

## Durability of Functionally Graded Concrete

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**Abstract :** Cement concrete has emerged as the most consumed construction material. It has also dominated all other construction materials because of its versatility. Apart from numerous advantages it has a disadvantage concerning durability. The large structures constructed with cement concrete involving the consumption of huge natural materials remain in serviceable condition for 5 - 7 decades only while structures made with stones stand for many centuries. The short life span of structures not only affects the economy but also affects the ecology greatly. As such, the improvement of durability of cement concrete is a global concern and scientists around the globe are trying for this purpose. Functionally graded concrete (FGC) is an exciting development. In contrast to conventional concrete, FGC demonstrates different characteristics depending on its thickness, which enables it to conform to particular structural specifications. The purpose of FGC is to improve the performance and longevity of conventional concrete structures with cutting-edge building materials. By carefully distributing various kinds and amounts of reinforcements, additives, mix designs and/or aggregates throughout the concrete matrix, this variety is produced. A key component of functionally graded concrete's performance is its durability, which affects the material's capacity to tolerate aggressive environmental influences and load-bearing circumstances. This paper reports the durability of FGC made using Portland slag cement (PSC). For this purpose, control concretes (CC) of M20, M30 and M40 grades were designed. Single-layered samples were prepared using each grade of concrete. Further using combinations of M20 + M30, M30 + M40 and M40 + M20, doubled layered concrete samples in a depth ratio of 1:1 was prepared those are herein called FGC samples. The efficiency of FGC samples was compared with that of the higher-grade concrete of parent materials in terms of compressive strength, water absorption, sorptivity, acid resistance, sulphate resistance, chloride resistance and abrasion resistance. The properties were checked at the age of 28 and 91 days. Apart from strength and durability parameters, the microstructure of CC and FGC were studied in terms of X-ray diffraction, scanning electron microscopy and energy-dispersive X-ray. The result of the study revealed that there is an increase in the efficiency of concrete evaluated in terms of strength and durability when it is made functionally graded using a layered technology having different grades of concrete in layers. The results may help to enhance the efficiency of structural concrete and its durability.

**Keywords :** fresh on compacted, functionally graded concrete, acid, chloride, sulphate test, sorptivity, abrasion, water absorption test

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