THE INFLUENCE OF OPC AND PPC ON COMPRESSIVE STRENGTH OF ALWA CONCRETE

By:

Fedya Diajeng Aryani, ST
Prof.Tavio, ST., MT., PhD
Prof. Dr. Ir. IGP Raka, DEA
Dr. Puryanto, ST., MT

Backgrounds

1. Many cases of structural failure are caused by earthquake.

DISASTER TYPE	House (unit)			Damage to the Facility (unit)		
	Severly Damage	Moderately Damage	Slight Damage	Health	Religious	Education
Gempa Bumi	2768	4795	9820	22	160	150

Backgrounds

2. The high density of concrete.
3. The occurrence of environmental pollution caused by Polystyrene waste generated by industrial companies.



Material

OPC

Fine Aggregate

ALWA made from Polystyrene

PPC

Water

Crushed stone

How to create ALWA Which Made from Polystyrene?

Polystyrene

Acetone

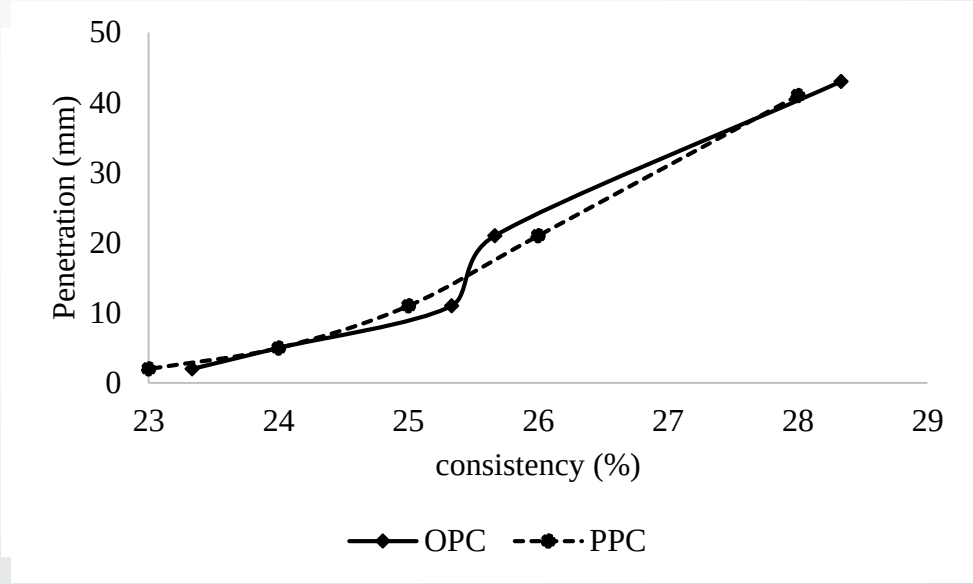
ALWA Made from Polystyrene

1.9

1

Cements

Test	OPC	PPC
Consistency (%)	25.11	24.83
Initial setting Time (minute)	45	166
Final Setting Time (minute)	150	190
Density (gr/cm^3)	3.06	3.07



Aggregates

Test	Fine Aggregate	Crushed stone
Absorption (%)	1.58	1.08
Specific Gravity (gr/cm^3)	2.67	2.68
Density (kg/m^3)	1487.33	1513.33
Fine Modulus (%)	2.40	6.64

