# THE EFFECT OF WASTE CLAY BRICK AS A PARTIAL SAND REPLACEMENT ON THE MECHANICAL PROPERTIES OF CONCRETE

AHMAD FAIZUL BIN ALI

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG



#### SUPERVISOR'S DECLARATION

I/We\* hereby declare that I/We\* have checked this thesis/project\* and in my/our\* opinion, this thesis/project\* is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

(Supervisor's Signature) Full Name : DR KHAIRUNISA BINTI MUTHUSAMY Position : ASSOC. PROFESSOR Date : 19 JUNE 2017



#### **STUDENT'S DECLARATION**

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

(Student's Signature) Full Name : AHMAD FAIZUL BIN ALI ID Number : AA13169 Date : 19 JUNE 2017

# THE EFFECT OF WASTE CLAY BRICK AS A PARTIAL SAND REPLACEMENT ON THE MECHANICAL PROPERTIES OF CONCRETE

#### AHMAD FAIZUL BIN ALI

Thesis submitted in fulfillment of the requirements for the award of the Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

JUNE 2017

#### ACKNOWLEDGEMENTS

First and foremost, I would like to take this opportunity to express my sincere appreciation to my main thesis supervisor, Assoc. Prof. Dr Khairunisa bin Muthusamy for valuable guidance, motivation and advices throughout the course of this study. Thanks for trusting and believing in me.

Furthermore, I am thankful to my beloved family for their devotion, support and faith in my ability to attain my goals. Many special thanks go to the technicians in the concrete laboratory for all their assistance throughout the project

Last but least, I would like to express my gratitude to all the lecturers and friends who lend a helping hand throughout this study.

# TABLE OF CONTENT

| DEC  | CLARATION                      |      |
|------|--------------------------------|------|
| TIT  | LE PAGE                        |      |
| ACF  | KNOWLEDGEMENTS                 | ii   |
| ABS  | STRAK                          | iii  |
| ABS  | STRACT                         | iv   |
| ТАВ  | BLE OF CONTENT                 | v    |
| LIST | T OF TABLES                    | viii |
| LIST | T OF FIGURES                   | ix   |
| LIST | T OF SYMBOLS                   | x    |
| LIST | T OF ABBREVIATIONS             | xi   |
| CHA  | APTER 1 INTRODUCTION           | 1    |
| 1.1  | Introduction                   | 1    |
| 1.2  | Problem statement              | 1    |
| 1.3  | Objective                      | 2    |
| 1.4  | Significance of research       | 2    |
| 1.5  | Scope of study                 | 3    |
| 1.6  | Layout of thesis               | 3    |
| CHA  | APTER 2 LITERATURE REVIEW      | 5    |
| 2.1  | Introduction                   | 5    |
| 2.2  | Municipal solid waste          | 5    |
| 2.3  | Types of municipal solid waste | 6    |

| 2.4  | Waste clay brick as waste  | 7  |
|------|----------------------------|----|
| 2.5  | Concrete in construction   | 8  |
| 2.6  | Types of concrete          | 9  |
|      | 2.6.1 Normal concrete      | 9  |
| 2.7  | Compressive strength       | 10 |
| 2.8  | FLEXURAL STRENGTH          | 11 |
| 2.9  | Sand mining in Malaysia    | 12 |
| 2.10 | The effect of sand mining  | 13 |
| СПАД | TER 3 METHODOLOGY          | 15 |
| CHAF | TER 5 METHODOLOGI          | 15 |
| 3.1  | Introduction               | 15 |
| 3.2  | Experiment flow process    | 16 |
| 3.3  | Materials use              | 17 |
|      | 3.3.1 Cement               | 17 |
|      | 3.3.2 Waste clay brick     | 17 |
|      | 3.3.3 Sand                 | 19 |
|      | 3.3.4 Coarse aggregate     | 19 |
|      | 3.3.5 Water                | 20 |
| 3.4  | Mixing proportion          |    |
| 3.5  | Specimen preparation 2     |    |
| 3.6  | Testing method             |    |
|      | 3.6.1 Slump test           | 22 |
|      | 3.6.2 Compressive strength | 22 |
|      | 3.6.3 Flexural strength    | 23 |

