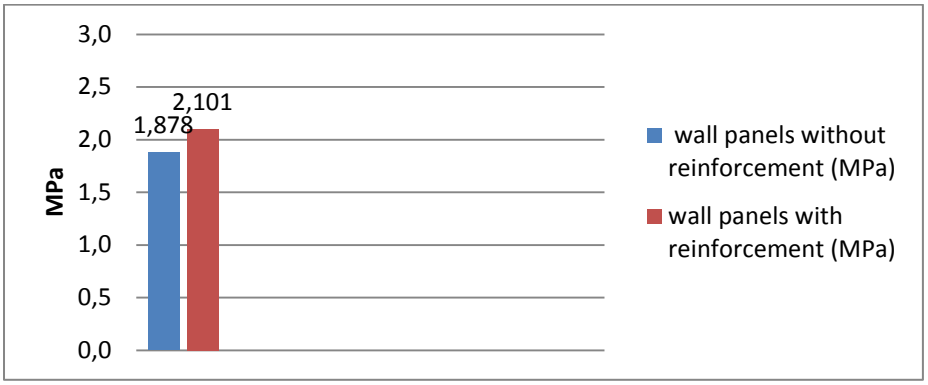
Compressive strength testing wall panels with wiremesh reinforcement can be seen in table.8.

Table 8. Compressive strength of Wall panels

No	Load (P)			Area cm^2	Average of compressive strength
	kN	N	MPa		
1	210	210000	2,10	1000	2,101
2	220	220000	2,20	1000	
3	228	228000	2,28	1000	
4	242	242000	2,42	1000	
5	250	250000	2,50	1000	

From the table above obtained value flexural strength of wall panels is 2,101 MPa. So if this speciment accept load more than the load above it will be directly broken.

From all the table and discovered that the average compressive strength of wall panels without wiremesh reinforcement of 1,878 MPa and an average compressive strength of wall panels with wiremesh reinforcement amounted to 2,101 MPa. Compressive stress increased by 11,859% from the average compressive strength of the wall panel without percutaneous wiremesh. In this experiment, contributing f_s wiremesh give at 548,079 MPa, the comparrison of value compressive strength between with and without wiremesh can be seen in graph 1 :



3.9 Flexural strength of Wall Panels without wiremesh reinforcement

Flexural strength testing wall panels without wiremesh reinforcement can be seen in table.10.

Tabel 9. Flexural strength of wall panels with reinforcement wiremesh.

No	b (mm)	l (mm)	h (mm)	Flexural Strength (MPa)	Average Flexural Strength (MPa)
1	500	1000	100	1,00	1,493
2	500	1000	100	1,28	
3	500	1000	100	2,22	

From the result we get the average value of maximum flexural strength of brick wall panels without reinforcementis 1,493 MPa so this value refer to the wall panels can retain the load.

3.10 Flexural strength of Wall Panels with wiremesh reinforcement

Flexural strength testing wall panels without wiremesh reinforcement can be seen in **table.10.**

Table.10. Flexural stress of wall panels

No	b (mm)	l (mm)	h (mm)	Flexural Strength (MPa)	Average Flexural Strength (MPa)
1	500	1000	100	3,20	3,80
2	500	1000	100	3,60	
3	500	1000	100	4,00	
4	500	1000	100	4,00	
5	500	1000	100	4,20	

. From the result we get the average value of maximum compressive strength of brick wall panelswith reinforcement is 3,80 MPa so this value refer to the wall panel can retain the load.

From the all table above discovered that the average flexural strength of wall panels without wiremesh reinforcement of 1,493 MPa and an average flexural strength of wall panels with wiremesh reinforcement amounted to 3,800 MPa, flexural strength increased by 154,464% from the average flexural strength of the wall panels without percutaneous wiremesh, the comparison can be seen in graph 2 :

Graph 2 Comparison of Flexural stress of wall panels

From the graph above test results, the flexural strengthwall panels has a bending strength is not small, making it suitable used as an alternative to a brick wall or other building materials. At the time of testing, the panels wall when receiving the maximum load is not immediately broken, only the arched detained by steel reinforcement which adds to the flexural strength of the wall panels.

4. CONCLUSION AND SUGGESTION

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

1. From the test of compressive strength mortar cube get the average value is 2,65 MPa this value is quality of mortar so this value refer the strength of mortar can retain the load.
2. From the test results of compressive strength of wall panels without wiremesh reinforcement get the average value is 1,878 MPa, while the wall panels with wiremesh reinforcement the average value is 2,101 MPa, if the valus is compare obtained the increase of compressive strengthby 11,859% because wiremesh reinforcement can retain the load itself.
3. From the test results flexural strength of panels wall without wiremesh reinforcement get the average value is 1,493 MPa, while the value of flexural strength panels wall with wiremesh reinforcement is 3,800 MPa, if the valus is compare obtained the increase of flexural strengthby 154,464% because wiremesh reinforcement can retain the load itself.

   Need for setting the flexural strength test equipment more practical again so that the test specimen can be accomplished in a timely manner, for further research, should be added dimensional variation wall panel to be more practical, efficient and easy in construction and

installation and for further research, should be added variation cement water ratio (fas) in order to get more diverse.

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