Mix Design

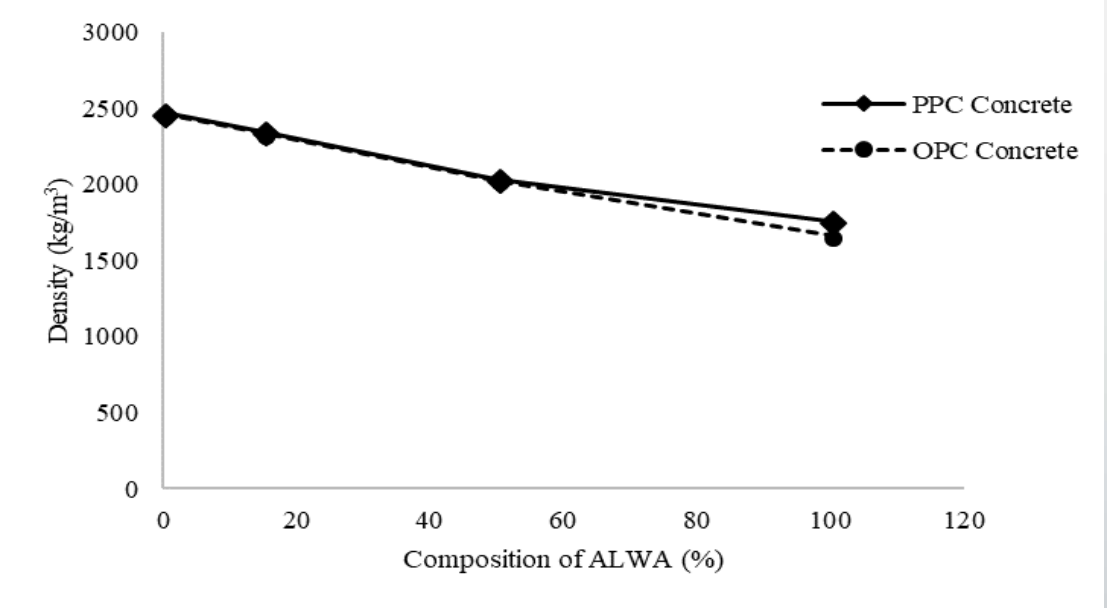
	Composition of ALWA (%)	w/c	Cement	Water	Fine Aggregate	Crushed Stone	Alwa Made from Polystyrene
OPC Concrete	0	0.3	700	210	547	931	0.00
	15	0.3	700	210	547	791	38.60
	50	0.3	700	210	547	465	128.65
	100	0.3	700	210	547	0	257.31
PPC Concrete	0	0.3	700	210	547	931	0.00
	15	0.3	700	210	547	791	38.60
	50	0.3	700	210	547	465	128.65
	100	0.3	700	210	547	0	257.31

Specimen

Composition of ALWA (%)	Types of Cement	Requirement Number of Specimen	
		Compressive Strength	Modulus of Elasyicity
0	OPC	3	
15		3	
50		3	
100		3	
0	OPC	3	
15		3	
50		3	
100		3	

Density

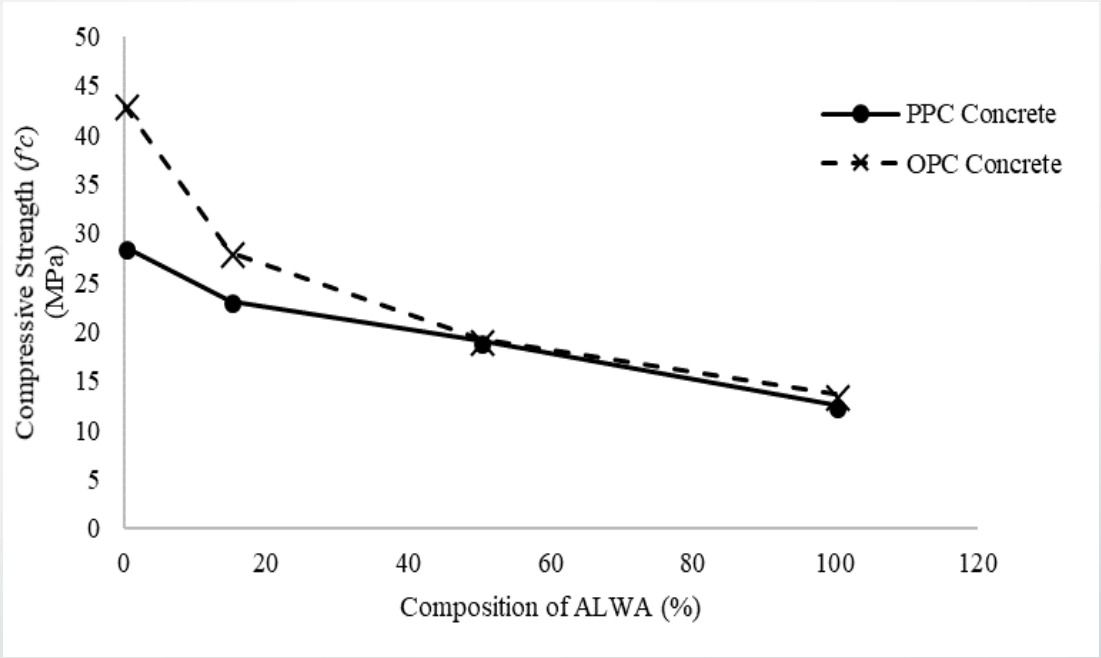
Composition of ALWA (%)	Density (kg/m^3)	
	OPC Concrete	PPC Concrete
0	2461.60	2472.21
15	2334.27	2344.88
50	2026.57	2037.18
100	1665.82	1761.31



According to SNI 2847:2013, the requirement for lightweight concrete is 1840 kg/m^3.

