POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

PROPOSAL:

To Identify Content Of Water Cement Ratio For Lightweight Brick Due To Strength

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CONTENT

CHAPTER 1

INTRODUCTION

Block, a structural element that is used to create a wall that has capability provide safety and shelter, enclose or divide, in construction term, to form the periphery or margin of a room or a building. In traditional masonry construction, block supported the weight of floors and roofs. A block wall also a must to be sturdy and long-lasting, it also comes with various types with matching characteristic to it.

There are 5 characteristic of a block that must be full filled. Firstly, strength and stability which could handle superimposed loads and resist lateral pressure caused by wind. Secondly, resistance to weather where exposure to sunlight, humidity, rain and cold will not affect the block in any how due to its objective of making which is to provide protection from external entities. Thirdly, the ability of fire resistance, this is to provide protection by slowing down the burning and decreasing heat through absorbing it, through these lives could be saved and number of fatalities decreased when a fire accident breaks out. Lastly, thermal and sound insulation which bring to its ability of reducing the amount of heat and sound penetrating the block wall either way, this will give comfort to the people in the building from heat from the sun and noisy sound.

From the 5 characteristics one stands to be the most important in giving a block its function as a practical and common construction material, which is strength. In this case, lightweight block that is made up with foam added making it density lesser than water which is 850 kg/m^3 and 1000 kg/m^3 respectively. To that the density of lightweight brick lets it float in water which makes it lighter than conventional clay block, but the question is what's the optimum water content for lightweight block that gives it strength stronger or equal strength to conventional clay block. Foamed concrete is a highly workable, low-density material which can incorporate up to 75 per cent entrained air. It is generally self-levelling, self-compacting and may be pumped. Foamed concrete is ideal for filling redundant voids such as disused fuel tanks, sewer systems, pipelines, and culverts - particularly where access is difficult. It is a recognised medium for the reinstatement of temporary road trenches. Good thermal insulation properties make foamed concrete also suitable for sub-screeds, filling under-floor voids and insulation on flat concrete roofs.

(*The Concrete Centre, part of the MPA, https://www.concretecentre.com/Specification/Special-Concrete/lightweight-concrete.aspx*)

In the vast present world where time and cost are taken into accounts strictly, and its crucial too for the construction world to be always up to the present needs, where building made easy, fast and sustainable. There are many ways to do so and the vision that we seek is by figuring the optimum water ratio in making lightweight and through this many contributions can be made to polytechnic, and we choose to take advantage of light weight and eco-friendly items that can be applied to reduce extra weight. The main objective is to provide efficiency and cost friendly by minimizing the use of water and adding an approximate of 30%-40% of air void that consist of light weight material with outstanding amount of load handling. Builders using lightweight concrete have the option of using a method of "internal curing", which enables the concrete to cure from the inside out. This is not possible when using normal concrete because it is not as porous as its lightweight counterpart.

1.2 PROBLEM STATEMENT

Today, there are numerous numbers of lightweight concrete but, the most famous in the construction world is by adding foam. Foam is the most easiest substance to produce and handle with minimal use of professional workers. Conventional clay bricks is widely used since it was introduced but, at this recent times, efficiency is very important due to its affect on the cost, environment and workability. The problem statement of the project is:

i. Water ratio in lightweight concrete
ii. Optimum density with the best strength

As a developing country, Malaysia must find sustainability in construction sector because heavy building materials may slow the progress and its productivity. On the other hand, conventional building that uses clay brick may result in high cost due to the price hike of the clay brick and the number of labour usage causing insufficient funds that leads to abandoned construction.

Conventional clay brick is prominent when it comes to construction but needs high investment in it and the causes high in funding. Finally, the use of heavy machinery to transport these clay bricks from factories causes latency of project completion and may cause insufficient fund due to transportation factor of this building material.

1.3 OBJECTIVES

Objective that are focused on are:

i. To create a foam generator.
ii. To produce lightweight concrete blocks .
iii. To find the best water cement ratio for light weight concrete block with the optimum density of 850kg/m^3 or less than 900kg/m^3

1.4 SCOPE OF STUDY

The scope of study is focusing in producing lightweight concrete brick:

i. Location is at the concrete lab at Polytechnic Sultan Salahuddin Abdul Aziz Shah.
ii. Method of concrete mixing is used with addition of foreign substance to achieve its objective.
iii. Our product will help to identify the best volume of water for the best strength of the concrete lightweight block.
iv. Size of the block will match the sizes that are already in the market

CHAPTER 2

LITERATURE REVIEW

A literature review is a body of text that aims to review the critical points of current knowledge and or methodological approaches on a particle topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. In essence, a literature review identifies, evaluates and synthesises the relevant literature within a particular field of research. It illuminates how knowledge has evolved within the field, highlighting what has already been done, what is generally accepted, what is emerging and what is the current state of thinking on the topic.

