Repair and Strengthening for Pre-stressed Concrete Pipe

A critical water supply spigot and socket concrete pipeline, operating at 25 bar of working pressure, at the Vygeboom Dam in South Africa, suffered from spalling corrosion and burst. The dam, constructed to store and regulate floodwaters of the Upper Komati River near Badplaas in 1968, aimed to create a reliable water supply for proposed power stations and stabilize downstream river flow.

The pipe failure, characterized by a 30cm x 20cm hole and a 2mm wide crack around the entire circumference, necessitated the shutdown of the entire line until repairs could be made. The client sought assistance from Corrocoat South Africa – Johannesburg for a comprehensive solution.

Spanning over 6 days, the critical project involved external excavation and traversing 200m within the pipeline for internal surface preparation, coating, and reinforcement. The team initially blast-cleaned the internal and external surfaces of the concrete pipe. Specialist concrete primers were then applied to reinforce and bond with the immediate concrete surface layer. The holes were filled with Corrocoat Corrofill E, and Corrocoat Zip E was applied to the pipe internals, while Polyglass 100 was applied externally. The internal and external integrity of the pipe was further reinforced using a carbon fibre repair system.

Design calculations were performed for pipe burst resistance, focusing on fibre orientation in the hoop direction for burst resistance. Additional calculations and layers of woven roving carbon fibre were employed for the holed area, while separate calculations for unidirectional carbon reinforcement over the crack were carried out to prevent pipe deflection.
The repair not only saved time but also capital compared to replacing the entire spigot with a new, unprotected fabrication. The reinforcement carried out by the team ensured the prevention of future failures at this critical pipeline juncture.

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