

GFRP Retrofit of the Ring-Beam of the Gently-I Nuclear Reactor Containment Structure

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Abstract

The Gently-1 nuclear power plant in Quebec was decommissioned in 1978. Since that time, the containment structure has been used for the storage of the moderately contaminated nuclear reactor. The enforcement of more rigorous environmental regulations, as well as economic considerations, have raised the decommissioning period from 40 to 100 years, thus severely increasing the durability requirements for the structure.

The containment structure, constructed of thick prestressed concrete, was in very good condition, except for the secondary concrete. The latter is a keystone for the durability of the structure because it fills the recesses and protects the terminations of the prestressing tendons against corrosion. The differential shrinkage caused cracking and debonding and, with freeze-thaw cycling over the years, the secondary concrete had to be removed and replaced. The ring-beam, at the top of the containment structure, was severely affected because the numerous tendons of the dome roof terminate at that level.

The retrofit of the ring-beam consisted of replacing the secondary concrete with high-quality shrinkage-compensated mortar and concrete, followed by wrapping with a glass fibre reinforced polymer (GFRP) fabric. The layout of the GFRP wrap was designed to mitigate the adverse effects of the new secondary concrete shrinking-induced cracks. Most of the concrete cold joints were covered by the GFRP wrap, which was anchored on the dome roof to provide an effective support. This presentation will discuss the repair process, and highlight the innovative GFRP rehabilitation solution.

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