



Delhi Metro Rail Corporation (DMRC) Phase III & Phase IV

Phase III was completed in 2019;
Phase IV is ongoing

ABOUT THIS PROJECT:		
Market Segment: Tunnels	Location: Delhi, India	Architect: DRMC Design
Contractors: Larsen & Toubro Ltd; Afcons Infrastructure Ltd; J Kumar; FEMC Pratibha JV	Owner: Delhi Metro Rail Corporation (DMRC)	Products Used: Xypex Admix C-2000 NF Xypex Concentrate

THE PROBLEM

The underground segments of the rail network are subject to high hydrostatic pressure, with portions of the tunnel up to 95 feet below grade. For phases, I and II, the Delhi Metro Rail Corporation (DMRC) specified membranes for the waterproofing of the underground tunnels. However, due to problems with the membranes and their constructability, many areas suffered from leaks and required repair.



The Engineers needed fast and permanent solutions for effective waterproofing properties and durability enhancement of underground structures to the negative side of the wet concrete surfaces. The constructors tried numerous strategies and materials,

but the Xypex Patch'n Plug and Concentrate system proved to be the preferred solution for stopping the water where the membrane failed.

THE XYPEX SOLUTION

Due to the success of the Xypex surface-applied and repair system in various projects, the Delhi Metro engineering team consulted Xypex to provide a waterproofing solution for phase III.

The engineering team specified Xypex Admix C-2000 NF and Xypex Concentrate for the waterproofing of phase III underground stations in conjunction with spray applied membranes on the rooftop slab.



Xypex C-Series admixtures are added during batching to incorporate crystalline technology into the concrete mix for the tunnel liner segments used by the tunnel boring machine. The Xypex chemical treatment reacts with cement and the byproducts of cement hydration to fill the capillaries in the internal structure of the concrete, creating a non-soluble permanent crystalline matrix. The result is concrete that prevents the penetration of water and other liquids for the structure's life and enhances the durability of concrete structures.

Xypex Concentrate is mixed with water and applied as a cementitious slurry for surface protection and sealing strips at construction joints and rooftop slabs. Xypex crystalline technology prevents the penetration of water and other liquids into the surface of the concrete, permanently protecting the underground stations and tunnel segments. During phase III, Xypex waterproofing was also used in the cast-in-place cut and cover construction, including the diaphragm walls, underground station structures, and roof slabs. The Xypex waterproofing solution performed so well that Delhi Metro Rail Corporation eliminated the membrane system and approved the Xypex crystalline solution for the 27 kilometers of new underground tunnels in phase IV of the project.

PROJECT BIO

Delhi, India, is currently constructing phase IV of the region's Metro Rail network, which includes 65 kilometers of additional track and 46 new stations. The Metro Rail system is relatively young, with the construction of the first phase beginning in 1998.

In only 25 years, it will have expanded to 394 kilometers of elevated, at-grade and underground track to support the 30 million people in the area that rely on this transportation network.



The underground portion of the project is considered one of the largest tunneling projects ever to take place under a major urban center. The Delhi Metro Rail system will consist of more than 53 kilometers of underground lines and 74 tunnels at completion, with the majority being waterproofed using Xypex materials and technology.



The massive multi-year project includes 19 tunnel boring machines working simultaneously to construct the tunnel system, which will run the length and breadth of the nation's capital.

