

**THE DURABILITY STUDY OF BLEND  
CEMENT USING SEWAGE SLUDGE ASH (SSA)  
AND EGGSHELL**

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## **SUPERVISOR'S DECLARATION**

**I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering with Honors.**

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**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.**

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THE DURABILITY STUDY OF BLEND CEMENT USING SEWAGE SLUDGE  
ASH (SSA) AND EGGSHELL

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## LIST OF SYMBOLS

$\text{CaCO}_3$	Calcium Carbonate
$\text{H}_2 \text{SO}_4$	Sulfuric Acid
$\text{Na}_2 \text{SO}_4$	Sodium Sulphate
$\text{m}^3$	metre cubic
mm	millimetre
ppm	parts per million
$\text{kg/m}^3$	Kilogram per metre cubic
$^\circ\text{C}$	Celsius
$\text{Ca}(\text{OH})_2$	calcium hydroxide
C-S-H	calcium silicate hydrate
$\text{CaSO}_4 \cdot 2\text{H}_2 \text{O}$	gypsum

## LIST OF ABBREVIATIONS

OPC	Ordinary Portland Cement
MSSA	Microwave Sewage Sludge Ash
SSA	Sewage Sludge Ash
ESP	Eggshell Powder
CaCO <sub>3</sub>	Calcium Carbonate
H <sub>2</sub> SO <sub>4</sub>	Sulfuric Acid
Na <sub>2</sub> SO <sub>4</sub>	Sodium Sulphate
m <sup>3</sup>	metre cubic
mm	millimetre
ppm	parts per million
kg/m <sup>3</sup>	Kilogram per metre cubic
IWK	Indah Water Kuantan
Ca(OH) <sub>2</sub>	calcium hydroxide
C-S-H	calcium silicate hydrate
CaSO <sub>4</sub> · 2H <sub>2</sub> O	gypsum