





BROOKLYN- BATTERY TUNNEL in New York

INSTALLING CERAMIC TILES IN THE LONGEST
CONTINUOUS UNDERWATER VEHICULAR TUNNEL
IN NORTH AMERICA

The Brooklyn-Battery Tunnel, officially known as the Hugh L. Carey Tunnel, is a toll road in New York City that crosses under the East River at its mouth, connecting the Borough of Brooklyn on Long Island with the Borough of Manhattan. The tunnel nearly passes underneath Governors Island, but does not provide vehicular access to the island. It consists of twin tubes, carrying 52,000 automobiles daily along four traffic lanes, and at 2,779 m is the longest continuous underwater vehicular tunnel in North America.

THE HISTORY OF THE TUNNEL

Proposals for a crossing between Battery Park in lower Manhattan and the Red Hook section of Brooklyn had been around since 1929. Originally envisioned

as a three-tube, six-lane tunnel, the crossing was to connect two pieces of rapidly expanding arterial network: the West Side Highway in Manhattan, and the "circumferential bypass" (later known as the Gowanus Expressway and the Belt Parkway) in Brooklyn.

The proposed tunnel was approved by the New York City Board of Estimate in

1930. However, its construction was delayed by the deepening economic depression.

The Brooklyn-Battery Bridge proposal was officially killed in 1939 when the Secretary of War under the Roosevelt Administration, Harry Woodring, said that the proposed crossing would be seaward of the Brooklyn Navy Yard. According to the War Department, the proposed bridge would have not only been vulnerable to attack in the event of war, but would also have blocked access to the Navy Yard.

Under the direction of Ole Singstad of the New York City Tunnel Authority, construction of the Brooklyn-Battery Tunnel commenced in 1940. Work on the tunnel, originally scheduled for completion in 1943, was halted due to World War II-induced shortages of steel and iron. When construction resumed in 1945, more than 450,000 kg of dynamite was used to bore through rock and earth beneath New York Harbor.

Over 12.6 million kg of steel, over 156,000 m³ of concrete, 3,011,083 m of electrical wire, 883,391 bolts, and 799,000 wall and ceiling ceramic tiles went into the structure.

In addition, about 93,600 tons of cast iron were used to line the tunnel. Ventilation was to be provided by 53 fans, operated by 104 motors that release over 170,000 m³ of fresh air into the tunnel.

The Brooklyn-Battery Tunnel opened in 1950 at a cost of 90 million U.S. dollars. The tunnel was a success from the very beginning, carrying approximately 41,000 vehicles per day during its first full year of operation in 1951.



PHOTO 1. The tunnel after the storm caused by Hurricane Sandy.

PHOTO 2. Preparing the installation bed with MODIFIED MORTAR BED.





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PHOTO 3. Installing ceramic tiles with ULTRAFLEX 3.

PHOTO 4. Grouting tile joints with ULTRACOLOR PLUS FA.

PHOTO 5. A view of the tunnel after completion of the works.

MAPEI PRODUCTS AT WORK ON THE JOBSITE

The tunnel was closed in preparation for Hurricane Sandy and completely flooded on October 29, 2012, after a severe storm surge. It reopened on November 13, following a cleanup process that included the removal of more than 227 million liters of water. The tunnel was the last New York City river crossing to reopen. Hurricane Sandy flooded the tunnel with salt water, causing electrical problems within the concrete tube.

The existing ceramic tile and mortar bed were removed, and electrical wiring was repaired. A new mortar bed was created, and the ceramic tiles were re-installed.

Gibraltar Contracting, the tile contractor on the Brooklyn Battery Tunnel project, was asked to float a new mortar bed and install 43,055 m² of Agrob Buchtal “Chroma” façade ceramic tiles across 4.5 m high walls of the 2.8-km long expanse of the Manhattan-to-Brooklyn side of the Brooklyn Battery Tunnel. The Chroma tiles offer easier cleaning, as well as diffusing light for motorists. These tiles also act as a fire-retardant, providing a protective coating for the tunnel in the event of a fire.

The biggest challenge came in preparing the installation bed for the bonding of the tiles. The removal of the original tiles left an extreme profile on the surface of the concrete substrates along the walls. The Gibraltar crew applied two coats of MODIFIED MORTAR BED, a premixed cement-based polymer-modified thick-bed and render mortar, that includes a blend of select aggregates.

This was a great solution because, rather than requiring the use of a latex additive, MODIFIED MORTAR BED only needs mixing with water to produce a thick-bed mortar with exceptional strength. With that challenge well met, the installers moved on to installing the nearly 800,000 ceramic tiles. Around the tunnel’s access areas for periodic maintenance, the crew installed a mint-green ceramic tile to make these areas easily visible.

All the tiles were set with ULTRAFLEX 3 adhesive. The crew then grouted all the joints with ULTRACOLOR PLUS FA grout, which produces no efflorescence. All the products used in this project are manufactured and distributed on the US market by Mapei Corp.

Work on the Manhattan-to-Brooklyn tube of the tunnel was completed in March 2017 as a part of a 282.5 million US-dollar repair job.

TECHNICAL DATA
Brooklyn Battery Tunnel (Hugh L. Carey Tunnel),
 New York City (USA)
Original Design: Ole Singstad
Periods of construction: 1940-1943, 1945-1950
Period of the Mapei intervention: 2016-2017

Intervention by Mapei: supplying products to prepare the substrates, install ceramic tiles, and grout tile joints
Client: City of New York (MTA Bridges and Tunnels)
Works director: Christian Varela
Main contractor: Tully Construction

Installation company: Gibraltar Contracting
Mapei distributor: Pro Tile Inc.
Mapei coordinator: Matt Hess, Mapei Corp. (USA)

MAPEI PRODUCTS
Preparing the substrates: Modified Mortar Bed*
Installing ceramic tiles: Ultraflex 3*

Grouting joints: Ultracolor Plus FA*

*These products are manufactured and distributed on the US market by Mapei Corp.

For further information on products see www.mapei.com