Historically, the structural design of masonry buildings was based on the empirical requirements of building codes for minimum wall thickness and maximum height. Bearing wall construction for buildings higher than three to five stories was uneconomical and other methods of support (steel or reinforce concrete frame) were generally used. In 1965, there was a renewed interest on the part of the design professional, architect and engineer, in modern bearing wall construction, wherein the design is based on a rational structural analysis rather than on outmoded arbitrary requirements. Many research projects have been conducted on the properties of the three basic components and the overall unreinforced masonry wall with vertical load and load eccentricities. (Mir Abdul Kuddus1, Pere Roca Fabregat 2)
(p-ISSN: 2320-334X, Volume 14, Issue 1 Ver. IV (Jan. - Feb. 2017))

2.1 MATERIALS OF LIGHTWEIGHT CONCRETE BLOCK.

Table 2.1

Materials	**Description**
Cement	Concrete, usually Portland cement concrete (for its visual resemblance to Portland stone) is a composite material composed of fine and coarse aggregate bonded together with a fluid cement (cement paste) that hardens over time—most frequently in the past a lime-based cement binder, such as lime putty, but sometimes with other hydraulic cements, such as a calcium aluminate cement or Portland cement.
Foam agent	Synthetic foaming agents are such chemicals which reduce the surface tension of liquid and commonly used globally to make blocks, bricks, CLC concrete etc where the high density is needed and it requires less energy for formation as compared to other foaming agents (*https://www.sakshichemsciences.com/foaming-agent.php*)
Plasticizer	Plasticizers or dispersants are additives that decrease the plasticity or decrease the viscosity of a material. These are the substances which are added in order to alter their physical properties. These are either liquids with low volatility or solids (*https://en.wikipedia.org/wiki/Plasticizer*)
Wooden Mould	The lightweight concrete mix is poured in a wooden made mould to give it a specific shape. This shape is measured to fulfil length, width and height that are in used in recent times.

2.2 TYPES OF LIGHTWEIGHT CONCRETE BLOCK

I. Light Weight Aggregate Concrete

This type of concrete is produced by using porous light weight aggregate of low specific gravity usually less than 2.6.

II. Aerated, Cellular, Foamed or Gas Concrete

This type of concrete is produced by introducing larger voids with in the concrete or mortar. These voids should be clearly distinguished from the fine voids produced by air entrainment.

III. No Fines Concrete

This type of concrete is produced by omitting the fine aggregate from the mix, which results in the large number of interstitial voids. In this concrete normal weight coarse aggregate is used.

(http://www.engineeringenotes.com/concrete-technology/light-weight-concrete/light-weight-concrete-types-and-applications-concrete-technology/31840 , article by Sharddhu S)

