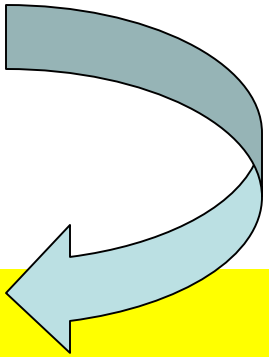
4th International Conference on Rehabilitation and Maintenance in Civil Engineering
Solo, July,11-12 2018

THE USE OF GRINDED ANDESITE-SAND AND FOAMING-AGENT TO IMPROVE THE POROSITY OF FOAM-CONCRETE

ERWIN ROMMEL
YUNAN RUSDIANTO
KIKI RURIS D
TRI EDY S
DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF MUHAMMADIYAH MALANG

STATE OF THE ART

- The addition of aluminum powder on aerated concrete can reduce the density and porosity of the form size. The porosity will increase as well as the increasing of aluminium powder content . The lowest porosities of 8.85% and 2.49% were obtained for the control (0% Al) by water soaking and vacuum saturated methods respectively
  (Shabbar, Nedwell, Wilson and Wu, 2016)
- The use of porous aggregate material called expanded glass (EG) granules on foam concrete has been done by wearing mineral used pozzolan metakaolin (MK) and microsilika (MS) to improve the properties of foam concrete shrinkage and long-term durability
  (Namsone, Sahmenko, and Korjakins, 2016)



GAP ANALYSIS

The difference of this study with other foam concrete research, the use combination of andesite-sand grinded and the amount of foam-agent in the manufacture of foam concrete.

The objective of the research

This study aims to determine the effect of using andesite-sand grinded and foam-agent on porosity properties of foam concrete.

Materials and mix-proportions

Material	Mix-controls	Mix-proportion			
		I	II	III	IV
cement	1	1	1	1	1
andesit sand	2,75	2,75	2,75	2,75	2,75
water-cement ratio	0,7	0,7	0,7	0,7	0,7
foam-agent / cement (%)	0	1	2	3	4

- The used Andesite sand milled until reach specifications as follows; 80% passing sieve No. 100 and 53.2% retained on the sieve No. 200 ; density 2,9 g/cm^3 ; absorption 4,5%.
- Foaming agent used by TXP ACC synthesis type.

