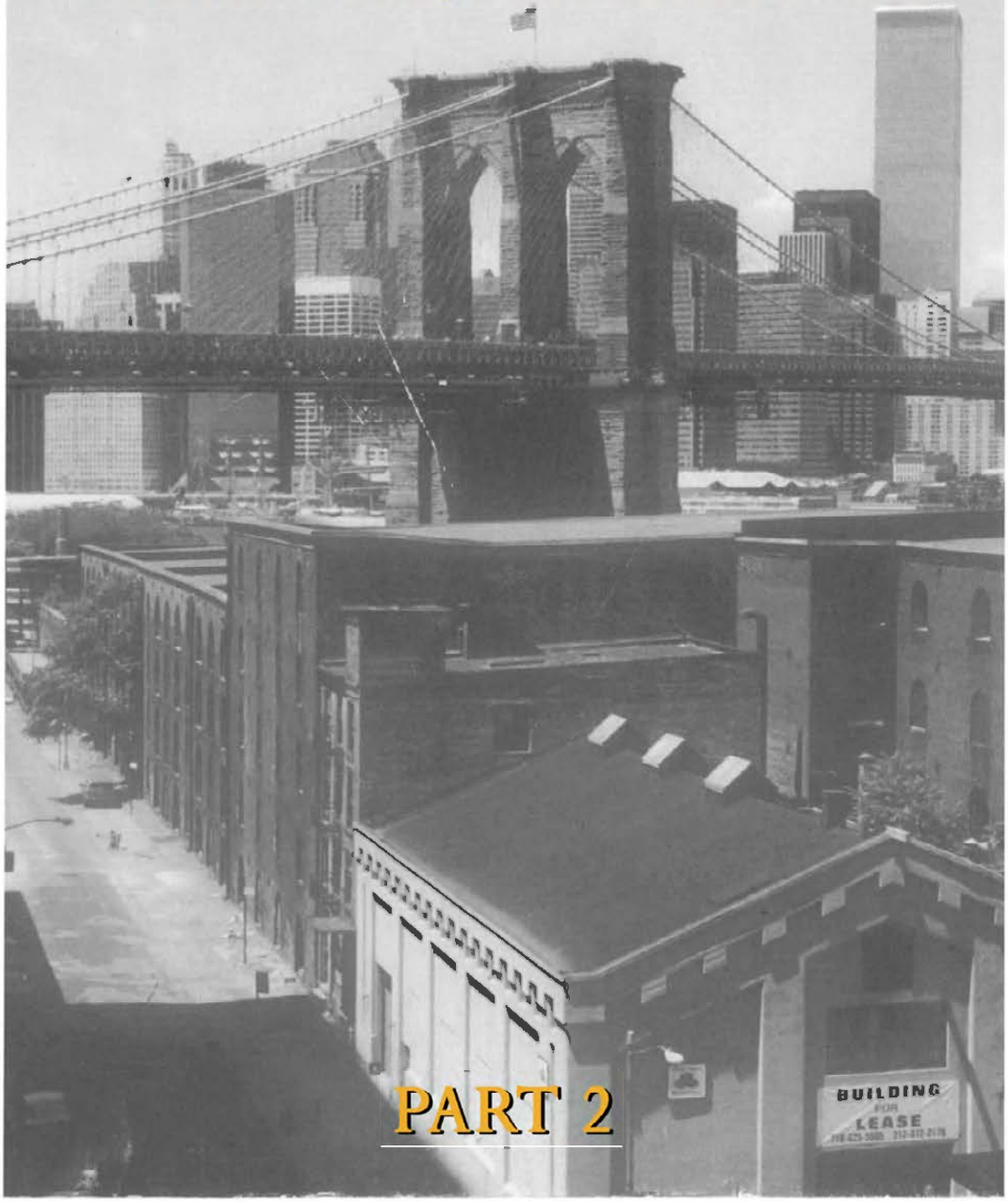
ROEBLING CHAPTER

SOCIETY FOR INDUSTRIAL ARCHEOLOGY

Brooklyn

31ST ANNUAL CONFERENCE

EAST of the RIVER SOUTH of the SOUND



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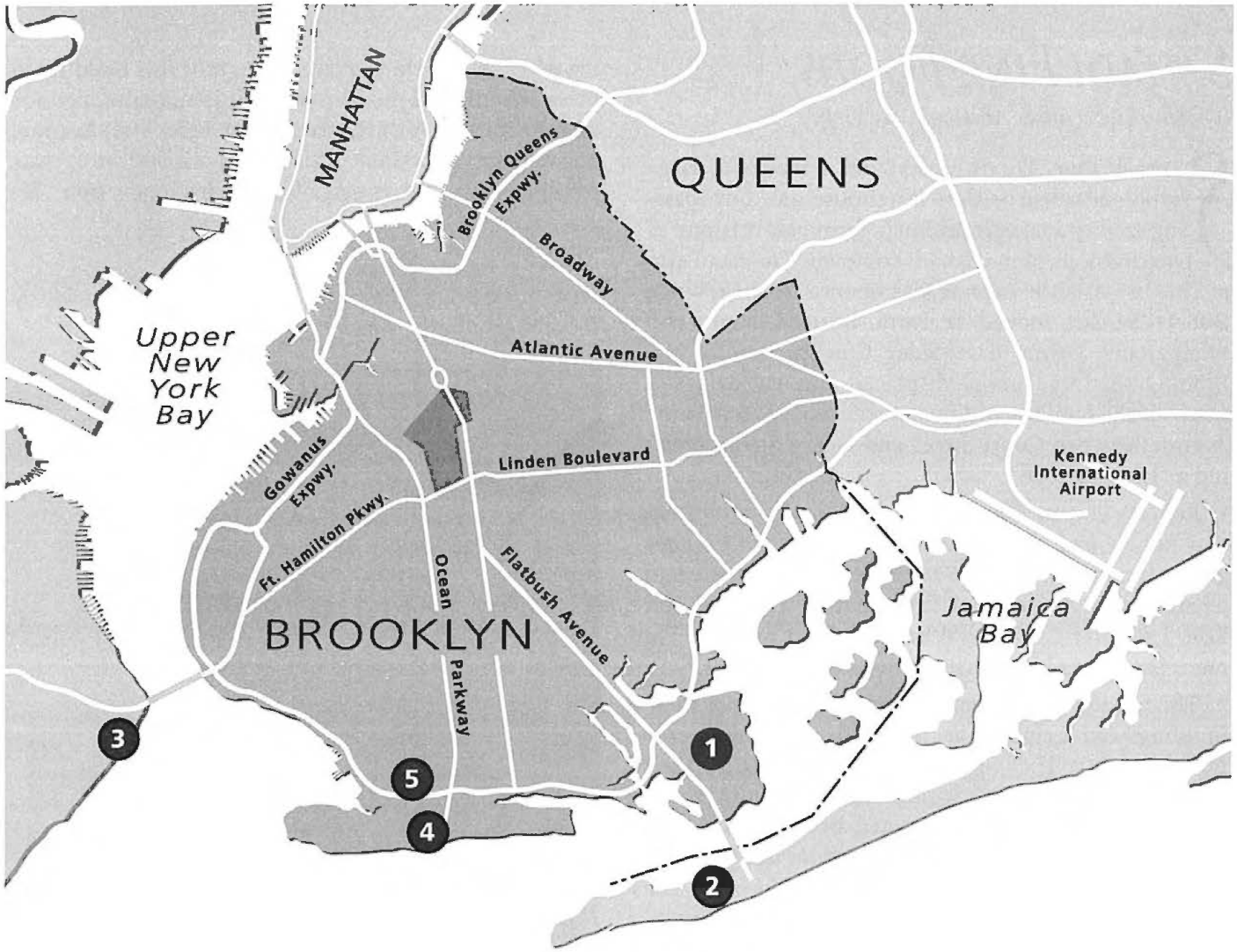
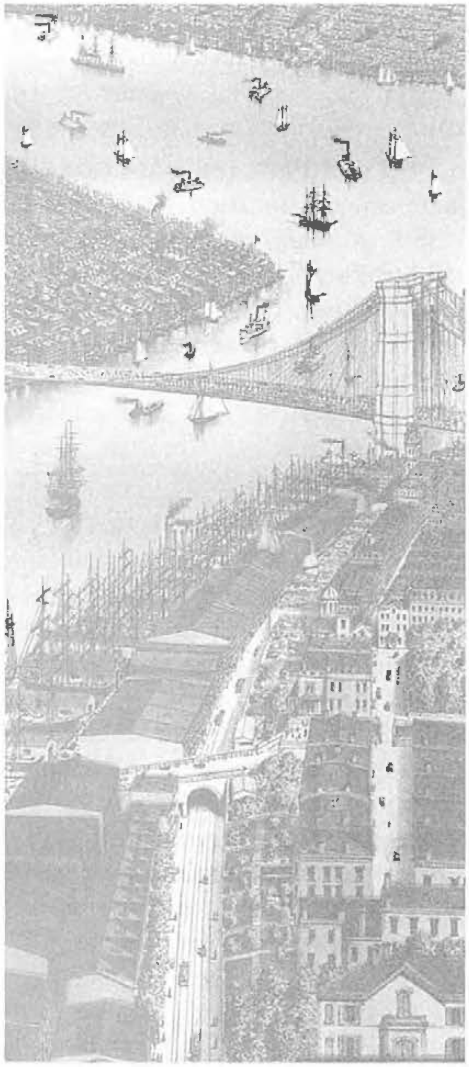