Chapter 3
METHODOLOGY

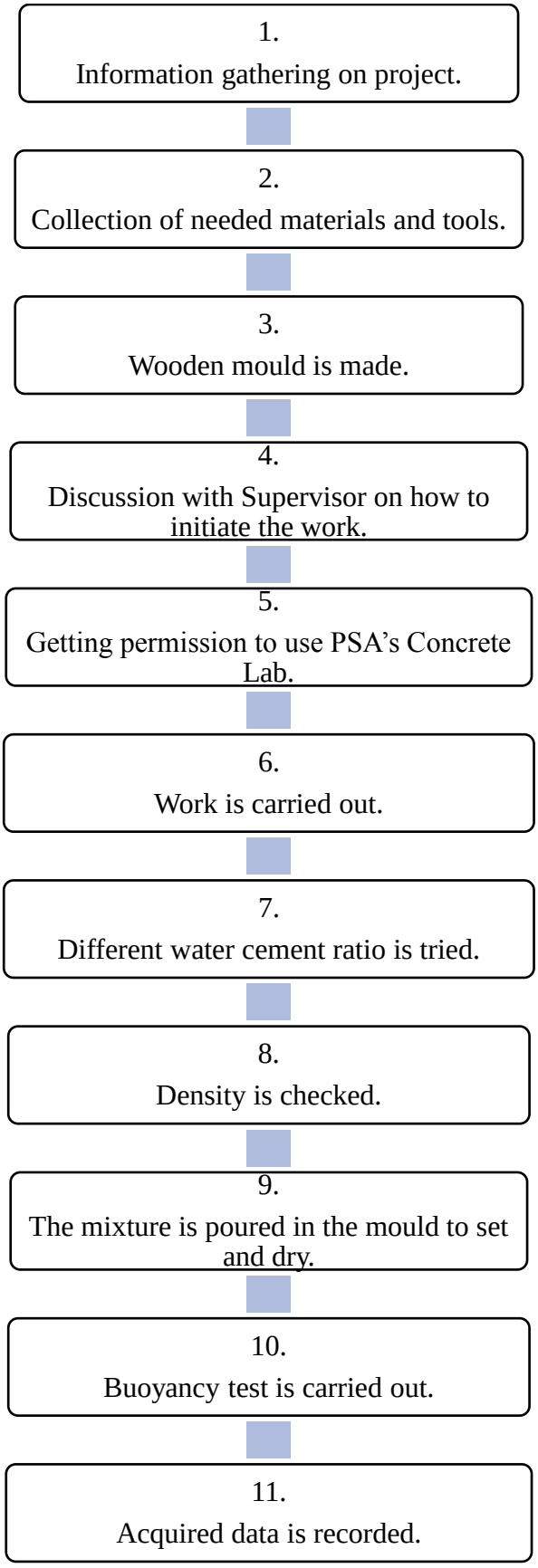
3.1 Introduction

Methodology can be the 'analysis of the principle of method, rules, and postulates employed by a discipline', 'the systematics study of methods that are, can be, or have been applied within a discipline' or 'a particular procedure or set of procedures'. Each and every steps of projects are a process to complete the project. Every step must be followed one by one and must be done carefully. If some error occurs it can make a project probably could not operates or do not look neat and perfect.

Methodology includes a philosophically coherent collection of theories, concepts or ideas as they related to particular discipline. Methodology refers to more than a simple set of methods, rather it refers to the rationale and the philosophical assumptions that underlie a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers.

This explains clearly about the study method for producing lightweight concrete by using foam. The test will be conducted to find the optimum density of 850 kg/m^3 to 900 kg/m^3. All the procedures are prepared accordingly, to assure research objectives are applicable, and to secure proper sequence and smooth running of the entire flow, from start to end. Different water cement ratio is take to consideration in carrying out this project.

