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POLITEKNIK NEGERI JAKARTA

PROCEEDINGS OF
THE THIRD ANNUAL SOUTH EAST ASIAN INTERNATIONAL SEMINAR (ASAIS) 2014
STATE POLYTECHNIC OF JAKARTA

Wednesday, November 12th , 2014
SANTIKA HOTEL - DEPOK

Annual South East Asian
International Seminar

P3M POLITEKNIK NEGERI JAKARTA
NOVEMBER 2014

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WELCOME FROM THE ORGANIZING COMMITEE

AssalamualaikumWrWb

We pray to Allah SWT for all His grace and gift He has given to us all so that the International Seminar on the Results of Researches and Community Services can today be conducted.

This international annual seminar (ASAIS 2014) is aimed to provide a dissemitaion forum for the results of researches and community services. This is expected to be a forum for information exchanges, discussion involving many parties: scholars, practitioners, and government. Interaction among different perspectives could become a medium to create technology development and sustainability accurately applicable in industry and society to enhance and support their autonomy in this modern era.

The ASAIS 2014 Program cover a broad spectrum of topics ranging from Technology, Commerce and Environment, following the reseachers/authors from Cambodia, Indonesia, Malaysia, Singapura, and Thailand.

We would like to take opportunity to thank all those who have contributed to the technical program in particular, all the participant for submitting their works and we hope you enjoy the progam

Finally, we look forward to suggestions and iriticism so that we can carry out the next international seminarin 2015 better.

WassalamualaikumWrWb

ASAIS 2014 Organizing Commitee

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WELCOME FROM DIRECTOR OF STATE POLYTECHNIC OF JAKARTA

Assalamu'alaikumWrWb,

We pray to Allah SWT for all His grace and gift He has given to us all so that today we can attend the International Seminar on the Results of Researches and community Services under the theme of "Creative industry based research and community services to encourage community autonomy", as a basis of knowledge and research development in higher education, both national and international which can be conducted by Research and Community Service Center in State Polytechnic of Jakarta.

The purpose of conducting this seminar is to provide knowledge and concepts exchange opportunity for multidiciplinary scientists to put forward their perspectives in national and state problems under the three defined sciences. Beside that, this forum can also be used to strengthen relationship of researchers from both national and international institutions.

In this instance we would like to thank:

1. The Minister of Culture and Education of the Republic of Indonesia
2. Prof. OumSaokosal , NPIC – Cambodia
3. Associate Profesor, Dr. WipaweeHatagam , Suranaree University of Technology NakhonRatcasima Bangkok
4. Presenters
5. All boards of committee who have made this happens

We hope that this academic activity can be conducted regularly and the spirit of the research will always sustain and give valuable contribution to the welfare and the development of the nation.

We thank you and hope you gain valuable benefits from the seminar.

WassalamuʼalaikumWrWb,

Jakarta, 12 November 2014

Director of state Polytechnic of Jakarta

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PREFACE

This proceedings contain sorted papers from Annual South East Asian International Seminar (ASAIS) 2014. ASAIS 2014 is the second annual international event organized by PusatPenelitiandanPengabdian (P3M) PoliteknikNegeri Jakarta Indonesia. This event is a forum for researchers for discussing and exchanging the information and knowledge in their areas of interest. It aims to promote activities in research, development and application on Technology, Commerce and Environment.

We would like to express our gratiture to all technical commite members who have given thirefforst to support this seminar. We also would like to express our sincere gratitude to Higher Education Republic of Indonesia, NPIC Cambodia , Suranaree University of Technlogy (SUT) RankonRatchasima Bangkok Thailand and the our sponsor National Instrument and, PT. PanairsanPratama.

Finally we also would to like to thank to all of the keynote speakers, the authors, the participant and all parties for the success of ASAIS 2014.

Editorial Team.