Workability of foam concrete

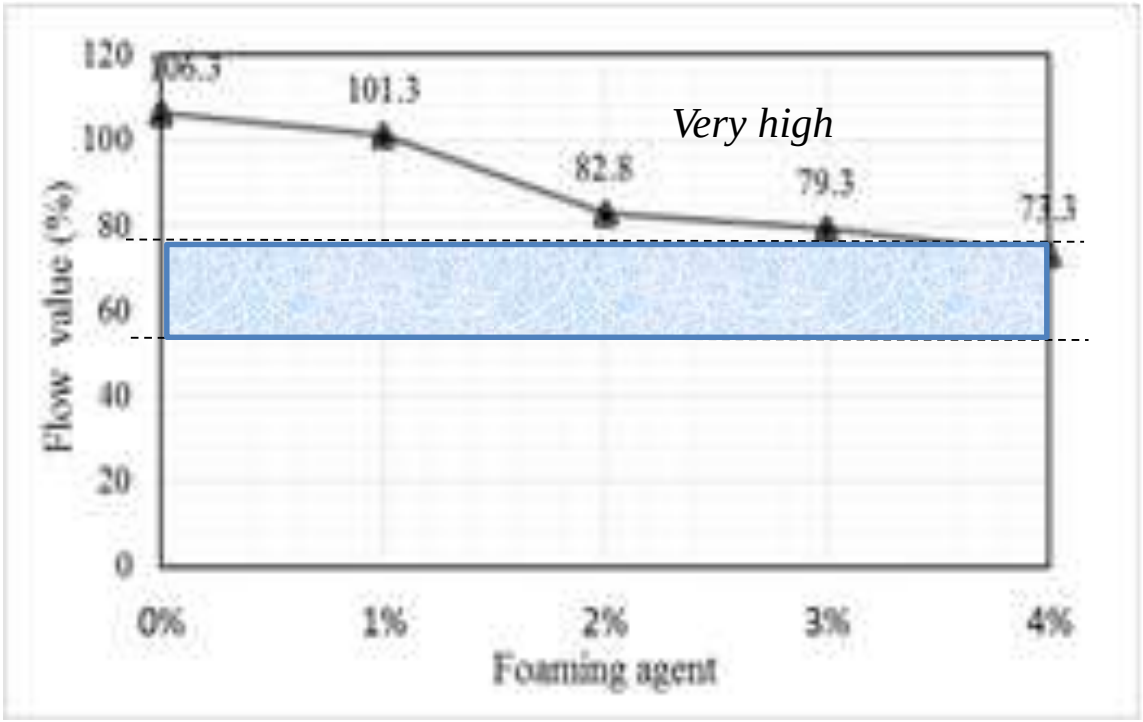


Table.2 The level of foam concrete workability

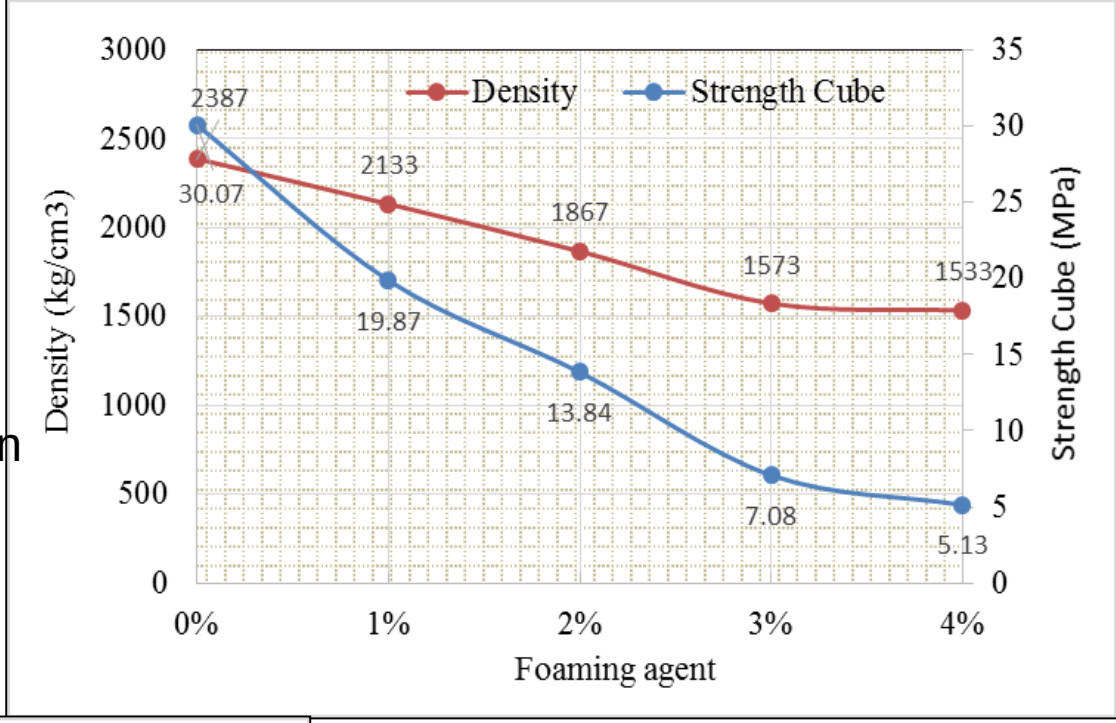
Class Designation	Flow Values	Description
VL	0-20 %	Very low
L	20-40 %	Low
M	40-60 %	Medium
H	60-80 %	High
VH	80-120 %"	Very High