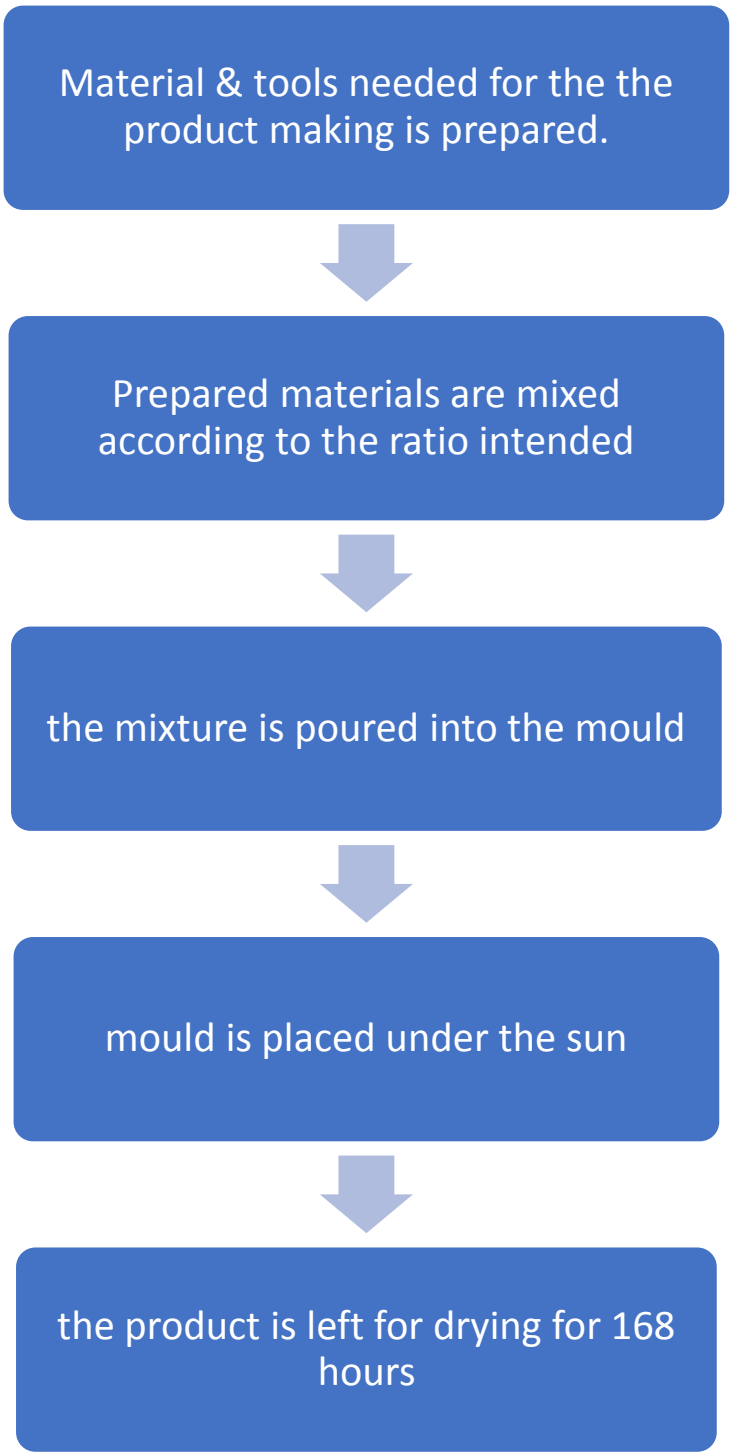
3.1 Flow Chart Process



3.2 Product Making

Making methodology by using (sample making in laboratory method)

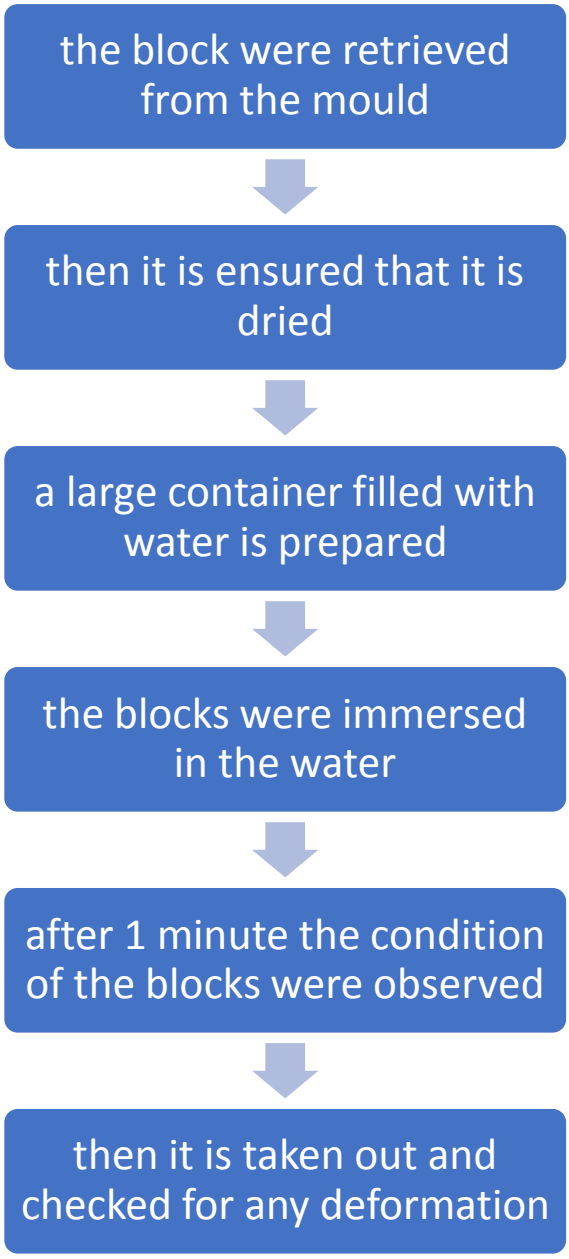
- Location: proposed Politeknik Sultan Salahuddin Abdul Aziz structure lab.