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TITLES OF TECHNOLOGY PAPER

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Compressive and Shear Strength Behaviour of Masonry Wall With Pumice Breccia as Mortar

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Abstract

This research aims to develop materials pumice breccia as instant mortar on brick wall construction. The special region of Yogyakarta (DIY) an enormous potential for the development of product-based natural pumice breccia. Based on Resources Information System Investment (2012), Pumice reserves stored on DIY Recorded more than two and a half billion cubic meters, Covering an area Gunung Kidul ± 2,497 billion m3, Bantul ± 76,067 billion m3 and Sleman ± 85,367 billion m3. in which each location located relatively next to one another. The method used is an experiment laboratory. This research used 3rd varians, which were CS (compressive strength); TBS (Tensile bond strength) and SS (shear strength). This research dealt with three tests (compressive test, tensile bond strength and shear stress). Proportion mix used 1Pc:4Pm and 1Pc:3Ps:3Pm. The test results show that on compressive strength, tensile bond strength and shear strength obtained the effective thickness of pumice mortar were 10mm, 15mm and 20mm respectively. The failure mode is combination failure. In general, pumice breccias can be used as adhesive material (mortar) substitute of conventional mortar in masonry brick.

Keyword: shear strength, masonry, pumice breccia

1. INTRODUCTION

To minimize the negative impact of the consumption of electrical energy in the building has developed the concept of green building With minimize the needs of artificial illumination and air conditioning. Nowadays, the presence of air-conditioning has become a standard requirement in the various types of building. To minimize the need for air-conditioning, the wall materials need to be developed that is capable of absorbing heat from outdoors is put in that will go into the room.

To develop these heat reducer wall material, required the development of a material that has the heat conductivity is small enough. In General, building material and has many pore heavy kinds of light will have a value of thermal conductivity is lower anyway. Therefore, this point has a lot of light aggregate based materials developed. Lightweight aggregates can be distinguished into two groups namely; natural and artificial lightweight aggregate. Lightweight aggregate structural criteria have been clearly defined in ASTM 330 that the dry content of the loose weights should not surpass 880 kg/m3 and weight of the aggregate must not exceed 2000 kg/m3.

The special region of Yogyakarta (DIY) an enormous potential for the development of product-based natural pumice breccia. Based on Resources Information System Investment (2012), Pumice reserves stored on DIY Recorded more than two and a half billion cubic meters, Covering an area Gunung Kidul ± 2,497 billion m3, Bantul ± 76,067 billion m3 and Sleman ± 85,367 billion m3. In which each location located relatively next

to one another. In this research, the most importance is mortar that serve as a bed joint between bricks, thickness mortar referring to the condition in the field. The use of lightweight mortar is one of the new things that will be applied to the mechanical testing laboratory. Mechanical tests that are developed are compressive stress, tensile bond strength and shear stress.

2. THEORY

Pumice is one of sediment, rocks namely volcanic rock that weight light because of being porous materials. Pumice usually light colored, or discoloration of the skin whitish. Pumice is also widely used in the days of ancient Rome, by the way in gali, in the wash, and then used as building materials. Because of its lightweight, then does it weigh when used as material in concrete structures, lighter weights will be produced (Setty, 1997).

Wisnumurti reported about the optimization of the use of the composition of the mixture of mortar to mighty press pair red brick walls. The test results showed that the optimal composition for masonry walls, red is on the composition of the cement mix 1: 6 sand, this is proven by the real difference is the smallest test results suggesting that the composition of a propotion mix of 1: 6 is no longer a real different with a proportion mix of 1: 5, 1: 4, and 1: 3. While the graph of the relationship between compressive strength of mortar and compressive strength walls indicates that an increase in compressive strength of wall along with strong improvement press the mortar being used.

According to Tjokrodimuljo (2007), mortar is a building material made from water, adhesive materials (e.g. mud, lime and portland cement) and fine aggregate (e.g., natural sand, etc.). The function of the mortar in masonry is red as the joint layer between red bricks with mortar itself. To get compressive strength in red brick, the mortar is required to have a minimum compressive strength equal strength with the brick. Mortar cement has a strong press between 3-17 MPa and have a specific gravity of between 1.8-2.20. as shown in Table 1 below.