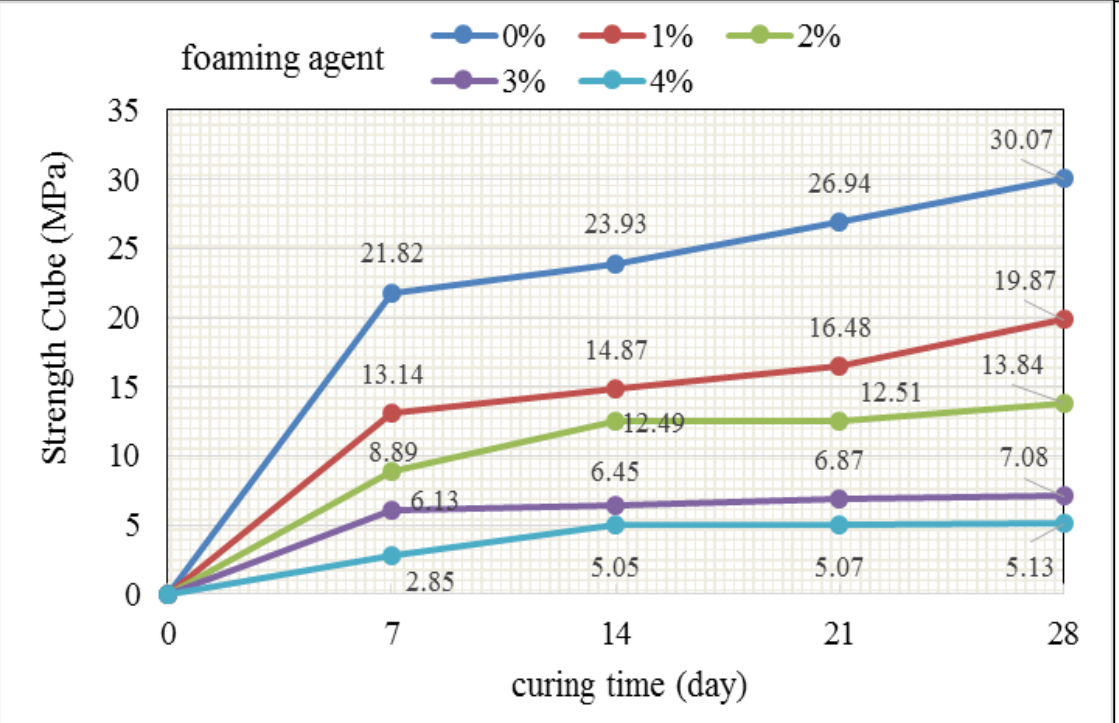
Source ; Nambiar and Ramamurthy, 2008

The level of workability obtained in this study can reach the high level category with w/c 0.7 and the use of foaming agent above 2%. while for the use of foam agent 0% and 1% will be produced workability of foam concrete categorized as a very high level of foam concrete. It is not preferable because it was resulted into a watery concrete.

Density and strength of foam concrete

- The addition of foam agent will reduce the density and compressive strength of foam concrete, but the use of 2% foam agent will produce foam concrete in lightweight concrete category (density <1900 kg/m^3) with compressive strength reach 13,84 MPa

