BOSTON to BOSTON

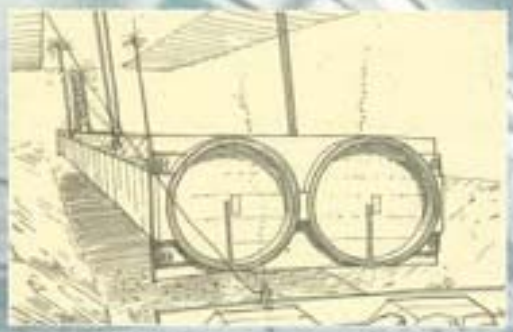
A million and a half cubic meters were excavated in the Boston Third Harbor Tunnel.

by Natasha Calandra and Ed Ou

Drawing 1:
The total cost of the Boston Tunnel was $258 million. $30 million were awarded in contracts to local construction firms. The drawing illustrates the amount of funds allotted to the each section of the project.

Drawing 2
Positioning tunnel sections on a bed of gravel. Once they were lowered into the water, the sections were then connected by specially trained divers.

DRAWING 1



DRAWING 2

PHOTO 1

Built to increase the capacity of the Central Artery expressway that runs through the heart of Boston, the Third Harbor Tunnel was designed to relieve traffic congestion by connecting South Boston directly with East Boston and Logan Airport. The tunnel is dedicated to Ted Williams, one of the past glories of the legendary Boston Red Sox baseball team. Work began in 1992 on digging a trench 1300 meters long, 30 m. wide, and 15 m. deep, on the bottom of the port of Boston. In two years the "Super Scoop", a dredging machine brought in specially from California, removed 700 cubic meters of soil and sediment from the bottom, despite some inconvenience experienced during lobster and herring migrations.

The dredging operation

To reduce the risk of rock fractures that are often the cause of water leaks in tunnels, the architects decided to employ a submerged structure consisting of two parallel tunnels to accommodate four lanes of automobile traffic. At its shallowest point the tunnel is 2.5 meters beneath the surface of the old port, so the longest section of the tunnel is protected by the surrounding rock. Several environmental measures were adopted during dredging to keep loosened sediments from contaminating the waters of the harbor: special rubber protection devices were fitted to the edges of the dredging bucket to prevent the release of contaminated material. While the "Super Scoop" proceeded with dredging, a second machine deposited a bed of gravel on which the tunnel sections would be placed. Each section is 100 meters long, weighs 7.5 tons and is outfitted with shafts for the ventilation system (see Drawing 2). The segments, whose interiors had been cast with horizontally and vertically curved profiles to house the roadways, were encapsulated in concrete and connected to each other

PHOTO 2

Photo 1
10 meters below sea level…a two-story scaffolding is erected to install ceramic tiles on the tunnel walls

Photo 2
Section after section, ceramic tile walls surround the four traffic lanes

under water with hydraulic joints. The tunnels rest on uneven terrain, being 25 m. deep at either end and 30 m. deep in the center. These differences in grade made it necessary to use materials with a high modulus of elasticity to compensate for ground settling of the structure. Specifications are stricter for tunnel tile than floor tile due to the environmental conditions to which a tunnel is exposed: constant moisture, continuous vibration, extreme temperature differences, and shock waves caused by the backfiring of internal combustion engines.

1,400,000 tiles

The project called for installation of ceramic tiles on the tunnel walls: 630,000 sq. ft. of 8x8 inch (25x25 cm.) tiles specially designed to enhance their bonding strength, for a total of 1,400,000 tiles! Such a large and highly specialized installation required the technical assistance of an experienced setting materials manufacturer. Design professionals for the project selected the world's largest and most experienced, Mapei Corp. with headquarters in Garland, Texas and four plants in the USA.
Mapei products passed fatigue strength tests and proved they could guarantee the high quality necessary for a tile installation in such extreme conditions. The walls were first given a slurry bond coat of cementitious mortar mixed with Mapei PLANICRETE 50* admixture, a synthetic rubber latex for better bonding and increased strength, followed by the installation of a scratch and float coat. Choosing the adhesive required careful evaluation.
This difficult project was made possible by using Mapei KERASET* thin set mortar, a cementitious adhesive that hardens without shrinkage, and bonds perfectly to all substrates normally used in construction, mixed

PHOTO 7

PHOTO 3

PHOTO 4

with KERAPLY* latex admixture.
Another product developed in the Mapei laboratories was selected for grouting a surface equivalent to that of 4,600 family bathrooms: ULTRACOLOR, a latex-modified, hydraulic cement grout that is fast drying, hardens without shrinkage and prevents formation of surface efflorescence.
"Mapei products have been selected for the tile installation in the Third Harbor Tunnel project. Mapei technical representatives have been on site on several occasions to ensure that their products were installed properly. The quality and performance of MAPEI products have far exceeded their competitors. From the spreadability of their KERASET, to the ease of clean up of their ULTRACOLOR grout.*
We are confident that we made the right decision in selecting Mapei products for this project," declared Bob Vesey, Project Manager.
We at Mapei couldn't be more pleased. ❑

PHOTO 5

PHOTO 6

Photos 3 and 4
The back-buttering and float system is used for setting the tiles. KERASET is first applied with a trowel to walls that have been given a slurry bond coat of cementitious mortar mixed with PLANICRETE 50* admixture (photo 3). Then KERASET* is spread on the back of tiles mounted on panels of 25*

Photo 5
Setting the tiles after applying the adhesive

Photo 6
4,600 bathrooms could have been grouted with the amount of ULTRACOLOR used in the tunnel.*

Photos 7 and 8
The "Central Artery" is ready to receive the thousands of vehicles that will pass…underwater!

Technical data sheets for the products mentioned in this article are contained in Mapei's "Resilient and Ceramic" Binder available from Mapei Corp. (USA) and Mapei Inc. (Canada).

PHOTO 8

TECHNICAL DATA SHEET

Project: "Third Harbor Tunnel", Boston

Executed: 1992-1997

Project Manager: Bob Vesey

Cladding: 8x8 inch (25x25 cm.) ceramic tiles

Products used for tile installation*:
PLANICRETE
KERASET
KERAPLY
ULTRACOLOR
* these products are manufactured by Mapei Corp. (USA)