

**THE EFFECT OF HARDENED  
PROPERTIES OF MORTAR CONTAINING  
PALM OIL FUEL ASH (POFA) AS PARTIAL  
SAND REPLACEMENT**

**NUR SHAFIQAH BINTI MD SA'AT**

**Bachelor of Engineering (Hons) Civil  
(Infrastructure)  
UNIVERSITI TEKNOLOGI MARA  
SEPTEMBER 2020**

**THE EFFECT OF HARDENED PROPERTIES OF  
MORTAR CONTAINING PALM OIL FUEL ASH  
(POFA) AS PARTIAL SAND REPLACEMENT**

By

**NUR SHAFIQAH BINTI MD SA'AT**

This report is submitted as a  
partial requirement for the degree of  
**Bachelor of Engineering (Hons) Civil (Infrastructure)**

**UNIVERSITI TEKNOLOGI MARA  
SEPTEMBER 2020**

## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Undergraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Candidate : Nur Shafiqah Binti Md Sa'at  
Candidate I.D. No. : 2017419844  
Programme : Bachelor of Engineering (Hons) Civil (Infrastructure)  
Faculty : Civil Engineering  
Thesis Tittle : The Effect of Hardened Properties of Mortar Containing Palm Oil Fuel Ash (POFA) as Partial Sand Replacement

Signature of Candidate :  .....

Date : September 2020

## ABSTRACT

The necessity of natural resource which is sand for construction industry due to the rapid growth of urbanization and industrialization in Malaysia has led to serious environmental pollution resulting from growing activities in sand mining. Palm oil fuel ash (POFA) is a waste product generated by palm oil industry and discarded in the landfill which it be a pollution waste to the environment. Thus, the use of POFA will solve the solid waste problem in Malaysia. POFA is a pozzolanic material and can serve as a partial replacement for sand. Therefore, this study investigates the effect of hardened properties of mortar containing POFA as partial sand replacement on the tensile strength and durability properties which is water absorption and porosity. Four mixture of mortar containing 0%, 5%, 10% and 15% of POFA by weight of sand were used in this experiment. The cylinder specimens were cast and undergoes curing process up to 3, 7 and 28 days before tensile splitting testing, water absorption and porosity testing. Outcome of this study shows that the higher amount of POFA in the mortar reduces the strength and durability of the mortar. However, it was noted that 5% of POFA is the optimum amount to be used as partial sand replacement which can enhance the performance of mortar strength and durability.

**Keywords:** Mixing ingredient, Mortar, Partially sand replacement, Palm oil fuel ash, Porosity, Tensile strength, Water absorption.

## ACKNOWLEDGEMENT

Assalamualaikum w.b.t.

First of all, Alhamdulillah, praise to Allah S.W.T. for the successful completion of my Final Year Project. This project would not have been possible without the assistance and guidance of certain individuals and organization whose contributions have helped in its completion.

I would like to express my sincere gratitude to both of my supervisor, Madam Nor Hafida Hashim and co-supervisor, Dr Noorsuhada Md Nor for the invaluable advice, guidance, and enormous motivation throughout the completing this final year project (FYP). Almost certainly without their cooperation, I might not be able to fulfill the project requirements, as it needs a lot of commitment towards finishing it.

Beside my supervisors, I also would like to express my gratitude to Dr Muhd Norhasri Muhd Sidek, a lecturer from UiTM Shah Alam, who had taken a lot of efforts to meticulously go through my report and came up with helpful suggestion. Without helping from him, I surely came into deep problem in completing this report.

I also would like to express my heartfelt gratitude to the Final Year Project committee for arranging various seminars as support and knowledge to assist me. The seminars were indeed very helpful and insightful. Special thanks to Assistant Engineer, En. Habibullah Bin Mahmud and En. Mohd Salleh Bin Abdullah, who provided access to laboratory and research facilities. It would not be possible for me to conduct this research without their precious support. I would like to thank my fellow laboratory mates in for the stimulating discussion and lending hand in doing the heavy laboratory works.

I am greatly indebted to my parents, for them to supporting me mentally and spiritually over this project period and my life in general. Last, but certainly not least, I would like to apologize if any party was inadvertently excluded from being mentioned above and would like to thank all parties that were involved in making this project a success.