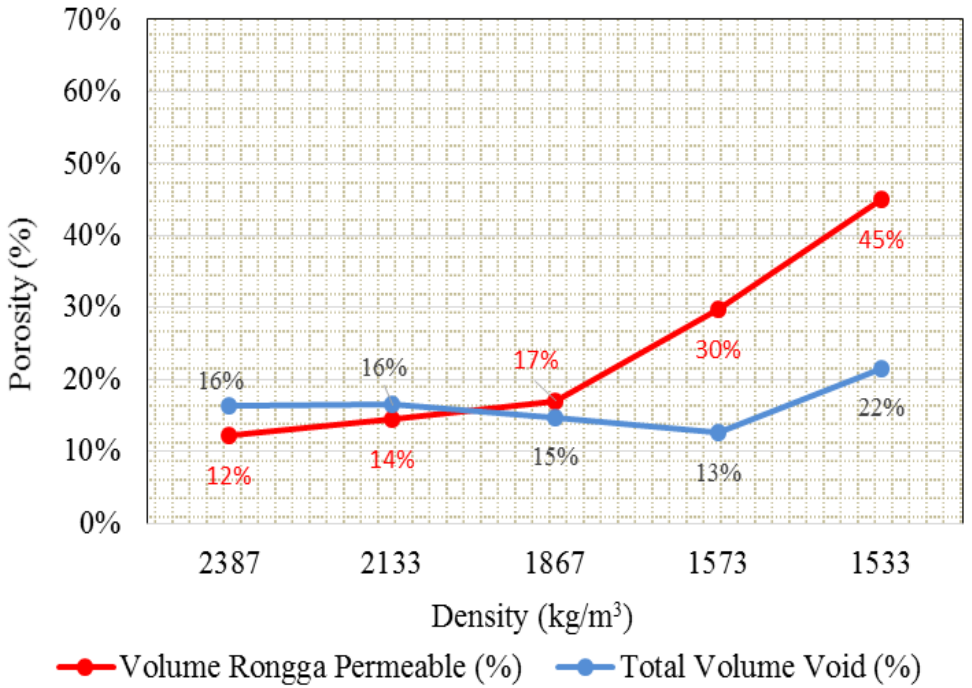


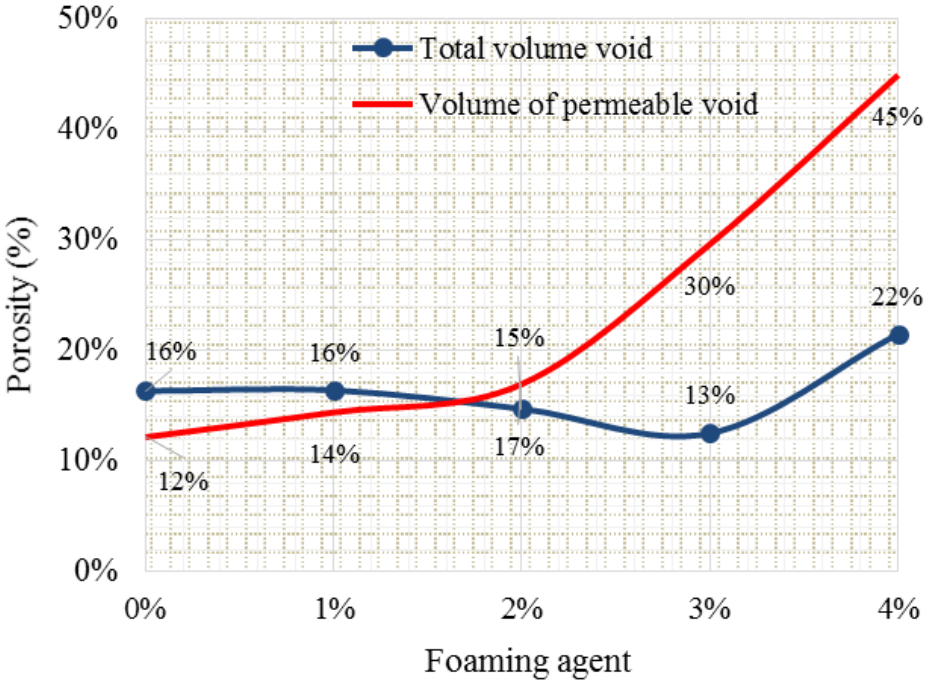


- Compressive strength of the foam concrete also increase with the increasing age of concrete, each at 7, 14, 21, and 28 days

POROSITY OF FOAM CONCRETE

Porosity also affects the density of foam concrete. These chart shows that the porosity of foam concrete will depends on density and the addition of foam agent. Porosity that measured by total void volume resulted into the lowest value of 13%, which is get from the use of 3% foam agent (1573 kg/m^3 of density).

