

# THE USING OF AERATED LIGHTWEIGHT CONCRETE AS AN ALTERNATIVE SUBSTITUTION FOR SOLID RED BRICK

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Abstract

*Aerated lightweight concrete or called Autoclaved Aerated Concrete, is also one of the alternative substitution material of solid red brick. Aerated lightweight concrete now has been widely marketed in several building materials stores and it is used in the project in Indonesia. Aerated lightweight concrete is a concrete which has a lighter specific gravity than a concrete which is generally made by adding the expandable material to create any cavities within, as thus the weight becomes lighter. Aerated lightweight concrete has two types: the wall panel type and the block type, with varied sizes depending on the manufacturer and type of utility. Aerated lightweight concrete weights around 600 - 1600kg/m<sup>3</sup> and it can withstand loads up to  $\pm 1200$  psi or  $\pm 84.372$ kg/cm<sup>2</sup>. Therefore, it is good for construction, especially for wall-constructing since it reduces the burden which is distributed to the foundation. The installation is faster and precise; hence it will save the time and reduce the cost of repairing.*

**Key Words :** *Aerated Lightweight Concrete, the wall panel type, the block type, weights, withstand loads*

## **1. BACKGROUND OF STUDY**

RECENTLY, THE DEVELOPMENT OF INDUSTRY IN INDONESIA IS GROWING RAPIDLY, ESPECIALLY IN THE JABODETABEK, THUS, LOTS OF URBAN RESIDENTS COME AND LIVE IN THAT AREA. ALONG WITH THAT PROBLEM, THE CONSTRUCTION OF HOUSING, SHOPPING-CENTERS, ENTERTAINMENT-CENTERS, SPORT AND OTHER SUPPORT FACILITIES ARE ALSO GROWING.

IN THOSE CONSTRUCTIONS, SOME BUILDING MATERIALS ARE REQUIRED. ONE OF THE BUILDING MATERIALS WHICH ARE NEEDED IS THE SOLID RED BRICK FOR CONSTRUCTING A WALL-PAIR. NOWADAYS, THE PRODUCTION OF THE RED BRICK IN ANY OTHER REGIONS DECREASES. THIS IS PROBABLY DUE TO THE LIMITED MAIN RAW MATERIAL—CLAY—BECAUSE THE LAND WHICH IS USED TO PRODUCE THE BRICKS HAS BEEN TURNED INTO BUILDINGS. IT FINALLY LEADS TO THE HIGHER PRICES OF THE BRICKS. MOREOVER, THE SMOKE OF THE BURNING IN THE BRICK-MAKING PROCESS CAN DISTURB THE CONVENIENCE OF THE LOCAL PEOPLE; HENCE, THE ALTERNATIVE SUBSTITUTION OF SOLID RED BRICK MATERIALS IS STARTING TO BE DEVELOPED.

ON ONE HAND, THE DEVELOPMENT OF THE BUILDING MATERIALS IS RAPIDLY GROWING, FOR EXAMPLE, IS AERATED LIGHTWEIGHT CONCRETE OR AUTOCLAVED AERATED CONCRETE. THIS AERATED LIGHTWEIGHT CONCRETE HAS BEEN WIDELY MARKETED IN SEVERAL BUILDING MATERIAL STORES AND IT IS NOW WIDELY USED IN THE PROJECT IN INDONESIA AS AN ALTERNATIVE SUBSTITUTION FOR THE SOLID RED BRICK MATERIALS. SINCE THIS LIGHTWEIGHT AERATED CONCRETE HAS SEVERAL STRENGTHS WHICH MAKE IT FOR BEING CONSIDERED AS AN ALTERNATIVE SUBSTITUTION ONE, IT STARTS TO CHANGE THE USING OF THE RED BRICKS IN INDONESIA.

