DEVELOPMENT OF A LOW COST INSULATION SYSTEM USING BOTTOM ASH FOR CFRP-CONCRETE COMPOSITES

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Department of Civil Engineering

University of Moratuwa
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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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Signature: Date:

The above candidate has carried out research for the Masters under my supervision.

Name of the supervisor: Dr. (Mrs.) J.C.P.H. Gamage

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Name of the supervisor: Dr. G.I.P. De Silva

Signature of the supervisor: Date:

ABSTRACT

The civil engineering industry is moving towards more greener and sustainable means of construction materials today. Improving the thermal comfort in buildings while conserving the natural resources is essential to maintain the ecological balance whilst improving health, wellbeing and productivity of humans. On the other hand, concrete structures have been the main construction element for the past five decades. Retrofitting these concrete structures using fiber reinforced polymer (FRP) has been a popular trend in the recent years. An insulation material has been developed using bottom ash which is a byproduct of the coal power generation process. The developed plaster could be used for either thermal comfort in buildings or as a cementitious insulation material for CFRP/Concrete composites. The research was conducted in four phases. Properties of bottom ash and properties of developed material were investigated in the first two phases. Modification of developed insulation material and application of CFRP/Concrete composites were investigated in the latter two phases. A N-type plaster was developed by replacing fine aggregates in conventional cement sand plaster by bottom ash. 60% of the sand was replaced by bottom ash. A thickness of 20 mm of the developed plaster can decrease the heat transfer 45% than conventional plaster. Furthermore, the developed plaster is 8% more cost effective than conventional plaster.

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LIST OF PUBLICATIONS

International Conferences

1. **K.A.D.Y.T. Kahandawa Arachchi**, J.C.P.H. Gamage and G.I.P. De Silva, " Thermal insulation systems for CFRP/Concrete Composites: A Review", in *International Conference on Structural and Construction Management*, 2019 - Published
2. **K.A.D.Y.T. Kahandawa Arachchi**, J.C.P.H. Gamage and E.R.K. Chandrathilake, "Bond Performance of Carbon Fiber Reinforced Polymer (CFRP) strengthened Reinforced Curved Beams", in *International Conference on Civil Engineering and Applications,*2019 – Published
3. **K.A.D.Y.T. Kahandawa Arachchi**, J.C.P.H. Gamage and G.I.P. De Silva, "Modification of a Bottom Ash Based Insulation Material using Saw Dust, EPS and Aggregate Chips", in *International Conference on Structural and Construction Management*, 2020 - Submitted

International Journals

1. A. Selvaratnam, **K.A.D.Y.T. Kahandawa Arachchi**, S. Kajanan and J.C.P.H. Gamage, "Behavior of Carbon Fiber Reinforced Polymer strengthened out-of-plane Curved Reinforced Concrete beams" – In Preparation
2. **Kahandawa Arachchi K.A.D.Y.T**., Selvaratnam A., Gamage J.C.P.H. and De Silva G.I.P, "Development of an Innovative Insulated Plaster using Bottom Ash to Enhance Thermal Comfort in Buildings" – In Preparation
3. **K.A.D.Y.T. Kahandawa Arachchi**, A. Selvaratnam, J.C.P.H. Gamage, V. Attanayaka, "Development and Application of a Bottom Ash based Cementitious Insulation material on CFRP/Concrete Composites" – In preparation
4. Selvaratnam A., **Kahandawa Arachchi K.A.D.Y.T**, Gamage J.C.P.H, "Experimental and Numerical analysis of an Innovative Wall Plaster Developed using Recycled EPS to Enhance the Thermal Comfort in Buildings" – In preparation

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