PENETRON®
TOTAL CONCRETE PROTECTION

PARK AVENUE TUNNEL

PROJECT	Park Avenue Tunnel
INDUSTRY	Transportation
LOCATION	New York, USA
PRODUCTS	PENETRON ADMIX

PARK AVENUE TUNNEL

CASE SUMMARY

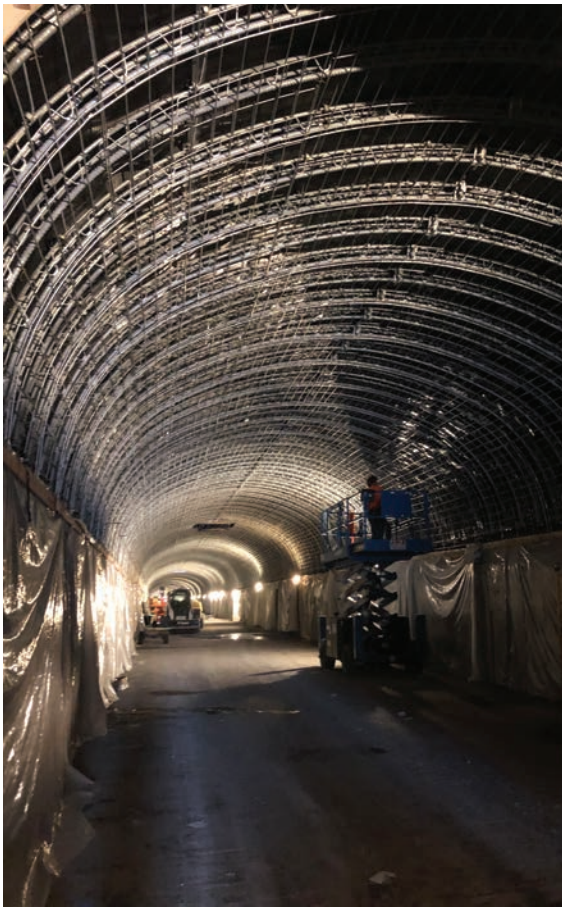
The US$24.5 million renovation of New York's Park Avenue Tunnel revived a historic underground thoroughfare in Midtown Manhattan. PENETRON ADMIX was added to the shotcrete mix to ensure a waterproof – and more durable – renovated tunnel.

The Park Ave Tunnel, also called the Murray Hill Tunnel, in the New York City borough of Manhattan is a 1,600-foot-long (488 m) tunnel that passes under seven blocks of Park Avenue in Murray Hill, carrying one lane of northbound traffic from 33rd Street to 40th Street. The original rail tunnel opened in 1834 by New-York and Harlem Rail, the first railroad in the city. It was originally an open cut through Murray Hill along the course of Park Avenue and was covered in the 1850s before being converted to a road tunnel in 1937.

By 2014, the New York City Department of Transportation Division of Bridges realized the tunnel was in dire need of structural remediation. Repair work to rehabilitate this 100+ year old structure began in February 2017.

"Applied to the internal reinforced shell along the entire length of the Park Avenue Tunnel, the PENETRON ADMIX-enhanced shotcrete structure is stronger and more durable than the original tunnel."

The Park Avenue Tunnel rehabilitation project was designed by WSP USA (formerly WSP/Parsons Brinckerhoff), a multinational engineering and design firm. Gall Zeidler Consultants supervised the demolition of the previous tunnel walls, the installation of new tunnel drainage, and the construction of new final support structures utilizing shotcrete, carried out by Cruz Concrete. The new PENETRON ADMIX-enhanced shotcrete lining (steel reinforcement with lattice girders to allow control of geometry) both strengthened and waterproofed the newly exposed bricks on the tunnel roof.



A crystalline solution: Originally built in the mid-1800s, the structural remediation of New York's Park Ave Tunnel (1,600-foot-long/488 m) was completed with PENETRON ADMIX-enhanced shotcrete.

When sprayed concrete – or shotcrete – is shot through a hose at high pressure onto a surface, the force of the application compacts and consolidates the applied shotcrete simultaneously, creating a well consolidated concrete structure. Although the hardened properties of shotcrete are similar to those of conventional cast-in-place concrete, the nature of the placement process resulted in an excellent bond with the exposed brick of the tunnel roof.

A Crystalline Solution

At the start of the project, the waterproofing specifications designated a polymer-modified topical mortar to be applied as a spray. However, as the design evolved, a decision was made to add a crystalline waterproofing admixture into the shotcrete instead. The material submittal was prepared by Tully Construction and Cruz Concrete (the shotcrete applicator) and included performance testing provided by US Concrete Products and Penetron. A thorough evaluation and approval process followed.

The tests and evaluations were important because the process of applying shotcrete is very dependent on the material properties. For the Park Avenue Tunnel, it was absolutely critical that admixtures did not change the set characteristics or the slump of the mix. Unlike poured or pumped concrete, there are no forms to hold shotcrete in place. A shotcrete mix with a delayed set can fall off a vertical or overhead surface. If the slump of the mix is increased, the shotcrete will run down the surface. If the slump is decreased, rebound may increase – where the material is too "dry" and bounces off the surface.

Simplifying the Job

Once approved, the project specifications were revised to include PENETRON ADMIX, an integral crystalline waterproofing admixture, into the shotcrete mix. This switch eliminated a job step as the admixture was now added to the shotcrete at the factory, which was packaged and delivered by US Concrete Products. The contractor was able to follow the previous process without any changes to the process or the schedule.

Getting a Stronger Concrete Structure

Wet process shotcrete was applied as a 9" (230 mm) to 12" (305 mm) internal reinforced shell along the entire vertical (up to the brick wall line) and overhead portions of the Park Avenue Tunnel, resulting in a structure that was much stronger than the original tunnel. Cruz Concrete applied the PENETRON ADMIX-enhanced shotcrete along the length of the tunnel roof.

The performance of PENETRON ADMIX fully met the criteria set forth in the project specifications and was shown not to interfere with the shotcrete's placement characteristics or in-place properties – PENETRON ADMIX is set neutral.

Enhanced with PENETRON ADMIX: Shotcrete is shot through a hose at high pressure onto a surface. The force of the application compacts the applied shotcrete, creating a solid concrete structure.

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