

**STUDY OF SAND BRICK RATIO 1:3 FOR PARTIAL  
REPLACEMENT OF SAND WITH PALM KERNEL SHELLS  
(0%, 5% AND 15%)**

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Thesis submitted in fulfilment of the requirements  
For the award of the degree  
Of Bachelor Civil Engineering

Faculty of Civil Engineering and Earth Resources  
University Malaysia Pahang

JANUARY 2017

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I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of the Degree of Civil Engineering

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I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

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This work hard dedicated to my beloved parents, lecturers and loyal friends who support me along the journey of education at University Malaysia Pahang.

## ACKNOWLEDGEMENTS

First and above all, I praise Allah, the almighty for providing me this opportunity and granting me the capability to proceed successfully. Without the will of Allah S.W.T, this task will not be able to be finished and the chances to contribute to the society and the academic world will not be able to be realized. This thesis appears in its current form due to the assistance and guidance of several people. I would therefore like to offer my sincere thanks to all of them.

I offer my sincerest gratitude to my supervisor, Madam Shariza Binti Mat Aris, who has supported me throughout my thesis with his patience. With his encouragement and effort, thesis would not have been completed or written.

For my parents, Madam Hasnah Binti Yusoff, and my family thanks for the morale supports. Not forgotten my loyal friends in UMP, especially in concrete Laboratory members.

Doa and my hope that ALLAH S.W.T repay your kindness.

## TABLE OF CONTENTS

|                                 |                               | PAGE |
|---------------------------------|-------------------------------|------|
| <b>SUPERVISOR’S DECLARATION</b> |                               | ii   |
| <b>STUDENT’S DECLARATION</b>    |                               | iii  |
| <b>ACKNOWLEDGEMENT</b>          |                               | iv   |
| <b>ABSTRACT</b>                 |                               | v    |
| <b>ABSTRAK</b>                  |                               | vi   |
| <b>TABLE OF CONTENT</b>         |                               | vii  |
| <b>LIST OF TABLES</b>           |                               | xii  |
| <b>LIST OF FIGURE</b>           |                               | xiii |
| <b>LIST OF ABBRIVIATION</b>     |                               | xv   |
|                                 |                               |      |
| <b>CHAPTER 1</b>                | <b>INTRODUCTION</b>           |      |
| 1.1                             | Background of Study           | 1    |
| 1.2                             | Problem Statement             | 2    |
| 1.3                             | Objectives                    | 3    |
| 1.4                             | Scope of Study                | 3    |
|                                 |                               |      |
| <b>CHAPTER 2</b>                | <b>LITERATURE REVIEW</b>      |      |
| 2.1                             | Introduction                  | 4    |
| 2.2                             | General                       | 4    |
|                                 | 2.2.1 Sand Brick              | 4    |
|                                 | 2.2.2 Palm Kernel Shell (PKS) | 5    |
| 2.3                             | Type of Bricks                | 6    |

|                  |       |                             |    |
|------------------|-------|-----------------------------|----|
|                  | 2.3.1 | Clay Brick                  | 6  |
|                  | 2.3.2 | Common brick                | 7  |
|                  | 2.3.3 | Facing brick                | 7  |
|                  | 2.3.4 | Engineering Brick           | 8  |
|                  | 2.3.4 | Sand – Lime Brick           | 8  |
| 2.4              |       | Properties of Brick         | 9  |
|                  | 2.4.1 | Compressive Strength        | 9  |
|                  | 2.4.2 | Water Absorption            | 10 |
| 2.5              |       | Method                      | 11 |
|                  | 2.5.1 | Curing                      | 11 |
| <b>CHAPTER 3</b> |       | <b>RESEARCH METHODOLOGY</b> |    |
| 3.1              |       | Introduction                | 13 |
| 3.2              |       | Methodology Flow Chart      | 14 |
| 3.3              |       | Design Brick Mix            | 15 |
|                  | 3.3.1 | Cement                      | 15 |
|                  | 3.3.2 | Water                       | 16 |
|                  | 3.3.3 | Kernel Shell                | 16 |
|                  | 3.3.4 | Fine Aggregates             | 18 |
| 3.4              |       | Parameter Used For Testing  | 18 |
|                  | 3.4.1 | Machine prepared sample     | 18 |
| 3.5              |       | Dimension Analysis          | 19 |
|                  | 3.5.1 | List prepared sample        | 20 |