| CHA  | PTER 4 RESULTS AND DISCUSSION                            | 24 |
|------|--|----|
| 4.1  | Introduction   | 24 |
| 4.2  | Workability of concrete                                  | 24 |
| 4.3  | Effect of waste clay brick on compressive strength test  | 25 |
| 4.4  | The effect of waste clay brick on flexural strength test | 30 |
| CHA  | PTER 5 CONCLUSION  | 35 |
|      |  |    |
| 5.1  | Introduction   | 35 |
| 5.2  | Conclusion   | 35 |
| 5.3  | Recommendations for future study                         | 36 |
| REFE | ERENCES  | 37 |

# LIST OF TABLES

| Table 2.1 | The composition of waste (percentage of wet weight) in malaysia | 7  |
|-----------|---|----|
| Table 3.1 | Mix proportion  | 21 |
| Table 4.1 | Slump test result   | 25 |
| Table 4.2 | Maximun strength of compressive strength test                   | 26 |
| Table 4.3 | Maximum strength of flexural strength                           | 31 |

#### LIST OF FIGURES

| Figure 2.1  | Gas pollution from landfill   | 5     |
|-------------|---|-------|
| Figure 2.2  | Case studies at Batu Pahat, Johor   | 8     |
| Figure 2.3  | Compressive test of clay brick  | 10    |
| Figure 2.4  | Flexural test on clay brick   | 11    |
| Figure 2.5  | Kosmo   | 12    |
| Figure 3.1  | Experimental work process   | 15    |
| Figure 3.2  | Ordinary Portland cement  | 16    |
| Figure 3.3  | waste clay brick  | 17    |
| Figure 3.4  | Preparation process of waste clay brick   | 17    |
| Figure 3.5  | River sand  | 18    |
| Figure 3.6  | Coarse aggregate  | 18    |
| Figure 3.7  | Tap water   | 19    |
| Figure 3.8  | Slump Test  | 21    |
| Figure 4.1  | The influence of waste clay brick content on workability of concre                            | te 24 |
| Figure 4.2  | The effect waste clay brick content on compressive strength of concrete at 7, 14, and 28 days | 26    |
| Figure 4.3  | Effect of waste clay brick on compressive strength at concrete at 0 <sup>o</sup>              | % 26  |
| Figure 4.4  | Effect of waste clay brick on compressive strength at concrete at 10%                         | 27    |
| Figure 4.5  | Effect of waste clay brick on compressive strength at concrete at 20%                         | 27    |
| Figure 4.6  | Effect of waste clay brick on compressive strength at concrete at 30%                         | 28    |
| Figure 4.7  | Effect of waste clay brick on compressive strength at concrete at 40%                         | 28    |
| Figure 4.8  | Effect of waste clay brick on compressive strength at concrete at 50%                         | 29    |
| Figure 4.9  | Effect of waste clay brick on flexural strength of concrete at 7, 14, and 28 days             | 30    |
| Figure 4.10 | Effect of waste clay brick on flexural strength of concrete at 0%                             | 31    |
| Figure 4.11 | Effect of waste clay brick on flexural strength of concrete at 10%                            | 31    |
| Figure 4.12 | Effect of waste clay brick on flexural strength of concrete at 20%                            | 32    |
| Figure 4.13 | Effect of waste clay brick on flexural strength of concrete at 30%                            | 32    |
| Figure 4.14 | Effect of waste clay brick on flexural strength of concrete at 40%                            | 33    |
| Figure 4.15 | Effect of waste clay brick on flexural strength of concrete at 50%                            | 33    |

# LIST OF SYMBOLS

| Р   | The Maximum Load at Failure          |
|-----|--------------------------------------|
| А   | The Cross Sectional Area of the Cube |
| fcf | The Flexural Strength                |
| F   | The Maximum Load                     |
| Р   | The Maximum Load at Failure          |
|     |                                      |

## LIST OF ABBREVIATIONS

| WCB  | Waste Clay Brick                       |
|------|--|
| ASTM | American Society Testing and Materials |
| BS   | British Standard                       |