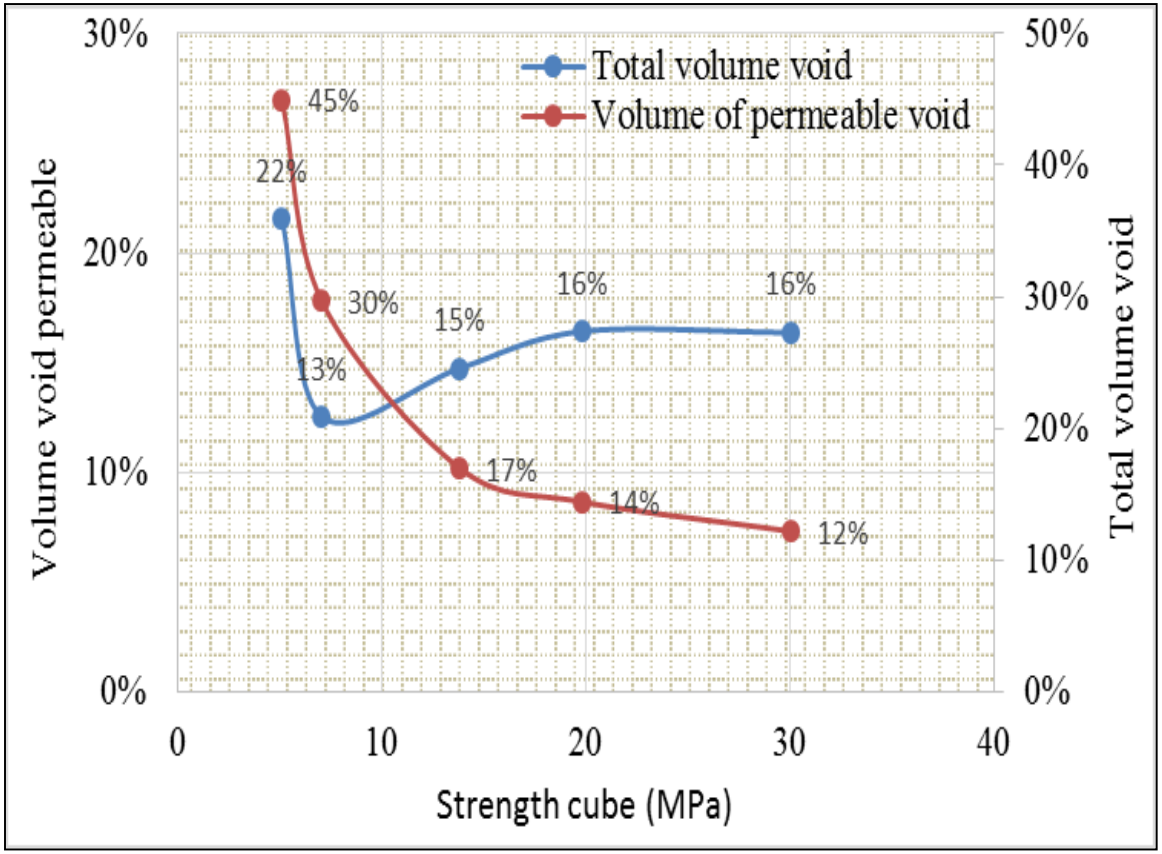




While, the porosity of foam concrete that measured by permeable volume void is tend to increase as well as the increasing addition of foaming agent. And it is not perfectly good for concrete durability.

POROSITY OF FOAM CONCRETE

The decreasing of “volume of permeable void” resulting into the increasing of compressive strength. But in the other hand, the “total volume void” is not decrease and tend to be stable.



CONCLUSION

1. The amount of foam-agent use in the making of foam concrete greatly affects the workability, density, compressive strength, and porosity of the concrete
2. The usage of andesite-sand grinded and 2% foam-agent increased density and the compressive strength of foam concrete, respectively 1867 kg/m^3 and 13,84 MPa,
3. The use of 2% foam-agent obtained 15% and 17% as best porosity value, respectively for the total void volume and volume of permeable void.

THANK YOU.....

APPENDIX SLIDE

RESULT ANALYSIS OF PSD

MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name: Lumajang Asli
Sample Source & type:
Sample bulk lot ref:

SOP Name: Cement OPC
Measured by: MALVERN INSTRUMENTS

Measured: Monday, October 03, 2016 10:30:09 AM
Analysed: Monday, October 03, 2016 10:30:11 AM

Particle Name: Cement OPC
Particle RI: 1.860
Dispersant Name:

Accessory Name: Scirocco 2000
Absorption: 0.1
Dispersant RI: 1.000

Analysis model: General purpose (fine)
Size range: 0.020 to 2000.000 um
Weighted Residual: 2.524 %