|                  |       |                                         |    |
|------------------|-------|-----------------------------------------|----|
|                  | 3.5.2 | Analysis sample                         | 21 |
| 3.6              |       | Procedure of Work                       | 21 |
|                  | 3.6.1 | Mould                                   | 22 |
|                  |       | 3.6.1.1 The procedure to form the mould | 22 |
|                  |       | 3.6.1.2 The preparation material        | 23 |
|                  |       | 3.6.1.3 Process of work                 | 23 |
| 3.7              |       | Curing                                  | 25 |
| 3.8              |       | Compressive Strength Test               | 26 |
|                  | 3.8.1 | Apparatus                               | 26 |
|                  | 3.8.2 | Procedures                              | 26 |
|                  | 3.8.3 | Calculation                             | 26 |
| 3.9              |       | Water Absorption                        | 28 |
|                  | 3.9.1 | Apparatus                               | 28 |
|                  | 3.9.2 | Procedures                              | 28 |
|                  | 3.9.3 | Calculation                             | 28 |
| <b>CHAPTER 4</b> |       | <b>RESULT AND DISCUSSION</b>            |    |
| 4.1              |       | Introduction                            | 29 |
| 4.2              |       | Compressive Strength                    | 30 |
|                  | 4.2.1 | Control Sample for Water Curing         | 30 |
|                  | 4.2.2 | Control Sample for Air Curing           | 31 |
|                  | 4.2.3 | 5% PKS for Water Curing                 | 32 |
|                  | 4.2.4 | 5% PKS for Air Curing                   | 33 |
|                  | 4.2.5 | 15% PKS for Water Curing                | 34 |

|                   |       |                                                 |    |
|-------------------|-------|-------------------------------------------------|----|
|                   | 4.2.5 | 15% PKS for Air Curing                          | 35 |
| 4.3               |       | Average Compressive Strength                    | 36 |
|                   | 4.3.1 | Average Compressive Strength for Control Sample | 36 |
|                   | 4.3.2 | Average Compressive Strength of 5% PKS          | 37 |
|                   | 4.3.3 | Average Compressive Strength of 15% PKS         | 38 |
|                   | 4.3.4 | Average Compressive Strength for Water Curing   | 39 |
|                   | 4.3.5 | Average Compressive for Air Curing              | 40 |
| 4.4               |       | Water Absorption                                | 41 |
|                   | 4.4.1 | Average Water Absorption for 7 Days             | 41 |
|                   | 4.4.2 | Average Water Absorption for 28 Days            | 42 |
|                   | 4.4.3 | Average Water Absorption Percentage             | 43 |
| 4.5               |       | Discussion                                      | 44 |
| <b>CHAPTER 5</b>  |       | <b>CONCLUSION AND RECOMMENDATION</b>            |    |
| 5.1               |       | General                                         | 45 |
| 5.2               |       | Conclusion                                      | 45 |
| 5.3               |       | Recommendation                                  | 46 |
| <b>REFERENCES</b> |       |                                                 | 47 |

**APPENDICES**

|   |                                             |    |
|---|---------------------------------------------|----|
| A | Control Sample for Water Curing at 7 days   | 49 |
| B | Control Sample for Water Curing at 28 days  | 50 |
| C | Control Sample for Air Curing at 7 days     | 51 |
| D | Control Sample for Air Curing 28 days       | 52 |
| E | 5% PKS for Water Curing at 7 days           | 53 |
| F | 5% PKS Replacement Water Curing at 28 days  | 54 |
| G | 5% PKS Replacement Air Curing at 7 days     | 55 |
| H | 5% PKS Replacement Air Curing at 28 days    | 56 |
| I | 15% PKS Replacement Water Curing at 7 days  | 57 |
| J | 15% PKS Replacement Water Curing at 28 days | 58 |
| K | 15% PKS Replacement Air Curing at 7 days    | 59 |
| L | 15% PKS Replacement Air Curing 28 days      | 60 |

