

Coal Combustion Product Type

DuraPozz Pro Fly Ash

Project Location

Gauteng, South Africa

Project Participants

Ash Resources, Bombardier Transportation, Bouygues Travaux Publics, Murray & Roberts, Strategic Partners Group, RATP Group, J&J Group, Farrells, Jaco Groenewald and GAJV, Martinez Architects, Atkins - Urban Edge Architects JV

Project Completion Date

2012

Project Summary

Gautrain is a 50-mile-long, high-speed commuter rail line in Gauteng, a northeastern province of South Africa that is home to Johannesburg, the country's largest city, and Pretoria, its administrative capital. It was constructed to help reduce vehicle congestion between those two cities as well as to provide rail service to Tambo International Airport. Construction of the system took over five years and involved significant tunneling and bridge/viaduct building over portions of terrain that boast sinkhole-prone dolomitic conditions.

Project Description

One of the largest rail construction projects globally in recent years, Gautrain required approximately 28 million cubic feet of concrete with durability stipulated for a 100-year lifespan. The above-ground portions of the rail line necessitated construction of approximately 50 bridges and 16 viaducts, much of which were formed from precast concrete. The main contractor, Bombela Civils Joint Venture (BCJV), specified Lethabong-based Ash Resources' DuraPozz Pro fly ash in virtually all of the project's concrete mix designs.



Credit: Manuguf - Wikimedia.



Credit: NJR ZA - Wikipedia.



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To create the required forms, BCJV created the largest precast yard in the Southern Hemisphere at Midrand, in suburban Johannesburg. The yard produced a wide variety of castings, including M-beams for bridges, parapets, viaduct segments, noise barriers, and tunnel walkway sections. The largest of the concrete castings were huge viaduct segments weighing between 45 and 65 tons apiece.

In many instances, a high-production precast yard would utilize CEM I portland cement of Class 42.5R or 52.5. However, after extensive trials, engineers Murray & Roberts settled on a concrete mix incorporating 30-35% DuraPozz Pro fly ash, which they deemed to be less expensive, more environmentally friendly, and higher strength than a pure-cement mix. Moreover, supplier Ash Resources was able to ensure the availability of the fly ash, which was sourced from the nearby Lethabo Power Station. Optimizing with other materials, an accelerated mix was attained that allowed the casting molds to be turned around within 12 to 18 hours, eliminating the need for steam curing. Compressive strength achieved exceeded 4000 psi within 24 hours and averaged 10,700 psi after 28 days.

The above-ground route to Pretoria crossed over unstable dolomitic limestone landscape. Meeting the challenge to create stable foundations, engineers utilized over 3.5 million cubic feet of grouting incorporating a fly ash/CEM I cement mix for good pumpability together with bentonite.