## **2. THEORETICAL APPROACH**

### **A. AERATED LIGHTWEIGHT CONCRETE**

AERATED LIGHTWEIGHT CONCRETE IS A CONCRETE WHICH HAS A LIGHTER SPECIFIC GRAVITY THAN A CONCRETE WHICH IS GENERALLY MADE BY ADDING THE EXPANDABLE MATERIAL TO CREATE ANY CAVITIES WITHIN, AS THUS THE WEIGHT BECOMES LIGHTER. LIGHTWEIGHT CONCRETE WAS FIRSTLY DEVELOPED IN 1923, IN SWEDEN, AS AN ALTERNATIVE MATERIAL TO REDUCE THE DEFORESTATION DUE TO ANY LOGGINGS. THEN, IT WAS DEVELOPED BY JOSEPH HEBEL IN WEST GERMANY IN 1943 WHICH IS DEVELOPED IN SEVERAL COUNTRIES LATER. INDONESIA HAS ALSO DEVELOPED THE USING OF THIS ALTERNATIVE MATERIAL, PRECISELY IN KARAWANG, WEST JAVA.

## **B. VARIOUS KINDS OF AERATED LIGHTWEIGHT CONCRETE**

AERATED LIGHTWEIGHT CONCRETE HAS SEVERAL TYPES, INCLUDING:

- **WALL PANEL TYPE**

WALL PANEL TYPE HAS SOME MEASURES; THE MEASUREMENT IS AROUND 4.20 M X 1.20 M X 60M, OR SOME OTHER SIZES. EACH OF MANUFACTURERS HAS THEIR OWN STANDARD SIZE DEPENDING ON THE USAGE. THIS WALL PANEL TYPE IS DESIGNED BY MAKING A WALL PANEL FORMATION. IT HAS A CONNECTING DESIGN WHICH IS LIKE A PUZZLE ON THE EDGE OF THE PANEL OR BESIDE THE PANEL IN ORDER TO TIGHTEN THE CONNECTION BETWEEN PANELS.

- **BLOCK TYPE**

BLOCK TYPE IS DESIGNED BY RESEMBLING THE RECTANGULAR RED BRICK. THE SIZE IS ABOUT 60CM X 20CM X 10CM, OR MAY HAVE ANY OTHER MEASUREMENTS SINCE EACH MANUFACTURER HAS THEIR OWN STANDARD SIZE. THIS TYPE IS BASICALLY DESIGNED IN ORDER TO RESEMBLE THE SOLID RED BRICK, YET, IT IS LIGHTER AND MORE PRECISE.



**PICTURE : HOUSING AT TAMAN NYIUR, SUNTER, JAKARTA**

## **3. METHOD OF WRITING**

IN THIS WRITING, THE WRITER USES THE METHOD OF LITERATURE TAKEN FROM SEVERAL BOOKS AND INTERNET. THE WRITER ALSO USES THE METHOD OF OBSERVATION BY DIRECTLY LOOKING ROUND SOME OF THE LOCATION OF THE PROJECTS IN JAKARTA AND BEKASI. THE WRITER ALSO WRITES THIS WRITING BASED ON THE WRITER'S EXPERIENCE WHILE WORKING ON SEVERAL PROJECTS IN ORDER TO OBTAIN THE ACCURATE DATA.