ATLANTIC GATEWAY

Floyd Bennett Field – Barren Island	**1**
Fort Tilden – Rockaway Point Boulevard, Far Rockaway	**2**
Fort Wadsworth – Bay Street & Richmond Avenue, Staten Island	**3**
Coney Island	**4**
NYCTA Coney Island Shops – Stillwell Avenue & Avenue X	**5**

CHAPTER FOUR
ATLANTIC GATEWAY



INTRODUCTION: DEFENDING THE HARBOR

By Paul J. Bartczak

"From its birth the new United States placed itself among the foremost of those countries which considered seacoast protection a prime necessity. The great forts that it built ... reflected the American attitude in an age that hoped for a peaceful aloofness from the rest of the world yet determined to defend itself from any possible foreign attack. The skill of American engineers translated these hopes into one of the most advanced coastal defense systems in the world." – Harold L. Peterson, Chief Curator, National Park Service

New York Harbor has an impressive collection of seacoast fortifications, spanning from the War of 1812 to the Cold War, and reflecting the evolution of military and engineering theory across that time. The first American system of fortifications, ca. 1794-1802, is characterized by open earthworks with parapets; some with facing revetments, some with an earthen redoubt or blockhouse to defend against land attack. No first-system fortifications exist in the New York area today. The second system (ca. 1807-1815) included open batteries, masonry-faced earth forts, and all-masonry forts with cannon inside the fort instead of atop its exterior walls. Examples include the original Forts Richmond and Tompkins on Staten Island; Fort Columbus (or Fort Jay) and Castle Williams on Governor's Island; and Fort Wood on Bedloe's Island (now the base of the Statue of Liberty).

The third system (ca. 1817-1861) featured large masonry forts, mostly polygonal in plan. Fort Schuyler on Throgs Neck (begun 1833) is a New York-area example, as is Battery Weed at Fort Wadsworth. Between 1886 and 1905, when William Endicott was Secretary of War, military theory dictated the construction of isolated reinforced concrete batteries blended into the landscape. Many of these included 20 feet (6.1 m) of concrete faced with 30 feet (9.1 m) of earth. Armament included "disappearing" guns and mortars. The New York area has several Endicott-period constructions. The Taft period (ca. 1905-1910) saw the enhancement of Endicott constructions with electricity for searchlights, communication, ammunition handling, and, especially, aiming and targeting.

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FLOYD BENNETT FIELD

By Paul J. Bartczak

In the late nineteenth century, the vicinity of Jamaica Bay was a place of exile for noxious industries such as rendering works and glue factories. Dead Horse Bay and Dead Horse Inlet commemorate the floating animal corpses that used to be commonplace in these waters. In the first decades of the twentieth century, much of the marshy area on the periphery of Jamaica Bay was filled in, initially with garbage and rubble, and later with sand pumped from the bay. The feature known as Barren Island was vastly enlarged and joined to the shore by these landfill operations, becoming a peninsula and the eventual site of Floyd Bennett Field.

This site was selected for New York City's first municipal airport due to the complete absence of any obstructions and the ease in locating the site from the air. The airfield was formally opened with a dedication ceremony attended by fifteen thousand people on May 23, 1931. The field was named after the naval aviator who had accompanied Admiral Richard E. Byrd on his historic flight over the North Pole on May 9, 1926, and who had died in 1928 during a heroic attempt to rescue fellow aviators in distress.

The airport was constructed with state-of-the art runways, hangars, and terminal facilities, and featured such innovations as underground tunnels from the basement to the ramp area, which allowed passengers to walk comfortably from the terminal to their aircraft in any weather. Notwithstanding these assets, the airport was a commercial failure. Because Newark Airport was closer to Manhattan, airlines would not schedule flights to Floyd Bennett. After the failure of the Post Office to designate Floyd Bennett Field as a mail terminal, the City of New York focused its efforts on North Beach Airport on Bowery Bay (today's LaGuardia Airport), which was even closer to Manhattan than Newark Airport.

Between 1931 and 1941, the low traffic levels, long runways, and isolated location made Floyd Bennett Field attractive to aviation pioneers and daredevils. Many record-breaking flights originated from the field, including trans-Atlantic, trans-continental, and around-the-world efforts. Notable aviation pioneers associated with Floyd Bennett Field include Wiley Post, Howard Hughes, Amelia Earhart, Roscoe Turner, Laura Ingalls, Jimmy Doolittle, Jacqueline Cochran, and Douglas "Wrong Way" Corrigan.

