ABSTRACT

Ultra-high-performance concrete (UHPC) is a special type of concrete with high compressive and tensile strength, high durability, and a dense microstructure that results in improved mechanical and durability properties. However, due to the high cement content typically used in UHPC, the carbon footprint of UHPC is generally very high. On the other hand, limestone calcined clay cement (LC3) is a more environmentally friendly alternative to ordinary Portland cement (OPC) with lower carbon emissions during production. Previous research has explored LC3 replacing up to 50% of OPC content in normal strength concrete, which contributes to significant reduction of carbon footprint. The use of LC3 binder in UHPC material though has not been widely explored. This thesis research presents a feasibility study on the development of UHPC with sustainable LC3 binders. Up to 30% of OPC replacement with LC3 binder in non-proprietary UHPC mixtures was investigated; the workability, compressive and tensile properties of the resultant UHPC mixtures were experimentally characterized to determine the influence of LC3 on UHPC.

**Keywords:** UHPC, limestone calcined clay cement (LC3), tensile strength, compressive strength, concrete, sustainability