COMPARISON OF CORROSION BEHAVIOR OF STEEL REINFORCEMENT BARS IN ORDINARY PORTLAND CEMENT AND PORTLAND POZZOLANA CEMENT ENVIRONMENTS

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Degree of Master of Materials Science

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Materials Science

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

In the Sri Lankan cement market present time blended hydraulic cement which is composited with fly ash or blast furnace slag are given a noticeable marketing share as supplementary cement. It has obtained more popularity for incorporating higher workability and achieving a higher lateral strength in the construction industry. But due to the pozzolanic reactivity of blended cement, there is a possibility of reduction of pH of concrete or cement mortar which may be detrimental to the passivity of reinforced steel.

In this study, the comparison of corrosion effect was researched with 15% fly ash blended cement as the pozzolanic cement (Bag-cement of Blended hydraulic cement) and Ordinary Portland cement. Coarse aggregates were excluded to get a clearer picture of the corrosion effect with the change of cement type. The cement mortar mixtures with 1.0: 3.0: 0.5 of cement: sand: water respectively, from both cement types were prepared. Specimens were cast in moulds with reinforcement bars to prepare the specimens for the pull-out test, Half cell potential test, compression test & loss of mass (due to corrosion). After casting test specimens were salt-conditioned by dipping in 5% NaCl solution for 30 minutes per day for 180 days.

Pull-out and compression test results acknowledge that pozzolanic cement contributes higher lateral strength than ordinary Portland cement. After the compression test, reinforced steel bars were removed from the cubes and it was observed that no corrosion has happened in bars that were fully enclosed with (both types of: PPC and OPC) cement covers. Therefore, it reveals that 15% of fly ash blended hydraulic cement does not disturb the passivity layer of steel reinforcements as a result of consumption of $Ca(OH)_2$. This study can be extended for further research with 25% or higher ratios of fly ash blended hydraulic cement.

Keywords: Ordinary Portland cement; Portland Pozzolanic Cement; corrosion of TMT steel bars; passivity of steel bars

ACKNOWLEDGEMENTS

I would like to express my gratitude, first of all, to Prof. S.M.A. Nanayakkara who cleared doubts about this research idea and for giving me the initial guidance. I would like to express my sincere thanks to my research supervisor Eng. Mr. S. P. Guluwita, senior lecturer for his coordination, encouragement, and guidance throughout this research. His instructions were highly fruitful and encouraging during the research study. I also express my acknowledgement to the M.Sc. research coordinator for the guidance offered.

I am much thankful to Sri Lanka Standards Institution for granting me a part funding to get registered to the degree of Master in Materials Science.

I highly appreciate Mr. M.A.K Jayatilaka, Director, and National Centre for Non-Destructive Testing, who permitted me to use the instrumentations and testing facilities. My sincere thanks also go to Eng. M.J.M. Hassandeen, General Manager, Melbourne Metal (Pvt.) Limited, Ja-Ela, for granting me the permission to use the laboratory facilities. I would like to acknowledge my gratitude to Mr. Yasendra Abegunawardhane, INSEE Cement, Paliyagada for permitting me to use their testing facilities. I would like to thank my dear husband for his support and encouragement throughout the research work to complete it successfully.

Finally, I would appreciate every person who supported me, encouraged me throughout this research work time which I remind with great gratitude.

K.B.M.V.S. De Costa

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LIST OF ABBREVIATIONS

Abbreviation	Description
BHC	Blended Hydraulic Cement
C_3A	Tricalcium aluminate, $3CaO.Al_2O_3$
C_3AF	Tetra-calcium alumino ferrite, $4CaO.Al_2O_3.Fe_2O_3$
C_2S	Dicalcium silicate, $2CaO.SiO_2$
C_3S	Tricalcium silicate, $3CaO.SiO_2$
CADR	Corrosion Analysis Detector Reading
CH	Calcium Hydroxide, $Ca(OH)_2$
C-S-H	Calcium silicate hydrate, $3CaO.2SiO2.3H_2O$
CSH_2	$CaSO_4.2H_2O$, Gypsum
H	H_2O
HCV	Half-Cell Voltage
NaCl	Sodium Chloride, Salt
OPC	Ordinary Portland Cement
PPC	Portland Pozzolanic Cement
ppm	parts per million
RHT	Rebound hammer test results
SLSI	Sri Lanka Standards Institution

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