Table 1. Properties of cement mortar made from cement and coarse sand

Volume of mixture (Cement: fine agregate)	**Water cement ratio**	**Spread value (%)**	specific gravity	**Compressive strength (MPa)**	**Tensile strength (MPa)**	**Water absorbtion (%)**
1:3	0,6	85	2,22	28	2,60	7,47
1:4	0,72	82	2,19	18	1,80	7,71
1:5	0,90	86	2,14	10	1,70	8,58
1:6	1,10	85	2,10	8	1,30	9,03
1:7	1,48	88	2,04	5	0,96	9,94

(Source: Tjokrodimuljo, 2007)

3. METHODOLOGY

Sampling and Testing

The pumice unit used in the masonry wall (produced and delivered in a single batch) have been produced especially for the current research project. The unit dimension are 225mm (length), 105mm (width) and 65mm (height). The masonry joints have a thickness of 10mm, 15mm, 20mm, respectively and are to be filled with pumice breccia, made using small aggregate size. The

compressive strength of concrete at 14 days is the averge four results obtained in tests with cylindrical specimens (diameter of 150mm and height of 300mm), according to the recommendation of SNI 2847-2013.

Table 2. Sampling and testing specimen

No	Specimen	Proportion mix	Types of tests	Total sample	Thickness mortar (mm)
1	$CS1_{a,b,c}$	1Pc:4Pm	compressive strength	9	10, 15, 20
2	$CS2_{a,b,c}$	1Pc:3Ps:3Pm	compressive strength	9	10, 15, 20
3	CSC	1Pc:4Ps	control	3	15
4	$TBS1_{a,b,c}$	1Pc:4Pm	tensile bond strength	9	10, 15, 20
5	$TBS2_{a,b,c}$	1Pc:3Ps:3Pm	tensile bond strength	9	10, 15, 20
6	TBSC	1Pc:4Ps	control	3	15
7	$SS1_{a,b,c}$	1Pc:4Pm	shear strength	9	10, 15, 20
8	$SS2_{a,b,c}$	1Pc:3Ps:3Pm	shear strength	9	10, 15, 20
9	SSC	1Pc:4Ps	control	3	15
				63	

Description of the Test Set-up

The specimens consist of three masonry courses subjected to a vertical pre-compression load, see the Figure 1. The top and bottom masonry courses are kept under constant pressure while a horizontal load is applied in the middle masonry course. Eventually this member slides, providing the value of the shear strength of the joints. Therefore, two joints are tested simultaneously.

Masonry compressive strength

Masonry compressive strength was de termined in accordance with the provi sions of Mojsilovic, et., al (2007). Three test on three unit were performed. See the Figure 1 below.

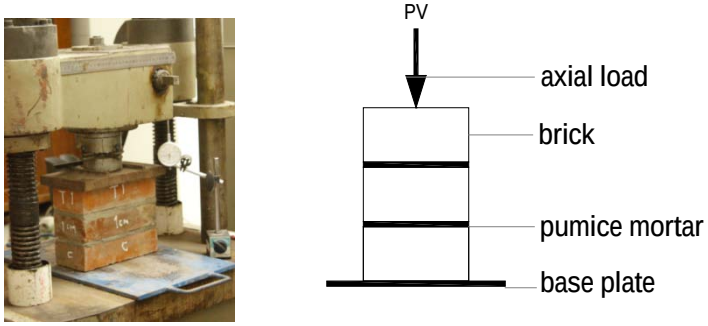

Figure 1. Compression test apparatus

The value of compressive strength can be calculate with equation follows:

$$\sigma = \frac{P}{A} \qquad (1)$$

Masonry tensile bond strength (*splitting test*)

This test is intended to determine tensile bond strength (splitting test) of pumice breccia as mortar. Testing method for tensile bond strength of masonry is presented in Figure 2 below.

