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CONEY ISLAND SUBWAY CAR REPAIR FACILITY PROJECT PROFILE

# GEOFOAM™

## World Wide Project Reports

Back On  
Track at  
Coney Island

Geofoam™  
with Mini-Pile  
System Stops  
60 years of  
Subsidence



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**For the last 60 years**, when one of New York City's 3,100 subway cars needed major repair, it has been wheeled to the Coney Island Main Repair Facility in Brooklyn-the largest of its kind in the world. And for those 60 years, the facility's floor got worse as the trains got better. Constructed on the former Coney Swamp, the repair shop was built on loose fill with no pile-support for the floors. Settlement gave way to voids; voids gave way to repeated floor failures.

After years of band-aids, the New York Transit Authority completed full-scale subsidence surgery. A 1984 \$100 million repair shop overhaul included over 4,000 cast in place mini piles, installed without interrupting shop operation. Repair goes beyond removing graffiti - cars routinely receive entirely new wiring systems, wheel assemblies, lighting, seats and other repairs. The whole facility, including rail yards, occupies about 100 acres, 12 of which are building space.

During original construction, the swamp filling apparently created mud/peat waves, causing uneven soft soil thickness underlying the site. The soils experienced long-term settlements from the weight of the fill and overlying structures. The steel frame, columns and outside walls were supported on pile foundations; the floor slabs were not. Only isolated column footings supported the slabs across the voids.

Subsidence was first recognized in 1927, two years into the life of the facility. Since then, floor slabs have been reinforced with concrete filled piles, gravel and grout. In 1980 a floor slab in the main shop dropped 18 inches. Because the 1984 shop overhaul included new cranes, new floors and new equipment, subsurface treatment had to solve existing problems under increased loads.

**Geofoam™ to the rescue.** Selection of a rehabilitation scheme was based on minimum disruption to shop operation, proven performance, compatibility with existing soil and cost savings. A mini pile system was chosen to be the best all around system. The mini pile (i.e. micro pile) is a cast-in-place, reinforced concrete pile originally developed for underpinning historic buildings.

Designed to carry loads by skin friction between piles and surrounding, sub-compressible layer soils, mini piles of 6 and 7 in. diameter were used for design capacities of 15 and 30 tons, respectively. Installation was efficient and strengthened mini pile performance. Pile lengths of 35 ft for the 15 ton pile and 45 ft for the 30 ton pile were estimated. Resistance to buckling when surrounded by the soft organic soils was analyzed and found adequate.

Compression and tension tests were performed to verify the adequacy of the mini pile design and the proposed installation procedure.

**Test results showed that the mini piles will support anticipated loads with minor pile displacements. Before installation of the mini piles, the existing voids were filled with a lightweight engineered Geofoam™ fill (30-36 lb. per cu ft). The fill, about 80% air and produced by adding pre-formed foam to the cement and water slurry, was pumped into the voids without removing the floor slab. Its low density inhibits additional settlement and corresponding down drag forces to the piles. The fill will also protect against erosion by blocking the water allowed by the voids.**

CREDITS Parsons Brinckerhoff, Quade & Douglas, Inc., New York City, designed the modernization and provided consultation during construction. Nicholson Construction Co., under subcontract to A.J. Pegno Construction Corp., installed the mini piles. Underpinning and Foundations, under subcontract to Slattery-NAB, installed the *Monotube* piles. Eastern Cellular Concrete installed the lightweight fill.

*The Coney Island Facility is owned and operated by the New York City Transit Authority.*

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