On May 22, 1941, the U.S. Navy leased Floyd Bennett Field from the City of New York. All commercial and private flight operations were discontinued by May 26. On June 2, 1941, Naval Air Station Floyd Bennett Field, New York, was commissioned. New York City relinquished all jurisdiction to the Navy Department on September 28, 1943. During the 1940s, the original 1931 control tower was replaced and Hangar B was constructed to house flying boats. The Naval Air Station continued in active service until 1971, when it was decommissioned and turned over to the U.S. Department of the Interior for inclusion in the Gateway National Recreation Area. ■

The ca. 1930 terminal at Floyd Bennett Field. Dennis Furbush.

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FORT TILDEN

By Paul J. Bartczak

Located on the Rockaway Peninsula, just east of Breezy Point in the borough of Queens, Fort Tilden constituted part of the outer defense of New York harbor during both world wars, and into the Cold War era. The first fortification on the peninsula was a blockhouse called Decatur, erected on Rockaway Point during the War of 1812 on land purchased from Nathaniel Ryder. Fort Tilden was established on February 19, 1917, and was officially named Fort Tilden on July 24 of that year, in honor of Samuel Jones Tilden (1814-1886), governor of New York from 1875 to 1876 and Democratic Presidential candidate in the 1876 election. Construction began on March 17, 1917, with the installation of four 12-inch (305 mm) guns. In April, installation of four 6-inch (152 mm) guns, a searchlight, watchtowers, and other permanent construction was under way. In June 1918, the 3-inch (76 mm) fixed anti-aircraft battery was begun and completed; the guns were mounted in September 1919.

In 1921, construction was begun for the installation of two 16-inch (406 mm) guns in individual batteries (Battery Harris East and West). The Washington Armament Conference of 1922 resulted in the cancellation of the Colorado class of battleships, making available twenty completed Model 1919 Mark II 16-inch naval guns, manufactured at Watervliet Arsenal (located up the Hudson River near Albany). In 1922, two of these guns were mounted in open "Panama" mounts which permitted the guns to rotate 360 degrees in azimuth and to elevate to 69 degrees. In the early 1940s, these guns were covered by concrete casemates that served to protect them from aerial attack and to prevent their being turned against New York City. The heavy weight of the armor-piercing shells (2,400 pounds [1,090 kg]) required the use of a railroad line, originally constructed to handle ammunition for other guns, to move the ammunition from the delivery dock. The rail line started at the dock on the Rockaway Inlet side of the peninsula, crossed Rockaway Beach Boulevard, turned west, and ran through the three magazine houses and the two gun positions of Battery Harris.

Following World War II, and the realization that aircraft constituted a greater threat than enemy battleships, the 16-inch guns were removed from their casemates and cut up for scrap. Fort Tilden became one of a number of locations in the New York metropolitan area used as launch sites for the Nike series of air defense missiles. Nike Ajax, the world's first guided surface-to-air missile, became operational at Fort Meade, Maryland, in December 1953, and was operational at Fort Tilden in March 1956. In 1958, the Nike Ajax missiles at Fort Tilden were replaced by Nike Hercules, which possessed greater speed, greater range, and the ability to carry a nuclear warhead. The Nike Hercules missiles were removed from Fort Tilden in 1972. ■

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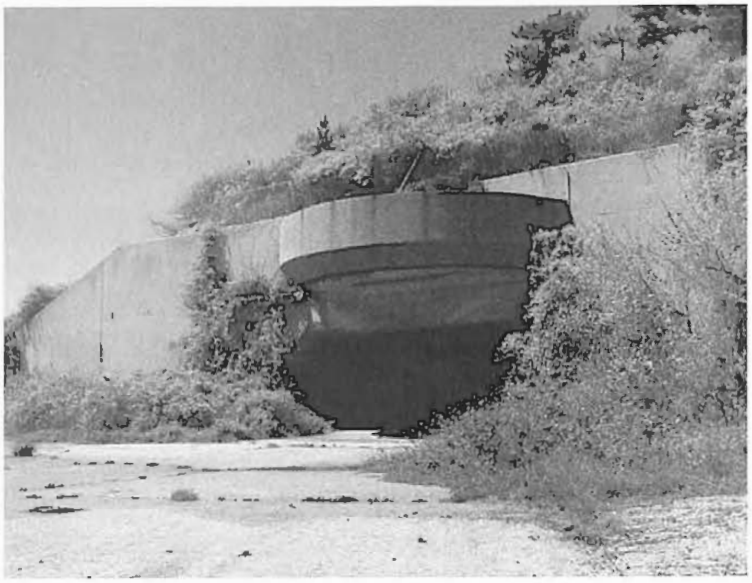

World War II-era concrete casement, now gunless, at Fort Tilden. Dennis Furbush.

FORT WADSWORTH

By Paul J. Bartczak

On the Staten Island side of the Narrows entrance to upper New York Bay, the State of New York constructed two second-system fortifications (the original Forts Richmond and Tompkins) for the War of 1812. They were later transferred to the federal government. In 1847, a third-system fort was started on the site of the second-system Fort Richmond, and its four granite tiers, capable of housing 116 guns, were completed in 1861. This fort was also named Fort Richmond for Richmond County (now the borough of Staten Island). After the Civil War, Fort Richmond was renamed Fort Wadsworth to honor Brigadier Gen. James S. Wadsworth, killed in 1864 during the Wilderness Campaign. In 1902, when the entire reservation was named Fort Wadsworth, the third-system fort was renamed Battery Weed, after Brigadier Gen. Stephen H. Weed, killed at Gettysburg.

In 1861, after the shattering power of modern rifled artillery on vertical masonry walls was realized, the seaward side of the second-system Fort Tompkins was modified to include extensive earthworks, more suited to absorbing such powerful shots. Fort Tompkins's land-side defenses were enhanced between 1859 and 1876 by the construction of a 30-foot-high (9.10 m) counterscarp which faced the fort's scarp, creating a 30-foot-wide dry moat. Galleries with gun slots in their walls, located within the scarp and counterscarp, permitted soldiers inside the fort to create a deadly crossfire in the dry moat.

The Fort Wadsworth complex also includes a number of structures from the Endicott Period, including gun and mortar batteries, and structures associated with other defensive measures such a mines (referred to as "torpedoes" in the nineteenth century). ■