**LIST OF TABLES**

| <b>Table No.</b> | <b>TITLE</b>                                                                                | <b>PAGE</b> |
|------------------|---------------------------------------------------------------------------------------------|-------------|
| 2.1              | Physical Properties of Palm Kernel Shell (PKS)                                              | 6           |
| 2.2              | Classification of Bricks by Compressive Strength and<br>Water Absorption (BS 3921 : (1985)) | 8           |
| 3.1              | List of sample                                                                              | 20          |
| 3.2              | Analysis of sample                                                                          | 21          |
| 4.1              | Average Compressive Strength for Control Sample                                             | 36          |
| 4.2              | Average Compressive Strength to 5% PKS                                                      | 37          |
| 4.3              | Average Compressive Strength of 15% PKS                                                     | 38          |
| 4.4              | Average Compressive Strength for Water Curing                                               | 39          |
| 4.5              | Average Compressive Strength for Air Curing                                                 | 40          |
| 4.6              | Average Water Absorption for 7 Days                                                         | 41          |
| 4.7              | Average Water Absorption for 28 Days                                                        | 42          |
| 4.8              | Average Water Absorption Percentage                                                         | 43          |

## LIST OF FIGURES

| <b>Figure No.</b> | <b>TITLE</b>                                                            | <b>PAGE</b> |
|-------------------|-------------------------------------------------------------------------|-------------|
| 2.1               | Clay Bricks                                                             | 7           |
| 2.2               | Sand Lime Brick                                                         | 9           |
| 2.3               | Strength Variations with Partial Replacement of Cement<br>with PKSA     | 10          |
| 2.4               | Relationship between Percentage PKS Replacement and<br>Water Absorption | 11          |
| 3.1               | Methodology Flow chart                                                  | 14          |
| 3.2               | Ordinary Portland Cement                                                | 15          |
| 3.3               | Tap water                                                               | 16          |
| 3.4               | The process of washing and weathering (sun-dried) of PKS                | 17          |
| 3.5               | Shape and size measurement                                              | 17          |
| 3.6               | Fine aggregate                                                          | 18          |
| 3.7               | Mixer Machine                                                           | 19          |
| 3.8               | Weighed scale                                                           | 19          |
| 3.9               | Dimension of Brick                                                      | 20          |
| 3.10              | Process of Cutting Formwork                                             | 22          |
| 3.11              | Finished Formwork                                                       | 22          |
| 3.12              | The oil                                                                 | 23          |
| 3.13              | Placed wet sacks                                                        | 24          |
| 3.14              | Air Curing Process                                                      | 24          |
| 3.15              | Water Curing Process                                                    | 25          |
| 3.16              | Testing Machine                                                         | 26          |
| 3.17              | Compressive Strength Test                                               | 27          |

|      |                                                               |    |
|------|---------------------------------------------------------------|----|
| 4.1  | Graph Compressive Strength of Control Sample for Water Curing | 30 |
| 4.2  | Graph Compressive Strength of Control Sample for Air Curing   | 31 |
| 4.3  | Graph Compressive Strength of 5 % PKS for Water Curing        | 32 |
| 4.4  | Graph Compressive Strength of 5% PKS for Air Curing           | 33 |
| 4.5  | Graph Compressive Strength of 15% PKS Water Curing            | 34 |
| 4.6  | Graph Compressive Strength of 15% PKS for Air Curing          | 35 |
| 4.7  | Average Compressive Strength for Control Sample               | 36 |
| 4.8  | Average Compressive Strength of 5% PKS                        | 37 |
| 4.9  | Average Compressive Strength of 15% PKS                       | 38 |
| 4.10 | Average Compressive Strength for Water Curing                 | 39 |
| 4.11 | Average Compressive Strength for Air Curing                   | 40 |
| 4.12 | Graph Average Water Absorption at 7 Days                      | 41 |
| 4.13 | Graph Average Water Absorption at 28 Days                     | 42 |
| 4.14 | Graph Average Water Absorption                                | 43 |