## **4. DISCUSSION AND ANALYSIS**

### **A. THE WAY OF MAKING AERATED LIGHTWEIGHT CONCRETE**

- **MATERIALS**

- QUARTZ SAND

- CEMENT
- FOAM LIKE SPECTAFOAM
- GYPSUM
- ALUMINUM PASTE (EXPANDABLE SUBSTANCE)
- WATER.
- **INSTRUMENTS**
  - AUTOCLAVE CHAMBER
  - CONTAINERS/TANKS
  - MOULD OF THE BLOCK OR WALL PANEL TYPE
  - MIXER
- **THE WAY OF MAKING**
  - 1) THE MATERIALS FOR THE DOUGH OF RAW AERATED LIGHTWEIGHT CONCRETE (EXCEPT WATER) ARE TAKEN INTO THE AUTOCLAVE CHAMBER OR ARE GIVEN A STEAM HEAT AND HIGH PRESSURE. THE TEMPERATURE INSIDE THE AUTOCLAVE CHAMBER IS AROUND 183 CELSIUS DEGREES. IT IS PURPOSED AS A PROCESS OF DRYING OR RIPPING.
  - 2) AFTER ALL MATERIALS ARE DRY, PLACE IT ALL IN THE CONTAINERS / TANKS TO BE MIXED WITH WATER AND THEN STIR UNTIL BLENDED.
  - 3) THE BLENDED DOUGH, THEN, IS CASTED IN THE 4.20 M X 1.20 M X 0.60 M PANEL MOULD OR IN ANY PROVIDED MOULD, THEN FILLS IN THE MIXED MATERIAL FOR ½ PART OF THE MOULD.
  - 4) WAIT UNTIL ± 7-8 HOURS UNTIL THE DOUGH ARE FLUFFED INTO THE FOAM WHICH MAKES THE VOLUME OF THE DOUGH TWICE LARGER THAN THE ORIGINAL VOLUME. IT IS BECAUSE OF CHEMICAL REACTION BETWEEN THE ALUMINUM PASTE AND CALCIUM HYDROXIDE WITHIN THE QUARTZ SAND AND WATER AS THUS PRODUCES HYDROGEN WHICH FORMS THE AIR BUBBLES IN THE CONCRETE MIXTURE. THESE AIR CAVITIES MAKE A LIGHTWEIGHT CONCRETE. AFTER THE HYDROGEN RELEASE INTO THE AIR, THE TEXTURE OF THE CONCRETE REMAINS SOLID AND SMOOTH.
  - 5) AFTER THE DOUGH OF THE AERATION BECOMES HARD, IT WILL BE EASILY FORMED AS NEEDED BY CUTTING IT USING THE WIRE DEPENDING ON THE WANTED SIZE.

- 6) NEXT, PUT IT INTO THE AUTOCLAVE CHAMBER FOR 12 HOURS FOR THE HARDENING PROCESS. DURING THE HARDENING PROCESS, THE TEMPERATURE WILL REACH 190 CELSIUS DEGREES AND THE PRESSURE CAN REACH 12 BAR OR 174 PSI.
- 7) AFTER REMOVING IT FROM THE AUTOCLAVE CHAMBER, THE AERATED LIGHTWEIGHT CONCRETE HAS HARDENED AND READY TO USE.

### **C. THE WEIGHT AND THE STRENGTH OF AERATED LIGHTWEIGHT CONCRETE**

AERATED LIGHTWEIGHT CONCRETE WEIGHTS AROUND 600 - 1600KG/M<sup>3</sup> WHICH IS LIGHTER THAN NORMAL WEIGHT OF SOLID RED BRICK WHICH WEIGHTS 1500-1700KG/M<sup>3</sup>. ALTHOUGH AERATED LIGHTWEIGHT CONCRETE HAS MANY AIR CAVITIES, BUT IT CAN WITHSTAND THE LOADS UP TO  $\pm$  1200 PSI OR 84.372KG/CM<sup>2</sup> WHICH IS GREATER THAN THE COMPRESSIVE STRENGTH OF GRADE 25 SOLID RED BRICK (25KG / CM<sup>2</sup>) AND 50 (50KG/CM<sup>2</sup>).

### **C. THE INSTALLATION OF AERATED LIGHTWEIGHT CONCRETE**

#### **1) INSTALLING THE WALL PANEL TYPE**

THE WALL PANEL AERATED LIGHTWEIGHT CONCRETE IS USUALLY INSTALLED BY SETTING UP THE PANELS AND TYING EACH PANEL BY COMBINING A SPECIFIC PART WHICH IS SUPPOSEDLY DESIGNED TO STRENGTHEN THE BOND/CONNECTION BETWEEN PANELS (RESEMBLING WHEN SOMEONE ARRANGES A PUZZLE), THEN, FILLS IN THE GAPS BETWEEN PANELS WITH THE INSTANT MORTAR. FOR SPECIFIC NEEDS, IT IS USUALLY REQUIRED THE CUTTING IRON OR ANY OTHER CONNECTION TYPES FOR TIGHTENING THE PANELS.

