Concrete for Marine Environment: Long-Term Exposure Test Results and Design Standard in Thailand

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Chloride is the primary cause of reinforced concrete structure deterioration because it migrates through concrete via pore solutions. Steel corrosion occurs when chloride content around the steel surface exceeds the chloride threshold of concrete. Therefore, concrete's resistance to chloride penetration is an essential attribute for the durability of reinforced concrete structures in chloride-rich environments. The durability of reinforced concrete structures is generally enhanced by using supplementary cementitious materials (SCMs) such as fly ash, ground blast-furnace slag, silica fume, calcined clay, and limestone powder in concrete mixtures.

In a marine environment, chloride ions can accelerate the rebar corrosion of concrete structures. When concrete is submerged in seawater, the primary process for chloride penetration is diffusion. However, many parts of the real structures are not always saturated but are exposed to a wet-dry environment like marine tidal and splash zones. In these conditions, the chloride penetration becomes more complex due to the interplay of diffusion, capillary suction, and other minor mechanisms moving chloride into the concrete. To assess the long-term durability improvement of concrete containing SCMs, it is necessary to examine the chloride penetration profile, chloride diffusion coefficient, compressive strength of concrete, and weight loss of the embedded steel. These evaluations should be conducted after continuous exposure to the tidal zone of the marine environment. Additionally, the concepts of design standards of the Department of Public Works and Town & Country Planning of Thailand are presented when considering steel corrosion due to chloride in the marine environment.