Compressive Stength

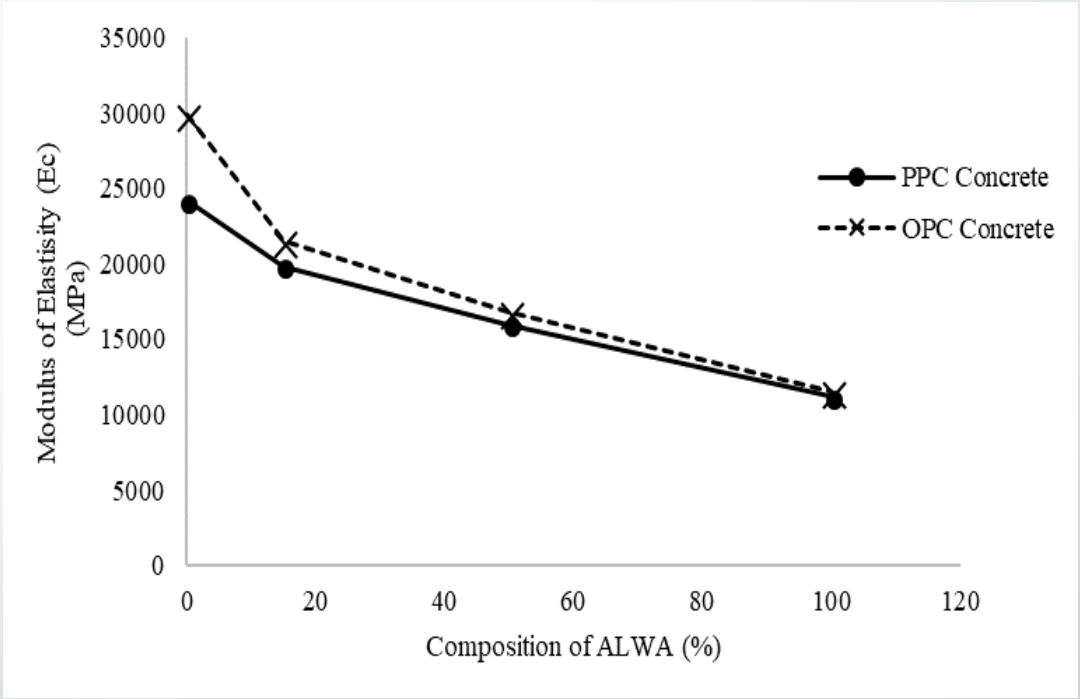
Composition of ALWA (%)	Compressive Strength (f'c) (Mpa)	
	OPC Concrete	PPC Concrete
0	43.05	28.65
15	28.06	23.10
50	19.23	19.02
100	13.61	12.52



According to SNI 2847:2013 [1], the minimum compressive strength requirements for earthquake-resistant concrete are 20 MPa and 17 MPa for structural concrete.

Modulus of Elasticity

Composition of ALWA (%)	Modulus of Elasticity (Ec) (Mpa)	
	OPC Concrete	PPC Concrete
0	29848.91	24150.44
15	21496.72	19813.68
50	16773.72	15990.72
100	11532.99	11177.96



Conclusion

1. The addition of ALWA made from polystyrene was able to reduce the density of concrete, in which the density of concrete was less than 1840 kg/m^3 on the addition of 100% ALWA made from polystyrene, which were 1665.82 kg/m^3 for OPC concrete and 1761.31 kg/m^3 for PPC concrete. This was due to the fact that the density of ALWA made from polystyrene is lighter in compared with the density of crushed stone.
2. The decrease of the density of concrete was directly proportional to the decrease of compressive strength and elasticity modulus value. This was due to the surface of ALWA made from polystyrene is slippery causing it is difficult to bind with other concrete material.
3. ALWA made from polystyrene could be used for structural concrete and earthquake resistant with respectively composition of 46.93% and 69.83% for OPC concrete, and 41.62% and 65.56% for PPC concrete.
4. The value of compressive strength and elasticity modulus was optimum with the use of ALWA made from polystyrene by adding 15% in OPC concrete.

THANK YOU