#### **2) INSTALLING THE BLOCK TYPE**

THE INSTALLATION OF THE BLOCK AERATED LIGHTWEIGHT CONCRETE IS LIKE ARRANGING THE BRICKS BY ALTERNATING INTERVALS OR AS NEEDED. EACH CONNECTION USES A THIN INSTANT MORTAR;  $\pm$  3 MM. IT DOES NOT REQUIRE MUCH SPACE AND TIME TO PREPARE THE MATERIALS SINCE USING THE INSTANT MORTAR. THE WAY IS QUIET SIMPLE, BY POURING THE MORTAR FROM THE WRAPPER AND MIXING IT WITH WATER BASED ON THE RULE.

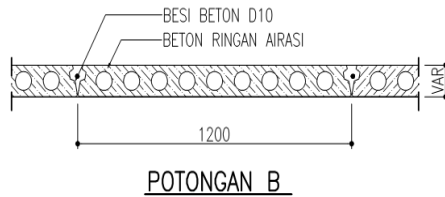
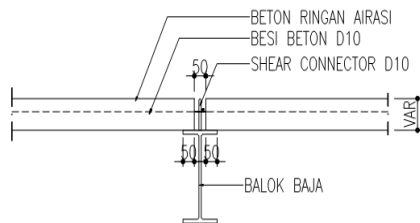
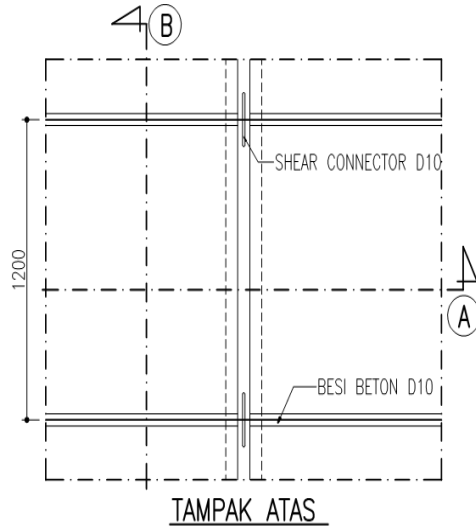
#### **3) FINISHING**

FOR MAINTAINING THE DURABILITY OF THE AERATED LIGHTWEIGHT CONCRETE, IT IS STILL REQUIRED THE WALL PLASTER AS LITTLE AS 1-1,5CM MORE THIN THAN IF WE MAKE SOLID RED BRICK COUSE WORKERS ARE ABLE TO CREATE PRECISION.

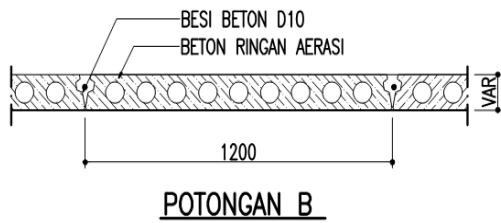
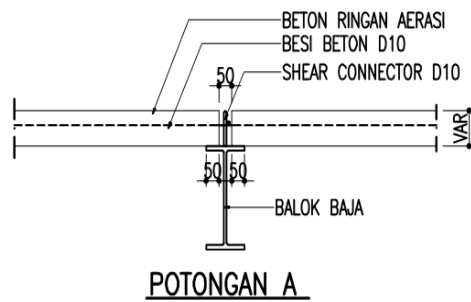
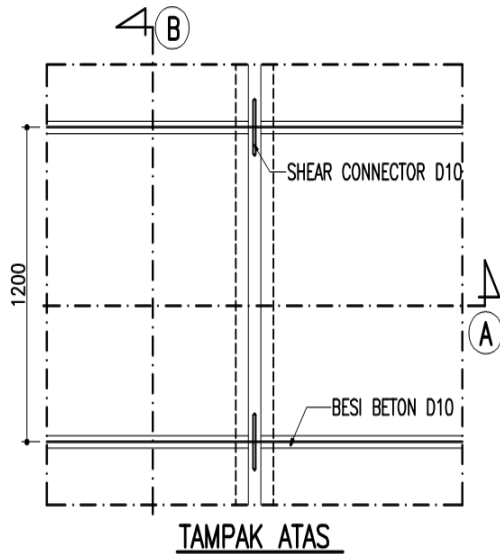
**D. THE CONNECTION SYSTEM OF AERATED LIGHTWEIGHT CONCRETE FOR WALL PANEL TYPE**