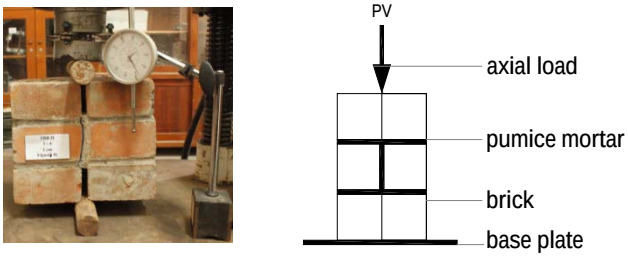

Figure 2. Splitting test shear bond stress apparatus

(Sources: Mojsilović, et.al, 2009)

The tensile bond strength of masonry prism (Mojsilović, et.al, 2009), obtained using equation 1 below:

$$\sigma_T = \frac{C.F}{D.t};\ with\ D = \sqrt{\frac{h.L}{\pi/4}} \qquad (2)$$

Where: h and *l* are the specimen height and width, respectively. In addition, *t* denotes the specimen thickness; *F* is the applied load and *C* a constant of 0.648. This constant depends on brick/joint stiffness and the chosen value was based on modulus of elasticity ratio of brick and mortar, *Eb*/*Em*, of approximately 2

Shear strength bond test

Testing method for shear strength bond test of masonry prism is presented in Figure 3 below (Tung, 2008).

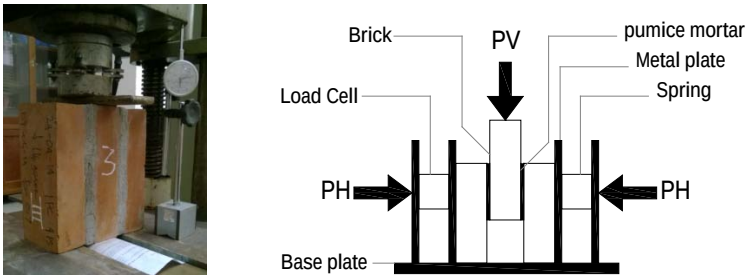

Figure 3. Tensile bond test apparatus

(Sources: Tung, 2009)

The shear strength of masonry prism, obtained using equation 2 below:

F = σ. A

(3)

Where: F= applied load (N); σ= shear strength (MPa); A=shear plane area (mm^2)

Research Tool

Compression Testing Machine trade mark Wfi (Wykeham Farrance International) from Blough, England, Capacity of 2000 kN; LVDT (linear variable diferential transducer), load cell, and others.

4. ANALYSIS AND DISCUSSION

Masonry tensile bond strength (Splitting test) of Masonry

Masonry bond strength of masonry brick is to find out the capacity of performance of pumice breccia mortar, the test results are presented in Table 3 below.

Table 3. Test result of masonry triplet

No	Specimen	types of tests	Proportion mix	Mortar thickness (mm)	Load average (N)	stress (MPa)
1	$CS1_{a,b,c}$	compressive strength	1Pc:4Pm	10	113843.33	4,85
				15	113190,00	4,76
				20	83790,00	3,52
2	$CS2_{a,b,c}$	compressive strength	1Pc:3Ps:3Pm	10	124705,00	5,32
				15	110903,30	4,68
				20	88118,33	3,71
3	CSC	Control	1Pc:4Ps	15	80523,33	3,45
4	$TBS1_{a,b,c}$	tensile bond strength	1Pc:4Pm	10	8640,33	0,11
				15	4671,33	0,06
				20	7521,50	0,09
5	$TBS2_{a,b,c}$	tensile bond strength	1Pc:3Ps:3Pm	10	4263,00	0,055
				15	3879,16	0,048
				20	6043,33	0,074
6	TBSC	Control	1Pc:4Ps	15	5643,17	0,081
7	$SS1_{a,b,c}$	shear strength	1Pc:4Pm	10	5216.87	0,11
				15	5504,33	0,47
				20	4165,00	0,09
8	$SS2_{a,b,c}$	shear strength	1Pc:3Ps:3Pm	10	3824,00	0,08
				15	8983.33	0,19
				20	5749,33	0,12
9	SSC	Control	1Pc:4Ps	15	9571,33	0,39

Note:

