K-1 Influence of cracks on service life of reinforced concrete structures

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ABSTRACT

Service life of reinforced concrete structures is too short in many cases. Important repair measures are often necessary after not more than 30 years. Repair measures cost usually more than new constructions and they are always a heavy load for the environment. The general situation is briefly outlined by means of data presented by the American Society of Civil Engineers (ASCE). Then selected historical structures, which survived many hundred years without serious repair measures are presented and discussed. It can be concluded that actual service life design is not realistic. Focus is placed on the role of cracks for an explanation of the short service life of modern reinforced concrete structures. Penetration of water and salt solutions into fine cracks is studied by means of neutron imaging. It can be shown, that cracks with a width finer than the crack width allowed by actual service life standards, are water filled within a short period. Even very fine cracks as observed in strain hardening cement-based composites (SHCC) are filled with water in a short time, whenever the surface gets in contact with water or an aqueous salt solution as for instance sea water in the splash zone. Under favorite conditions cracks in concrete can be closed by self-healing. It will be shown that under usual conditions in practice water repellent surface impregnation is a most effective method to avoid penetration of water and salt solutions. In this way service life of reinforced concrete structures can be extended considerably and service life costs can be reduced.