THE WAY TO CONNECTION AERATED LIGHTWEIGHT CONCRETE IS AS FOLLOWS :

**1) PLACEMENT OF AERATED LIGHTWEIGHT CONCRETE ON STEEL STRUCTURE**



**2) PLACEMENT OF AERATED LIGHTWEIGHT CONCRETE ON CONCRETE STRUCTURE**



**E. THE PRICE COMPARED BETWEEN AERATED LIGHTWEIGHT CONCRETE AND SOLID RED BRICK**

USUALLY, AERATED LIGHTWEIGHT CONCRETE ( TYPE BLOCK ) HAVE SIZE AVERAGE 20 X 60 X 10 CM OR SMALLER CAN BE A BIT THICK. WHILE THE SOLID RED BRICK HAVE SIZE APPROXIMATELY 25 X 12 X 4.5 CM OR SMALLER FEW CENTIMETERS. IN A 1 M<sup>2</sup> PAIR-WALL, USE SOLID RED BRICK APPROXIMATELY 85 PCS AND USE APPROXIMATELY OF 8.5 PCS AERATED LIGHTWEIGHT.

WHEN VIEWED IN TERMS OF PRICE , AERATED LIGHTWEIGHT CONCRETE PRICE RANGES RP. 6500, - / PCS AND SOLID RED BRICK PRICE RANGE RP 375, - / PCS. THUS, FOR 1M<sup>2</sup> PAIR-WALL REQUIRES A COST RP RP. 6500, - X 8.5 = RP. 55 250, - FOR AERATED LIGHTWEIGHT CONCRETE AND RP. 375, - X 85 = RP. 31 875, - IF USE SOLID RED BRICK

(OUTSIDE OF THE SPEC).

**E. THE EXCESSES OF AERATED LIGHTWEIGHT CONCRETE**

- 1) EASY TO BE SHAPED AND CUTTING ORDER TO FULFILL THE NEEDS OF THE BUILDING BY USING A SAW OR OTHER CUTTING TOOLS.
- 2) EASY TO USE  
AERATED LIGHTWEIGHT CONCRETE HAS LARGA SIZE MEANS THAT CONSTRUCTION WORKING IS FAST. ALL OFF-CUTS CAN ALSO BE SAFELY UTILIZED MINIMIZING WASTAGE.
- 3) EASY TO BE LOADED SINCE IT IS LIGHTWEIGHT.
- 4) REDUCING THE BURDEN WHICH IS CONNECTED TO THE FOUNDATION AS THUS IT WILL REDUCE THE COST FOR TIGHTENING THE FOUNDATION
- 5) THE SHAPE IS PRECISION AS THUS THE PAIR OF WALLS CAN ALSO BE PRECTISE.
- 6) THE RISKS OF PRODUCTION'S FAILURE ARE FEWER SINCE THE PROCESS OF PRODUCTION IS WELL-CONTROLLED.
- 7) IT USES PARTICULAR CEMENT INSTEAD OF USING A  $\pm$  3MM MORTAR; HENCE THE WALL-PAIR IS TIDIER AND IT CAN REDUCE THE COSTS FOR REPAIRING.
- 8) THE SIZE WHICH IS LARGER THAN THE SOLID RED BRICK WILL SHORTEN THE INSTALLATION TIME.
- 9) HEAT, FIRE, AND EARTHQUAKE RESISTANT. AERATED LIGHTWEIGHT CONCRETE THAT PRODUCES CONTAINS SILICA AND GIVING IT IMPRESSIVE HEAT INSULATION QUALITIES. AERATED LIGHTWEIGHT CONCRETE WILL GIVE A FIRE RESISTANCE OF 4 HOUR.
- 10) DURABLE, RESILIENCE IS ROUGHLY EQUAL TO THE CONVENTIONAL CONCRETE.
- 11) SOUNDPROOFED  
AERATED LIGHTWEIGHT CONCRETE HAS GOOD SOUND INSULATION QUALITIES COMPARED TO OTHER BUILDING MATERIALS