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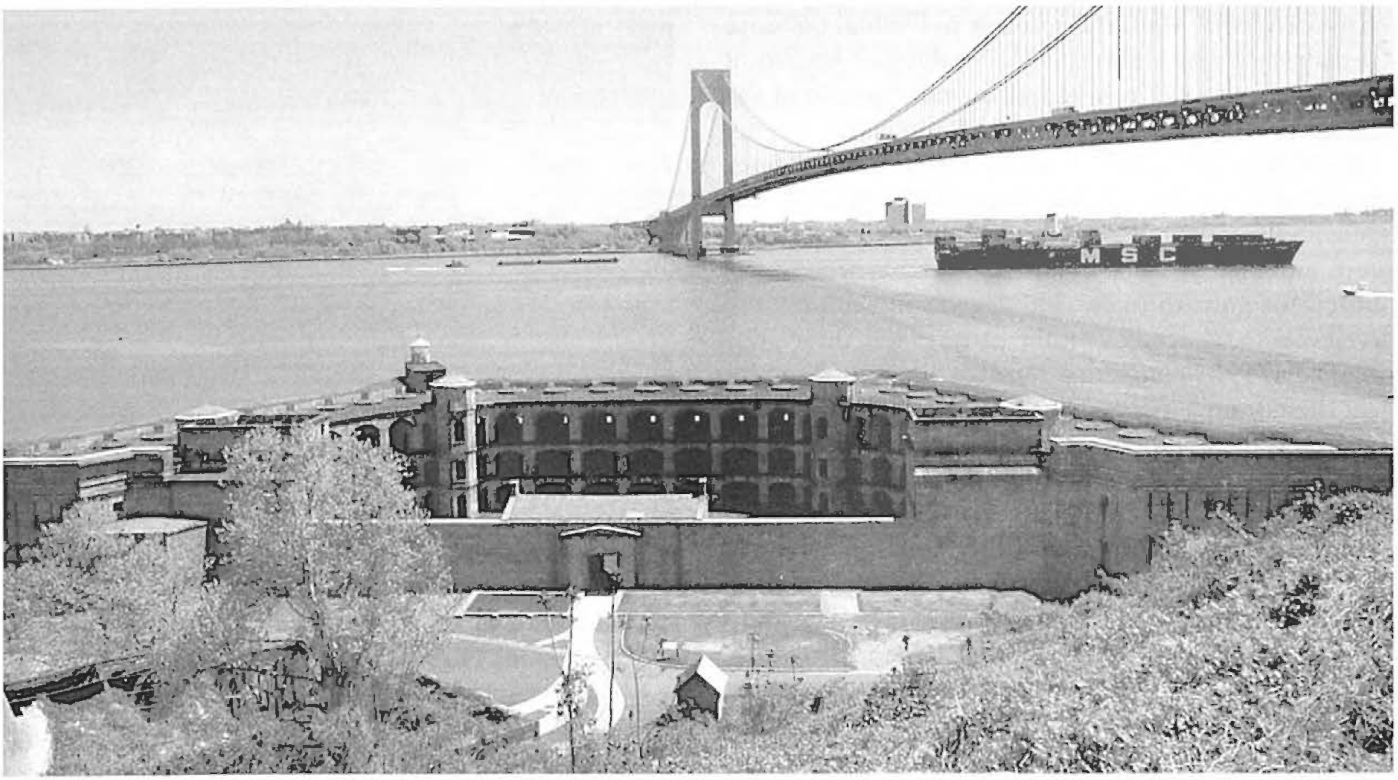


Fort Wadsworth on Staten Island and the Verrazano-Narrows Bridge. Nick Malter.

CONEY ISLAND NEW YORK'S PERMANENT WORLD'S FAIR

By John B. Manbeck

Coney Island began as a tourist attraction for lovers of fresh fish, grew into a sportsmen's Valhalla, developed into a bathing resort and, finally, transformed itself into an amusement Mecca, adapting the best attractions from American World's Fairs. As such, publicists touted Coney Island as a permanent world's fair.

The first American world's fair, New York's "Crystal Palace" exhibition on 42nd Street, set the trend by introducing technical and industrial novelties to the public. After the Civil War, inventors, developers, and entrepreneurs sought showplaces in which to demonstrate their creations. By the 1870s, railroads had started to crisscross the nation, and in Brooklyn, the Great Bridge was under construction. Efforts to pull the divided country together materialized in Philadelphia's Centennial Fair in 1876, celebrating our united heritage.

Among the most touted and popular exhibits in Philadelphia was the new Corliss dynamo, demonstrating the power of American ingenuity and male inventiveness. (In actuality, the Women's Pavilion housed a smaller but more effective dynamo built by a female.) But power and machinery became the motif for this exposition. Among the inventions displayed were the telephone, the ice cream cone, and the safety bicycle.

Around the fairgrounds ran the Primordial Railway, later known as a monorail. The inventor of the crosscut saw exhibited at the fair, but seemed more interested in the railway. Near him, new seamless stockings, the talk of the fashion world, were demonstrated at a booth. And above the Fairmont Park fairgrounds rose the Sawyer Observation Tower, a 300-foot (91.4 m) Erector set.

According to the international rules, world expositions were destined to be temporary: six months' duration. But several entrepreneurs saw that their longevity could be preserved in the wilderness of Coney Island. The man who designed the crosscut saw, E. Moody Boynton, impressed by Philadelphia's transit system, developed a staggered seating rail car with a single set of wheels. He opened the elevated Boynton Bicycle Railway from New Utrecht to Coney Island, which ran between 1890 and 1892. He claimed it could run up to 100 miles per hour (160 km/h), the first year under steam, the second by electricity.

Andrew Culver, a Brooklyn railroad man, visited Philadelphia and bid for the Sawyer Tower as an attraction for his terminus and hotel in Coney Island. Transferred in 1882, it was renamed the Iron Tower and featured two steam-powered Otis elevators to whisk visitors up 300 feet (91.4 m) above sea level. The Brooklyn Bridge opened a year later but its towers were only 274 feet (83.5 m).

Surf Avenue was macadamized, becoming the main drive through the heart of Coney Island. Photographs of the island – it was an island at the time – and its adjoining communities were taken from the tower. To the east, one could see posh Manhattan Beach, with the narrow-gauge Marine Railway from the Philadelphia fair running down to Orient Point. In the other direction lay Sea Lion Park (opened in 1895) and Steeplechase (1897).

Steeplechase owner George Tilyou, who later purchased the Iron Tower for his advertising, roamed the world seeking new rides and thrills. From England came the park's namesake ride, with wooden horses that simulated a horseback ride over fields and meadows, but with two riders mounted on each horse.

Next, Tilyou honeymooned in Chicago, just in time for the Columbian Exposition, but a year late for Columbus' anniversary. He marveled at the gigantic Observation Wheel invented by George Washington Ferris. He wanted it. But it had been promised to the St. Louis Centennial. He could, however, buy a smaller version, which he did.

Tilyou then traveled to Buffalo for its Pan-American Exposition in 1901. There he met Thompson and Dundy, two Midwesterners who had developed a twin carousel ride called Giant See Saw and a "rocket" ride to the moon. He lured both to Coney Island, along with their creations.