3.3 Testing

3.3.1 Buoyancy test

Buoyancy is the upward force of water that allows objects to float. Objects that can float in water, or other liquids, are said to be buoyed in the water. An object's ability to float comes from the upward force of the liquid in which it is placed. This test is done to find its capability of floating in water due to its density lower than the density of water. The samples are dried thoroughly to find its full capability.



3.2 Lightweight Concrete block and Properties

In this project, the wide use of lightweight concrete block is varying. The design of lightweight concrete block is shown in Product Design. This design is acquired from the standard size product of building block in Malaysia.

3.2 PRODUCT DESIGN

Figure 1.1

Size used in this project :

Length: 600 mm

Height: 200 mm

Width: 100 mm

3.3 PRODUCT PRODUCTION

3.3.1 Sample is made in lab

- Location: Polytechnic of Sultan Salahuddin Abdul Aziz Shah's Concrete Lab

3.3.2 Types of ratio

Table 1.1 Type of Ratio

No.	Ratio
1.	***Ratio 1*** 1:1 = Cement : Fine Aggregate (Sand) Water is 38% of cement and sand = 1.14 litre Foaming agent is 1: 10 = 100 ml foaming agent (added into 1 litre water) White Plaster = 1kg Plasticizer = 100ml
2.	***Ratio 2*** 1:1 = Cement : Fine Aggregate (Sand) Water is 40% of cement and sand = 2 litre Foaming agent is 1: 10 = 500 ml foaming agent (added into 1 litre water) White Plaster = 1kg Plasticizer = 100ml

3.4 PREPARATION OF MATERIAL

i. Portland Cement

Figure 3.1:cement is being weight

ii. Water

Figure 3.2: water amount measured

iii. Fine Aggregate : Sand

Figure 3.3: sand is weighted

iv. Foaming Agent + water

Figure 3.4:synthetic foam

v. White Plaster

Figure 3.5: lime plaster

vi. Air Compressor

Figure 3.6: 2hp air compressor

vii. Measuring tape

Figure 3.7: inch and meter measuring tape

viii. Plasticizer

Figure 3.8: concrete plasticizer

Chapter 4

RESULT & ANALYSIS

4.1 INTRODUCTION

The results section should aim to narrate the findings without trying to interpret or evaluate, and also provide a direction to the discussion of our final year project. The results are reported and reveal the analysis. To achieve the objective of study, we use water absorption test.

(tom, 2015)

4.1 Compression test

Table 4.0: results of compression test using compression machine

Block	**Density , kg/m^3**	**Load taken, kN**	**Strength, MPa**
Sample 1	910	7.32	0.3
Sample 2	960	79.26	4.6
Controlled sample	900	101.28	4.6

4.2 Density Analysis

i. With ratio 1 : 1 = water 38% of cement, with density of 910 kg/m^3

Figure 4.1: Block failure

ii. With ratio 1 : 1 = water 38% of cement , with density of 960kg/m^3

Figure 4.2: solid block

CHAPTER 5

CONCLUSION & IMPROVEMENTS

5.1 Problem solving

Each project that is to be developed should not be missed from encountering problems during the implementation of processes. Our team had encountered problems in getting the foaming solution due to its not sold in small quantity. This had been solved by consulting our supervisor and finding construction personnel that sell in small amounts.

5.2 Ideas & Improvements

At the end of this project we have found some flaw in the study that can be improved. Firstly is the foam generator, for a prototype it had succeed its objective but better versions can be worked out to have efficiency and cost friendly. Secondly is the type of foaming agent, where we had used synthetic type only due to only access to it. Many more foaming agent type can be used to carry out this study and have more prominent result .

5.3 Conclusion

In conclusion, lightweight concrete block are easy to work with, especially in decreasing the use of many labour our high-tech that may cost a lot in todays market. Even though foam may sound very illogic due to its physical look, it may give enough strength to take high level of weight on it. Through this project we've found that making lightweight block is not a big deal. Its jus the initial cost but in the end it may give prominent results.

Many more research and development work can help to improve this treasure-like technology of concrete world due to ever expending science and engineering. Ideas that can improve this is, by producing a stronger foam that is light and not to forget environmental-friendly in mind. Second, better plasticizing may give better result in the near future, where can help solve brittleness problems in the lightweight concrete block dilemma.