Sensitivity: Normal
Obscuration: 1.73 %
Result Emulation: On

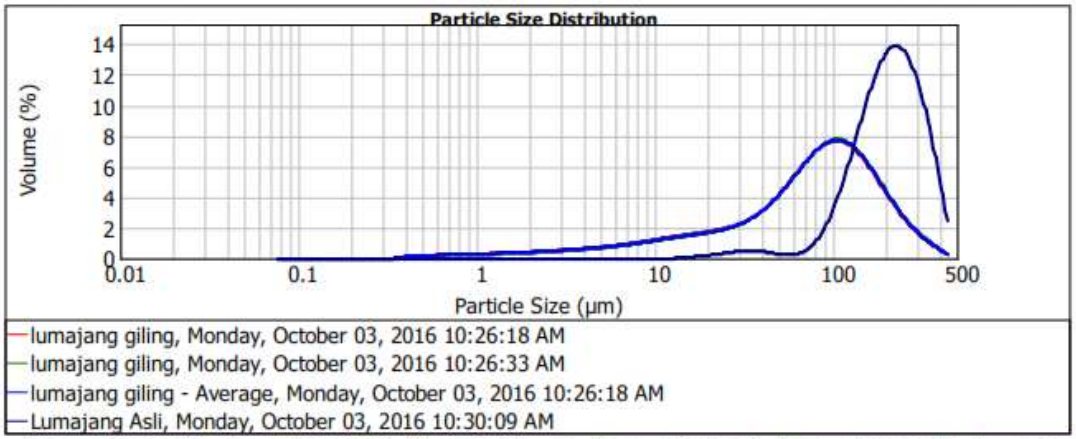
Concentration: 0.0128 %Vol
Specific Surface Area: 0.0114 m²/g

Span : 1.093
Surface Weighted Mean D[3,2]: 167.737 um

Uniformity: 0.343
Vol. Weighted Mean D[4,3]: 219.903 um

Result units: Volume

d(0.1): 114.012 um **d(0.5):** 211.259 um **d(0.9):** 344.954 um



Size (µm)	Vol Under %
0.500	0.00
1.000	0.00
1.046	0.00
1.500	0.00
2.000	0.00
2.500	0.00
3.000	0.00
5.000	0.00
10.000	0.00
15.000	0.02
20.000	0.25

Size (µm)	Vol Under %
25.000	0.64
32.000	1.33
36.000	1.70
38.000	1.87
40.000	2.02
45.000	2.33
50.000	2.56
53.000	2.66
56.000	2.74
63.000	2.92
71.000	3.20

Size (µm)	Vol Under %
75.000	3.42
80.000	3.79
90.000	4.90
100.000	6.61
106.000	7.92
112.000	9.45
125.000	13.39
140.000	18.89
150.000	22.96
160.000	27.26
180.000	36.18

Size (µm)	Vol Under %
200.000	45.12
212.000	50.31
224.000	55.31
250.000	65.26
280.000	75.06
300.000	80.52
315.000	84.09
355.000	91.64
400.000	96.89
425.000	98.56
450.000	99.67

Size (µm)	Vol Under %
500.000	100.00
560.000	100.00
600.000	100.00
630.000	100.00
710.000	100.00
800.000	100.00
850.000	100.00
900.000	100.00
1000.000	100.00
1120.000	100.00
1180.000	100.00

Size (µm)	Vol Under %
1250.000	100.00
1400.000	100.00
1600.000	100.00
1700.000	100.00
1800.000	100.00
2000.000	100.00

Particle Size Distribution (PSD)

SAND MILLING PROCESS

60 minutes of grinding time

BOWL-MILL SET

Model : BICO – 395-50X Series : 73454, Volt : 220/380/440
Ball Size : 1½” 27 pcs ; 1” 63 pcs ; ¾” 195 pcs

Mix-concreting

Flow table testing

Porosity of concrete equation

$$\text{Volume of permeable void} = \left[\frac{(g_2 - g_1)}{g_2}\right] \times 100\%$$

$$\text{Total void volume} = \left[\frac{(g_3 - g_1)}{g_3}\right] \times 100\%$$

g_1 g_2 g_3, respectively bulk density; apparent density; absolute density (g/cc)