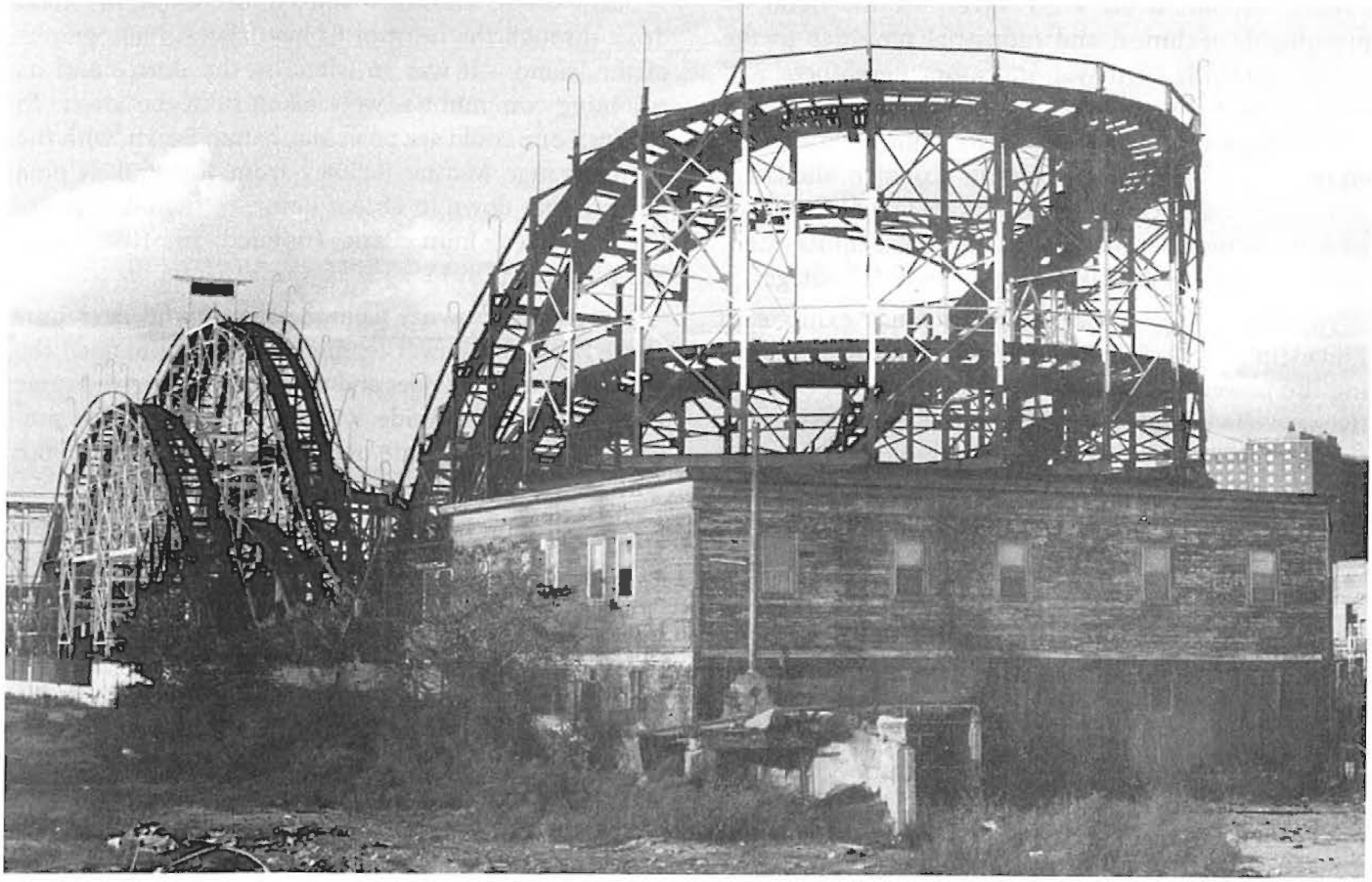
Other Chicago attractions came to Coney Island: the Ice World ride, which lasted one hot season, and belly-dancing Little Egypt, a torrid attraction of the day. The St. Louis Exposition's Kaleidoscope Tower came to the newly opened Luna Park, which Thompson and Dundy started during their second Coney Island residency.

The following year, Dreamland materialized with

The Creation, a giant semi-clad statue of Eve outside a Biblical cyclorama, direct from St. Louis. Dreamland's owner, William Reynolds, also brought the Santos Dumont Airship, and hired its famous pilot to demonstrate the wonders of air travel.

The next international fair, the Panama-California Exposition in San Diego, reversed Coney Island's acquisitive streak by taking Fred Thompson from Luna Park for its designer and architect. Chicago's 1933 Fair contributed Bob's Tornado roller coaster, but San Francisco's 1939 Exposition was largely ignored, probably because of the East Coast competition: that same year, the New York World's Fair came to Queens.

From this local exposition, the Tilyou family acquired the Plane-O-Rama ride and the coup, the Lifesaver Parachute Jump. This landmark of contemporary Coney Island still stands, although its machinery has been dismantled. Rising above the old Steeplechase grounds now occupied by Keyspan Stadium and the Cyclones baseball team, it remains a monument to American ingenuity and the mechanical genius behind amusement technology. ■



The 1926 "woody" rollercoaster Thunderbolt. Now the site of Keyspan Energy Ballpark. The builder and, later, his son lived in the house under the framework. Dave Markowitz.