**LIST OF ABBREVIATIONS**

|                 |                                   |
|-----------------|-----------------------------------|
| H               | height                            |
| JKR             | Jabatan Kerja Raya                |
| Kg              | Kilogram                          |
| L               | length                            |
| M <sup>3</sup>  | Meter Cubic                       |
| M <sub>1</sub>  | Mass of specimen before immersion |
| M <sub>2</sub>  | Mass of specimen after immersion  |
| MS              | Malaysia Standard                 |
| mm <sup>2</sup> | Milimeter Square                  |
| mm              | Milimeter                         |
| N               | Newton                            |
| OPC             | Ordinary Portland Cement          |
| PKS             | Palm Kernel Shell                 |
| Vs              | versus                            |
| W               | width                             |

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## ABSTRACT

Sand brick was a popular building material in construction in Malaysia. This is because, brick sand readily available. To meet the demand so high and the economy is not uniform in this century, it is one of the initiatives taken by the industry to reduce the use of materials and replaced with waste material. The natural ingredients of Palm Kernel Sell (PKS) tested because it belongs to the disposal of waste. In this study, PKS is used as a material to replace sand in sand bricks. The size used by sieve passing 4.75 mm with a mix ratio of 1: 3 (1 cement: 3 sand). There are 3 types of percentages used in this test which is control sample, 5% PKS and 15% PKS as replacement of sand. The overall number of samples is 120, in which each number is the 40 of sample for each 7 days and 28 days. Before the sample is subjected to compressive strength, it must go through the process water curing and air curing. Both types of curing were carried out for 7 days and 28 days. This method conducted to select the optimum compressive strength for the whole of the 10 samples taken at random. In addition, this curing also tested the ability of PKS to water absorption. The process to evaluate the rate of water uptake by the PKS. From tests conducted found samples containing 5% PKS in a 28-day compressive strength shows the most optimal and 5% PKS of air curing. As for the absorption of water, 15% PKS at 28 days was higher than the other. This is because the percentage of PKS is replaced with the most quantity. Finally, the results obtained from the tests meet the criteria required by JKR Standard but control samples were recommended for use in the construction besides of the weather factor.

## ABSTRAK

Bata pasir merupakan bahan binaan yang popular dalam pembinaan di Malaysia. Ini kerana, bata pasir mudah didapati. Bagi memenuhi permintaan yang amat tinggi serta ekonomi yang tidak seragam pada abad ini, maka satu inisiatif di ambil oleh pihak industri bagi mengurangkan kadar penggunaan bahan dan diganti dengan bahan sisa buangan. Oleh yang demikian, bahan semulajadi iaitu tempurung kelapa sawit diuji kerana ia tergolong dalam pembuangan sisa buangan. Dalam kajian ini, tempurung kelapa sawit digunakan sebagai bahan ganti pasir dalam bata pasir. Saiz yang digunakan melebihi 4.75 mm dengan nisbah bancuhan 1: 3 (1 simen, 3 pasir). Terdapat 3 jenis peratusan yang digunakan dalam ujian ini iaitu bata kawalan, 5% dan 15% tempurung kelapa sawit sebagai bahan ganti pasir. Keseluruhan jumlah sampel ialah 120 di mana setiap jumlah sampel adalah sebanyak 40 biji bagi setiap 7 hari dan 28 hari. Sebelum sampel dikenakan kekuatan mampatan, ia perlu melalui proses pengawetan iaitu pengawetan air dan pengawetan udara. Kedua-dua jenis pengawetan ini dilakukan selama 7 hari dan 28 hari. Pengawetan ini dijalankan untuk mendapatkan kekuatan mampatan untuk keseluruhan optimum bagi setiap 10 sample yang diambil secara rawak. Selain itu, pengawetan ini juga bagi menguji kebolehan tempurung kelapa sawit dalam penyerapan air. Proses ini bagi menilai kadar serapan air oleh tempurung. Daripada ujian yang telah dijalankan didapati sampel yang mengandungi 5% tempurung kelapa sawit pada 28 hari menunjukkan kekuatan mampatan yang paling optimum dan 5% juga bagi pengawetan udara. Manakala bagi penyerapan air, tempurung kelapa sawit untuk 15% pada 28 hari adalah tinggi berbanding dengan yang lain. Ini kerana, jumlah peratus tempurung kelapa sawit yang diganti dengan kuantiti yang paling banyak. Akhir sekali, keputusan yang diperolehi daripada ujian memenuhi kriteria yang di kehendaki oleh standard JKR namun sampel kawalan adalah lebih di sarankan untuk kegunaan pembinaan di Malaysia atas faktor cuaca.

