Masters Desertion Showcase
Year 2023

Department: Civil Engineering

Programme: Masters in Engineering

Specialization: Structural Engineering

1	**Title of the Thesis** Comparative Study of OPC and LC3 Concrete Containing Lightweight Aggregates.
2	**Abstract** There are numerous benefits to using lightweight concrete (LWC) as a building material in terms of concrete technology, economics, and the environment. It is porous, thus reducing the overall dead weight of the structure. In the production of clinker, an excessive amount of carbon dioxide (CO2) is released. The best way to decrease the amount of cement clinker is to replace cement with supplemental cementations materials (SCMs). One of the advanced technology is to introduce a new cement blend, named limestone claimed clay cement (LC3) which is environmentally friendly and exhibits better properties than OPC. In this study, experimental investigation has been carried out to study the mechanical, as well as, durability properties of lightweight concrete prepared with OPC and LC3. The natural aggregates were replaced from 0 to 100% with light-weight aggregates with a variation of 20%. The durability performance was only analyzed on 0% and 100% replacement. It has been observed that lightweight concrete strength decreases as the replacement percentage of lightweight aggregate is increased as compared to normal-weight concrete. It is also observed that lightweight concrete shows better durability performance when prepared using LC3 than OPC, in terms of pull-out, permeability, and absorption capacity. Based on the extensive study carried out, it was found that LC3 provides better mechanical properties and is more beneficial in terms of durability as compared to OPC.
3	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** The utilization of Limestone Calcined Clay Cement (LC3) and lightweight concrete in urban regions positively impacts the sustainability of cities, supporting the achievement of Sustainable Development Goal 11 (SDG 11) - "Sustainable Cities and Communities." Here are the key ways in which LC3 and lightweight concrete contribute to SDG 11: 1. Reduced Carbon Emissions: LC3 significantly reduces carbon dioxide emissions by 30% compared to ordinary Portland cement (OPC), aligning with SDG 11's goal of promoting low carbon cities. 2. Energy Efficiency: LC3 production requires less energy than OPC, contributing to energy efficiency in manufacturing and supporting SDG 11's objective of resource efficiency and sustainable consumption. 3. Improved Durability: Lightweight concrete offers enhanced durability properties, reducing the need for frequent repairs and contributing to SDG 11's focus on resilient cities and communities. 4. Efficient Resource Utilization: Lightweight concrete incorporates lightweight aggregates made from industrial waste materials, promoting resource efficiency and sustainable waste management, which are essential aspects of SDG 11. 5. Reduced Transport Impact: Lightweight concrete's lower weight reduces fuel consumption and greenhouse gas emissions during transportation, aligning with SDG 11's target of promoting sustainable urban mobility. By adopting LC3 and lightweight concrete, cities can advance SDG 11 by promoting sustainable construction, reducing carbon emissions, enhancing resource efficiency, and creating resilient and livable communities. These materials provide concrete pathways toward sustainable urban development.
4	**Scholar Details** Name: Syed Muhammad Fahad Hussain Email Address: hussainfahad76@gmail.com Contact No: (+92) 3350237139
5	**Supervisor & Co-supervisor Details** Supervisor: Dr Tariq Jamil mtariqjamil@gmail.com tariqjamil@neduet.edu.pk