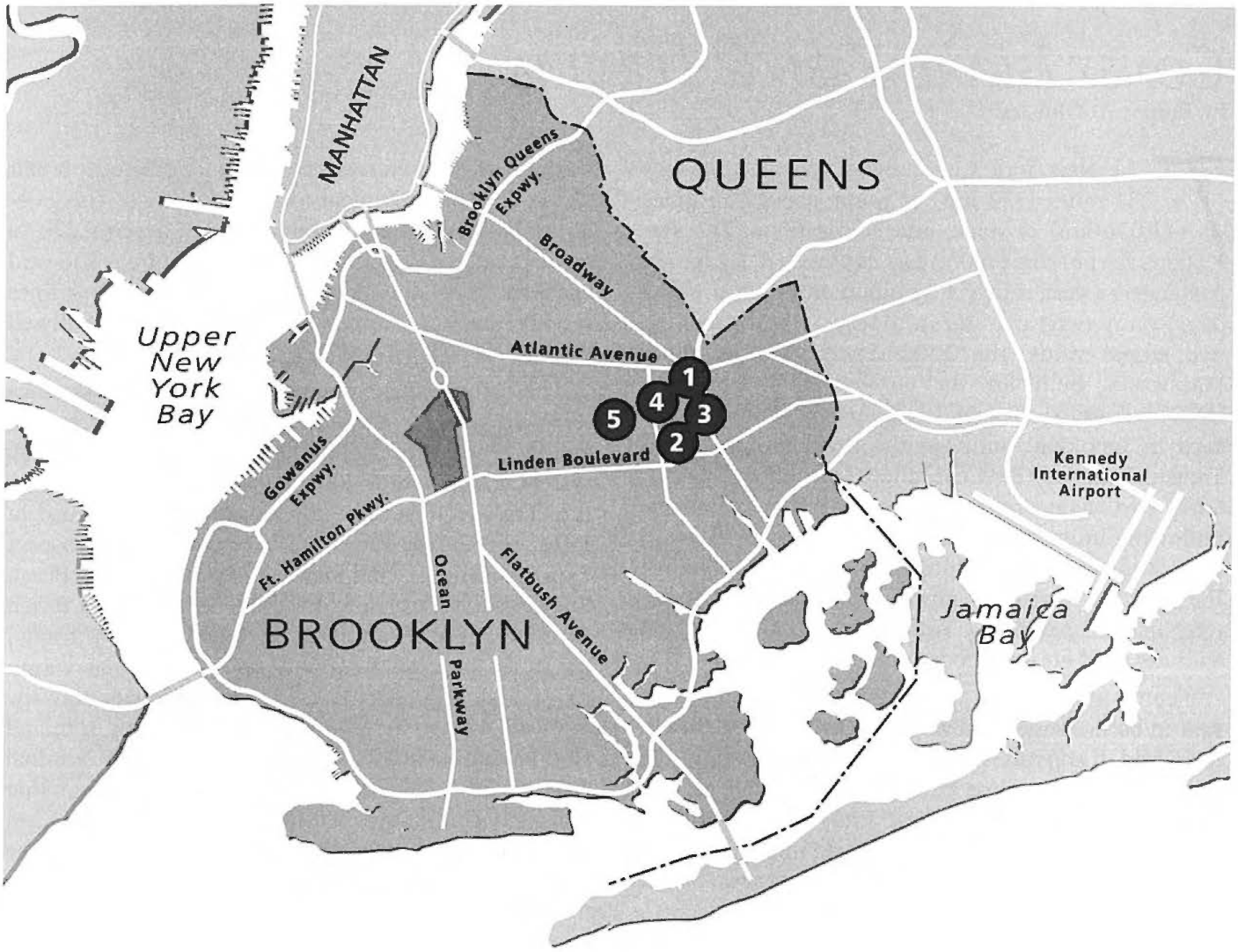
CONEY ISLAND YARD & TERMINAL

By Robert A. Olmsted

The New York City subway system comprises 231 miles (372 km) of route, about 656 miles (1,056 km) of track, and 468 stations. The system's fleet of some 6,000 cars carries over 1.4 billion passengers a year, nearly 4.6 million on a typical weekday. Twenty-two yards store and service these cars. The two largest yards, the 207th Street Yard in upper Manhattan, built for the city-owned Independent (IND) subway system in 1932, and the Coney Island Yard in Brooklyn, built for the Brooklyn-Manhattan Transit Company (BMT) around 1926, contain the system's two major repair and car overhaul facilities. Following unification of the city's subway systems in 1940 and the physical integration of the compatible IND and BMT systems (routes now designated by letters) in the post-World War II era, the Coney Island Yard assumed greater importance.

The 60-acre (24 ha) Coney Island Yard complex is said to be the largest subway yard and shop facility in the world. It consists of three storage yards: the Avenue X Yard for Culver line trains, and the Stillwell and Coney Island yards for West End, Sea Beach, and Brighton line trains. The complex also includes a main overhaul shop, car inspection sheds or "barns," a car wash, signal towers, electrical and traction repair shops, and an assortment of other facilities. The gatehouse on MacDonald Avenue has been described as "a rare example of eclectic cottage architecture." The yard has direct track connections with all four subway lines serving the huge Coney Island Terminal at Stillwell Avenue.

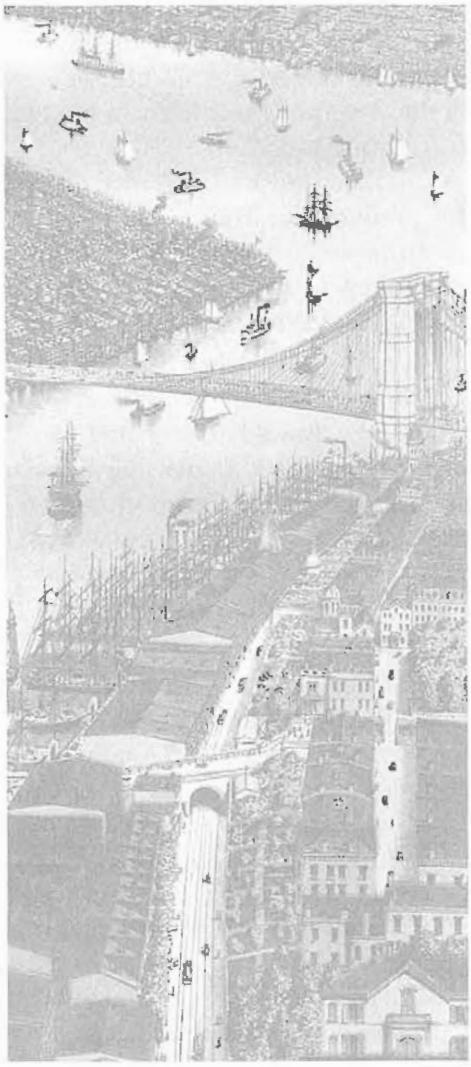
These four lines originally were built as surface steam railroads to the seashore and later were rebuilt and incorporated into Brooklyn's elevated and subway system. The Brighton Line (today's Q trains) began as the Brooklyn, Flatbush, and Coney Island Railroad in 1878. The Culver line (F trains) began as the Prospect Park and Coney Island Railroad in 1875. The Sea Beach line (N trains) began as the New York and Sea Beach Railroad in 1879, and the West End line (W trains) began as the Brooklyn, Bath, and Coney Island Railroad in 1864. All four lines were consolidated into the Stillwell Avenue Terminal (on the West End terminal site) beginning in 1918. The Stillwell Avenue Terminal is currently undergoing a major reconstruction that will include a unique 300-foot-long (91 m) train shed incorporating photovoltaic cells to supply some of the terminal's power needs. ■



East New York

Broadway Junction – Broadway & Fulton Street	**1**
Adriatic Wood Products – 1994 Pitkin Avenue	**2**
Renaissance Wood Products – 21 Snediker Avenue	**3**
Fabricon – 140 Hinsdale Street	**4**
Legion Lighting – 221 Glenmore Avenue	**5**
Bagels by Bell – 10013 Foster Avenue	**6**

CHAPTER FIVE
EAST NEW YORK



INTRODUCTION

By Mary Habstritt

East New York has had little manufacturing throughout its history. In 1860, its population of one thousand was almost entirely farmers and hired hands. Most businesses in the nineteenth century were part of the hospitality industry or supported the agriculture of the area. Roadhouses, taverns, and livery stables were established along Jamaica Avenue, originally the Plank Road, to serve travelers on their way to the Queens racetracks, or, later, to visit the many nearby cemeteries. Reflecting the change in clientele, a hotel opened in the 1870s as the Aqueduct Hotel (near Aqueduct Racetrack) changed its name to the National Hotel when the National Cemetery opened.

There was the occasional factory and there were always small craft operations. Developer John Pitkin opened a shoe factory in 1835, but further such development was stymied by the economic downturn in 1837. A number of breweries existed in the area, but only one was left by 1948. There were many wagon makers, wheelwrights, and harness makers; a number of undertakers; quite a few stonecutters; and at least one tinsmith, cigar maker, and gold beater. Swill-boiling plants collected refuse from hotels in Manhattan, boiled it, and sold it to feed cattle and hogs. At least four saw or molding mills existed over time, including one at the corner of Pitkin Avenue and Junius Street in the 1870s.