***E. SOME PROJECT THAT USE AERATED LIGHTWEIGHT CONCRETE***

- 1) FASADE GREEN BAY PLUIT AT PLUIT , JAKARTA (AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)



- 2) HOUSING AT TAMAN NYIUR, SUNTER, JAKARTA  
(AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)



- 3) HOME RENOVATION AT HARAPAN INDAH, BEKASI  
(AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)



- 4) CITRA BAJATAMA OFFICE AT TAMAN NYIUR, SUNTER , NORTH JAKARTA (AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)

- 5) AIM FOOD MANUFACTURING INDUSTRY AT CIBITUNG, WEST JAVA (AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)
- 6) MAPLE PARK APARTMENT AT KEMAYORAN, JAKARTA (AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)
- 7) POSTGRADUATE BUILDING AT ISLAMIC'45 UNIVERSITY, BEKASI, WEST JAVA (AERATED LIGHTWEIGHT CONCRETE USE FOR WALL-PAIR)
- 8) ETC

## **5. CONCLUSIONS AND RECOMMENDATIONS**

### **A. CONCLUSION**

1. AERATED LIGHTWEIGHT CONCRETE IS RANGED ABOUT  $600 - 1600\text{KG/M}^3$  AND IT CAN WITHSTAND THE LOADS UP TO  $\pm 1200\text{ PSI}$  OR  $84.372\text{KG/CM}^2$ , THEREFORE, IT IS GOOD FOR WALL CONSTRUCTION, ESPECIALLY FOR WALL-PAIR.
2. THERE ARE SOME PROJECT AT JAKARTA AND WEST JAVA USE AERATED LIGHTWEIGHT CONCRETE
3. AERATED LIGHTWEIGHT CONCRETE HAS SEVERAL ADVANTAGES WHICH CAN SAVE THE TIME, REDUCE THE COSTS OF INSTALLING OR REPAIRING.

### **B. SUGGESTION**

THE AERATED CONCRETE SHOULD BE DEVELOPED BY USING INEXPENSIVE , ENVIRONMENTAL FRIENDLY MATERIALS AND LOCAL MATERIALS.

## BIBLIOGRAPHY

TATA SURDIA, SHINROKU SAITO, 1992. *PENGETAHUAN BAHAN TEKNIK*. PT. PRADNYA PARAMITA : JAKARTA.

NINIK PARYATI ,2004 *.KUALITAS BATA DENGAN PENAMBAHAN KOTORAN SAPI*. UJB : YOGYAKARTA.

ANONIM.1987. *STANDART INDUSTRI INDONESIA (MUTU DAN CARA UJI BATA MERAH PEJAL)*. DEPARTEMEN PERINDUSTRIAN : JAKARTA

ANONIM.2002. *TATA CARA PERANCANGAN CAMPURAN BETON RINGAN DENGAN AGREGAT RINGAN*. DEPARTEMEN PERINDUSTRIAN : JAKARTA

[HTTP://CHENSCO1.EN.MADE-IN-CHINA.COM](http://CHENSCO1.EN.MADE-IN-CHINA.COM)

[HTTP://SANGGAPRAMANA.WORDPRESS.COM](http://SANGGAPRAMANA.WORDPRESS.COM)

[HTTP://PU.GO.ID](http://PU.GO.ID)

[HTTP://KINGPONSELKU.COM](http://KINGPONSELKU.COM)

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[HTTP://FLICKRIVER.COM](http://FLICKRIVER.COM)

[HTTP://JAYACELCON.CO.ID](http://JAYACELCON.CO.ID)

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[HTTP://BANDHSOLUTIONSLTD.COM](http://BANDHSOLUTIONSLTD.COM)

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[HTTP://BELING.NET/ARTICLES/ABOUT/PORTLAND\\_CEMENT](http://BELING.NET/ARTICLES/ABOUT/PORTLAND_CEMENT)

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