CS1a,b,c: tegangan tekan pada ketebalan benda uji 10mm, 15mm dan 20mm

TBSC : tensile bond strength control

SSC : shear strength control

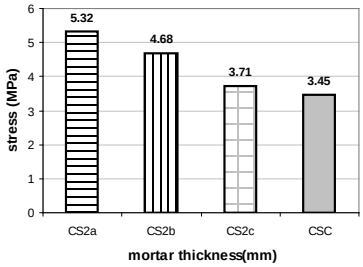

Figure 4. proportion mix 1Pc:4Pm

Compressive strength test

Testing press intended to find out the compressive stress of wall, the test results is presented in Figure 4 and Figure 5 below.

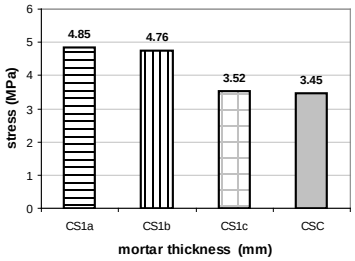

Figure 5. proportion mix 1Pc:3Ps:3Pm

Based on Figure 4 above show that the compressive strength at proportion mix 1Pc:4Pm of specimen CS1a, CS1b, CS1c and CSC were the results 4.85MPa, 4.76MPa, 3.52MPa, 3.45MPa respectively. Compressive strength optimum on CS1a specimen. The different value of stress compared with CS1b, CS1c, CSC were the results 1,89%; 37,78% and 40,58% respectively. Figure 5 show that compressive stress with proportion mix 1Pc:3Ps:3Pm of specimen CS2a, CS2b, CS2c and CSC were the results 5.32MPa, 4.68MPa, 3.71MPa and 3.45MPa respectively. Compressive strength optimum at CS2a specimen. The stress different result compare with CS2b, CS2c and CSC were

13.68%; 43.40% and 54.20% respectively.

In General, the test results above indicate that the thickness of the mortar is effective on compressive strength obtained a value of 10 mm. Interpretation of these results is wall will receive the load (beams, plates and columns), so that the behavior of the ravages of load tap on the wall will be more dominant than due to shear force (due to the optimum shear force will only occur when the earthquake). Conventional Mortar is more brittle and have a lower load capacity compared to the pumice breccia mortar. It is identified as a mortar pumice has a light weight materials (1gram/cm3). Because of its low weight, it will change the characteristics of mortar that was brittle, a mortar that has pretty strong endurance against load.

Tensile bond strength

Tensile bond strength intended to find out the performance of masonry brick. the test results is presented in figure 6 and figure 7 below.

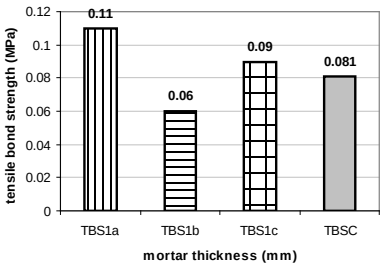

Figure 6. Proportion mix 1Pc:4Pm

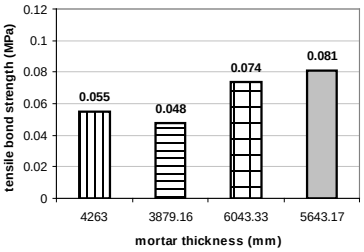

Figure 7. Proportin mix 1Pc:3Ps:3Pm

Based on Figure 6 above show that the tensile bond strength at proportion mix 1Pc:4Pm of specimen TBS1a, TBS1b, TBS1c and TBSC were the results 0.11MPa, 0.06MPa, 0.09MPa and 0.081MPa respectively. Tensile bond strength optimum on TBS1a specimen. The different value of stress compared with TBS1b, TBS1c, TBSC were the results 83.33%; 22.22% and 11.11 respectively. Figure 5 show that tensile bond strength with proportion mix 1Pc:3Ps:3Pm of specimen TBS2a, TBS2b, TBS2c, and TBSC were the results 0.055MPa, 0.048MPa, 0.074MPa and 0.081MPa respectively. Tensile bond optimum at TBSC specimen. The stress different result compare with TBS2a, TBS2b, TBS2c were 47.27%; 68.75% and 9.46%. respectively.