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 BACKGROUND OF STUDY**

Natural waste is unnecessary or that do not have value. It may consists of the unwanted left over from a manufacturing process (industrial, commercial, mining or agriculture). The natural waste may be removed or accumulated. Due to that, development of the industries has led to the production and disposal natural waste. However, natural waste is growing and uncontrolled nowadays promoted to make it as an innovation in the construction industry to control it. Undoubtedly, It should be managed properly or with the other side are re-used the natural waste to produce new product and to avoid pollution through with mission the development of the green technology. This is a strategy to ensure stability and sustainability in natural system control. In other hand, the presence of waste is an indication of overconsumption and that materials are not used efficiently, this will cause the earth's capacity to bear the excess raw materials increasingly higher. This causes problems for the ecosystem because of the amount of waste that cannot be handled.

Brick is a durable building materials and its use is widespread. It has been around for hundreds of years and it is important to build the structure of the building in the field of civil engineering. (Tan, 1994). The earliest bricks made from clay. It is taken from close to the surface of the ground, or rivers banks, mold into shape by hand and dried in the sun. In

the 19<sup>th</sup> century, the process was developed to make bricks from sand and lime. Besides that, the bricks are classified into two by their quality and impact of the manufacturing process. BS 6100: Section 5.3:1984: Glossary of Terms, gives extensive definition of the relevant words, but a distinction need to be drawn between the following usage categories (Doran). Generally, structural uses such as foundations walls and floor.

Palm oil is grown in 43 countries around the world. One of the major players in the palm oil industry is Malaysia known as the best term of managing its forest resources. Forest area is increase by 14,000 ha per year between 2010 and 2015. From this point, Malaysia's forest area is increasing, the growth and use of palm oil is also growing rapidly. Although, import and export was happened, but still cannot control of accumulated palm kernel shell. As a result of the issues is high but used in industrial mills were ineffective which is palm kernel shell, then it is used as an alternative to reduce and prevent pollution.

## **1.2 PROBLEM STATEMENT**

On this day, house construction rapidly constructed in Malaysia. Therefore, the uses of sand brick in high demand even thought a lot of variety type of brick but one of the choices of the materials used is sand brick for construction.

Overall, in Malaysia there are 70 palm oil processing factories. Furthermore, in a day the amount of processing and production of palm kernel shell removal unbalanced. So, waste palm kernel shell becomes one of the issues in the industry due to dumping of from palm kernel shell that is not utilized by the industry. In order to reduce the natural waste, make use material to be replaced sand in making brick as an alternative.

## **1.3 OBJECTIVE**

In the construction one of the main material are bricks. Other than the type of brick used, it also involves the strength and water absorption levels of these bricks. Therefore, the

presence of natural waste such as palm kernel shell and an increase in the use of sand brick then the efforts taken to solve the problem.

In this case, there are two objectives to ensure the appropriate use of brick:

- (i) To investigate the compressive strength of sand brick with use palm kernel shell.
- (ii) To identify the Water Absorption of the sand brick with palm kernel shell.

#### **1.4 SCOPE OF STUDY**

The scope of this study will focus on laboratory test to determine the compressive strength and water absorption of sand brick using palm kernel shell (PKS) as fine aggregate replacement. This raw material that replacing sand in making sand brick sample with the ratio of cement and sand is 1:3. This PKS is collected from the palm oil kernel shell processing store around Kuantan, Pahang. Then, the PKS samples are washed thoroughly to remove dirt and then sun dried until completely dry. The experimental is conducted at the concrete Laboratory of University Malaysia Pahang. There is the specifications of the scope in this study are:

- (i) The ratio of kernel used are 5% and 15% to replacement of fine aggregate in sand bricks.
- (ii) 10 samples for each percentage are made for the Air Curing method and Water Curing method for 7<sup>th</sup> days and 28<sup>th</sup> days for testing under compression test. Overall, the total specimen is 120.
- (iii) The size of brick specimens used 225 mm (L) x 113 mm (W) x 75 mm (H) according JKR standard.

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