After annexation by Brooklyn in 1886 and consolidation with New York City in 1898 accelerated the extension of the transportation network to outlying areas such as East New York, the area boomed with residential development. By the 1930s, it was home to enclaves of European immigrants who had escaped overcrowded conditions in Manhattan. The southern portion of the area held farms through the 1950s. By the 1960s, suburban flight took hold with a vengeance and East New York saw a population turnover of 80 percent. By 1970, between 25 and 50 percent of its residents were receiving public assistance, corruption in the U.S. Department of Housing and Urban Development left buildings abandoned, and crime spiraled out of control. In the late 1970s, a vigorous campaign to revitalize the area was begun. The 77-acre (31 ha) East Brooklyn Industrial Park was created in 1980 to bring much-needed jobs and manufacturing activity to the neighborhood. ■

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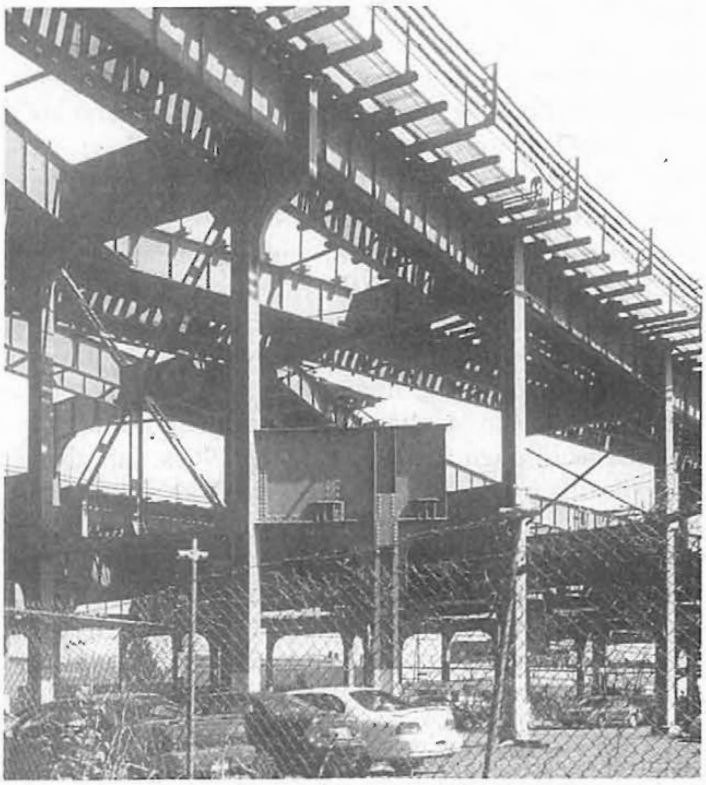
BROADWAY JUNCTION

By Robert A. Olmsted

What is probably the world's most complex elevated railroad interchange overwhelms the East New York section of Brooklyn. Three elevated lines ("els") originally crossed here: the Broadway-Jamaica el (today's J and Z trains), the Canarsie el (L train), and the Fulton Street el (A train, moved underground in 1946). Track connections to an adjacent yard further complicate the layout. It was an amazing engineering feat because what exists today replaced an earlier single-level intersection called Manhattan Junction between 1916 and 1918 while trains continued to run. The massive escalator enclosure opened in 1948 to provide a free transfer with the new Fulton Street subway. The elevated complex, renamed Broadway Junction, is presently being renovated again. The three el lines have a long history.

The Broadway el reached East New York in 1885 as an extension of Brooklyn's first el, the Lexington Avenue line (which closed in 1950, and is not to be mistaken for Manhattan's Lexington Avenue subway). In 1888, the Broadway el was extended west to a ferry on the East River, and in 1908, was extended again over the Williamsburg Bridge to Manhattan. In 1916, the Broadway el and Manhattan Junction were completely rebuilt, under operation, for heavier subway cars. Portions of the el around Van Siclen Avenue (including the venerable station head house and latticed columns), however, retain their 1880s appearance. Interestingly, J and Z trains on their run from Broad Street to Jamaica Center use structures originally built over an entire century: in sequence, 1931, 1913, 1908, 1888, 1885, 1893, 1917, 1918, and 1988! That's versatility!



The Canarsie and Broadway-Jamaica elevated lines converge in East New York. Gerald Weinstein, Photo Recording Associates.

The Fulton Street el reached East New York from Fulton Ferry on the East River in 1888, and was extended eastward to the Brooklyn city line (an area still called City Line) by 1893. It met the Broadway el at Manhattan Junction. Fulton Street el service was discontinued in stages between 1940 and 1956, but structural vestiges still exist in the East New York junction. The 1915 elevated extension to Lefferts Boulevard is still used by A trains.

The Canarsie line began as the Brooklyn, Canarsie, and Rockaway Beach Railroad, which opened in 1865 as a surface steam railroad. It originally ran from the Long Island Rail Road's East New York station to Canarsie Landing, where passengers could continue by boat across Jamaica Bay to Rockaway Beach, then a fashionable resort. By 1906, it became part of the Brooklyn Rapid Transit (BRT) Company's elevated system, and the tracks were electrified and raised to connect with other elevated lines at Manhattan Junction. The southern section to Canarsie became a streetcar operation.

The final link at Broadway Junction was added in 1928, carrying the Canarsie line high over the entire complex to connect with the new 14th Street subway (today's L train). The 14th Street-Canarsie line is in the process of becoming the subway's most modern line, the first to get a new high-tech computerized communication-based train control (CBTC) system and the newest subway cars (R143 class). As part of that project, a section of the elevated interchange is now being reconfigured to allow the removal of redundant structures left over from the Fulton Street el.

The Long Island Rail Road's Atlantic and Bay Ridge branches also pass through East New York. ■

ADRIATIC WOOD PRODUCTS

By Mary Habstritt

Founded in 1982 by Croatian immigrants Tony Grbic and his wife Miljerika, Adriatic Wood Products specializes in wood moldings and other carved wood components. Tony, who came to the United States in 1970, is a third-generation woodworker and worked as a plant manager for a lumber mill in Brooklyn for eleven years before starting his own business. Their son, John, has since joined them in managing the company.

Beginning with wholesaling to cabinetmakers, architects, and contractors specializing in restoration projects, the company has since moved into the retail arena, marketing its products through home improvement centers. The company manufactures all kinds of moldings, both machine-made and hand-carved, for use in furniture, picture frames, and store fixtures. Its custom carvings can be seen in such luxury Manhattan hotels as the Essex House, the Ritz-Carlton, and the Plaza.

Originally located in a 12,000-square-foot (1,115 m²) plant at 675 Berriman Street, further south and east in East New York, the company moved to its current location in 1989 as the business expanded. In 2000, the company purchased the building next door and almost doubled its space to nearly 90,000 square feet (8,360 m²). ■

Adriatic Wood Products' recently remodeled building on Pitkin Avenue. Gerald Weinstein, Photo Recording Associates.

RENAISSANCE WOOD PRODUCTS

By Mary Habstritt

Renaissance Wood Products was founded in 1982 in the Williamsburg neighborhood of Brooklyn by Gaspare di Stefano and Francesco Viterbo, both originally from Italy. The company moved to East New York in 1998 in order to gain more manufacturing space. The current plant encloses 21,000 square feet (1,950 m²), more than double the space occupied previously. It consists of two buildings, one built in the 1950s, and the other in the 1960s. The previous occupant was a manufacturer of steel turnstiles.