The use of mortar pumice will optimal value on 1pc: 4pm in proportion mix. Based on results show that pumice breccia have resistance and bond better than the conventional mortar. so the value of ductility brings much more compared to conventional mortar. Ductility is the capacity of a structure to deform at an almost-constant load, passing the elastic phase and dissipating the energy transmitted by the seismic waves through attrition and hysteresis phenomena. So, a structure will established, even though the conditions in the verge of collapse. On a structure wall, value ductility can be used by using partial and full of ductility.

Shear bond test (shear strength)

Shear bond test intended to find out the shear strength of wall, the test

results is presented in Figure 8 and figure 9 below.

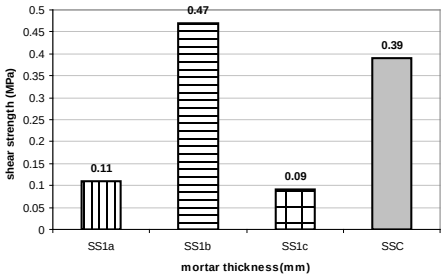

Figure 8. proportion mix 1Pc:4Pm

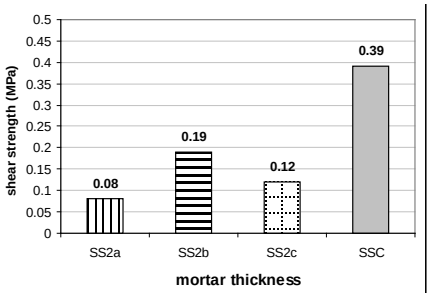

Figure 9. proportion mix 1Pc:3Ps:3Pm

Based on Figure 8 above show that the strength bond strength at proportion mix 1Pc:4Pm of specimen SS1a, SS1b, SS1c and SSC were the results 0.11MPa, 0.47MPa, 0.09MPa and 0.39MPa respectively. Shear strength optimum on SS1b specimen. The different value of stress compared with SS1b and (SS1a, SS1c, and SSC) were the results 76.60%; 80.85% and 20.51% respectively. Figure 9 show that shear strengt with proportion mix 1Pc:3Ps:3Pm of specimen SS2a, SS2b, SS2c and SSC were the results 0.08MPa, 0.19MPa, 0.12 MPa and 0.39MPa respectively. Shear strength optimum at SSC specimen. The shear strength different result compare with SS2a, SS2b and SS2c were 79.49%; 51.28% and 69.23% respectively. The value of the shear stregth using an aggregate pumice without sand positive trends, this is indicated by the shear strength value is always greater than the test control specimen. Based on laboratory test, Pumice is considered to be into breccia mortar type M and N. this mortar have 45,38% fines grade.

Failure Mode

The test sample described previously were also instrumented to allow the rate at which a crack propagates through a triplet to be monitored. Hasil pengujian disajikan pada Gambar 10 di bawah ini.

Figure 10. failure mode

These test given a clear indication of the failure mode. It was apparent that the type of loading condition were intiated by tensile/shear and combination failure between the brick brick/mortar interface at the bottom of the sample and travels upwards on joint. This appeared to confirm that the increase in strength previously observed was not due to an increase in shear strength alone.

5. CONCLUSION

The compressive strength results SC1a and SC2a on volume of mixture 1Pc:4Pm and 1Pc:3Ps:3Pm were 4.86MPa and 5.32MPa respectively.

The test results of tensile bond strength máximum TBS1a and TBSC on volume of mixture 1Pc:4Pm and 1Pc:4Ps were 0.11MPa and 0.081MPa respectively.

The test results of shear strength TBS1a and TBSC on volume of mixture 1Pc:4Pm and 1Pc:4Ps were 0.47MPa and 0.89MPa respectively.

The failure mode on all simple show that combination failure.

6. ACKNOWLEDGMENTS

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