This custom woodworking shop produces armoires and other cabinetry as well as frames for upholstered sofas and chairs, usually working with interior designers. Wood turning and both machine and hand carving are performed by ten to twenty employees. The partners split supervision of the operation with di Stefano, trained in the craft in Italy, overseeing the handwork, and Viterbo running the machine end of production.

The location of Renaissance Wood Products here is part of a recent effort to bring manufacturing to the area. The company is one of about a hundred located within the 77-acre (31 ha) East Brooklyn Industrial Park, one of eight neighborhood industrial parks administered by the New York City Economic Development Corporation (EDC). EDC offers various financial incentives to businesses that locate within park boundaries. ■

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Renaissance Wood Products in the shadow of the Canarsie el. Gerald Weinstein, Photo Recording Associates.

FABRICON

By Mary Habstritt

Marvin Sylvor founded Fabricon in 1983, after a career in window display and decorating took a turn toward carousels. He was working for the Manhattan Mall on Herald Square, helping to decorate each floor to represent a different New York neighborhood, when it occurred to someone that the Central Park floor should have a carousel. So he built one with the help of a couple of old carousel makers. Then South Street Seaport asked for one and the business was born.

The company's first job was to restore a very rare 1910 carousel in Queens's Forest Park. Its wooden figures were created by Daniel Muller & Brother, a company in business from 1903 to 1917 that built only twelve carousels. Daniel Muller is the only classically trained sculptor to have created carousels and the one in Queens is one of only two he designed that survive intact.

Fabricon has re-designed and updated the basic carousel operating machinery, little changed since the nineteenth century, to reduce maintenance. The mechanism, nicknamed "The Muscle," uses an electric drive with self-lubricating factory-sealed bearings made with UHMW, a low-friction polymer. Electronic controllers and mini-motors drive the horses.

Fabricon is the only one of perhaps six U.S. carousel makers doing custom work. Its "horses" may be giraffes, lions, rabbits, or even rabbis. The company's sixty-one carousels built to date are installed all over the world, with locations including São Paulo, Hong Kong, Auckland, New Zealand, and Riyadh, Saudi Arabia. Currently, the company is creating a carousel for Bryant Park, adjacent to the grand New York Public Library, in Manhattan. To match the park's French style, the carousel uses a floral theme, enriching each figure with elaborate trappings of tulips, roses, and dahlias that take three to five days to paint.

The company carries on a Brooklyn tradition of carousel carving. From 1880 to 1930, a host of wood carvers developed the glitzy Coney Island style, characterized by mirrors and flamboyant horses bedecked in jewels and gold and silver leaf. In addition to custom work, Fabricon will make standard carousels from vintage Coney Island, Philadelphia, or Country Fair designs.

The 17,500-square-foot (1625 m^2) plant in East New York has space for the assembly of a carousel as big as sixty feet (18 m) in diameter. Space, and economic incentives to bring jobs to the community, are reasons why the company re-located to the neighborhood industrial park from Middle Village, Queens, in 1998. The two-story building was formerly occupied by a clothes rack manufacturer. ■

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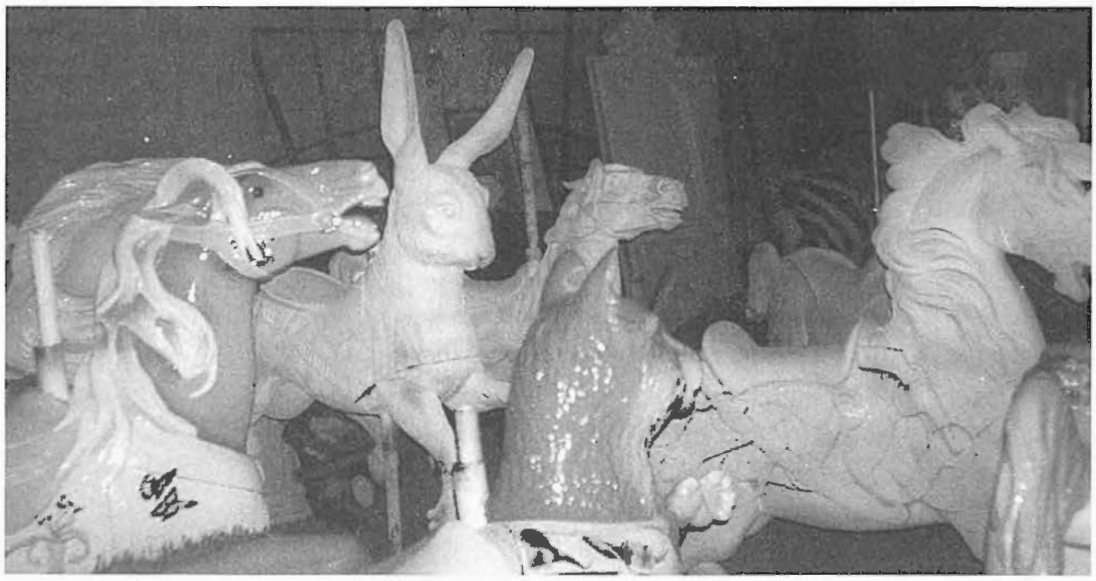

Painted and unpainted "ponies" in the Fabricon shop. Katherine Bartczak.

LEGION LIGHTING

By Mary Habstritt

James "J. B." Bellovin began Legion Lighting in 1946 to make fluorescent lighting fixtures. He had designed and manufactured lighting equipment for the armed forces during World War II. The fluorescent lighting industry was young then and the firm grew quickly with it, moving to its current 50,000-square-foot (4,600 m²) facility in 1957. J. B.'s son, Sheldon, followed his father into the business and now shares supervision of the operation with his sons, Evan and Michael.

The fluorescent fixtures are cut from sheet steel using a computerized stamping machine and then go through bending, forming, and welding steps. They are painted in a fully automated powder-coating process. The assembly line was eliminated some years ago and each fixture is now assembled from beginning to end by the same employee. The monotony of the old assembly line method resulted in lack of attention and the assembler had no reason to take pride in the work. The company has found that the new method greatly reduces the number of defective fixtures. ■

Legion Lighting on Glenmore Avenue. Gerald Weinstein, Photo Recording Associates.

BAGELS BY BELL

By Mary Habstritt

Bagels by Bell was founded in 1947, when Martin Bell took over a small neighborhood bakery. It grew from a basement in Borough Park and moved to several small storefronts. Until recently called Bell Bagel and Bialy, the company moved from its location at Flatlands Avenue and East 81st Street, also in Canarsie, six years ago in order to expand production. The current building, formerly used by a steel fabricator, is twenty-five years old and covers 10,000 square feet (930 m^2). The company has been managed by Martin's son, Warren, for the last twenty years and has grown sevenfold since its founding.

If you purchase a bialy in an East Coast supermarket, it probably came from Bell. A bialy is flatter than a bagel and hole-less. Unlike a bagel, it is not boiled before baking. Made with high-gluten flour, water, yeast and salt, the depression in the center is filled with diced onions and a sprinkle of poppy seeds. The texture is somewhat like Italian focaccia, but its name reflects its eastern European origin in Bialystok, Poland. Along with bagels and bialys, Bell makes pletzel, a Jewish flatbread of a cracker-like consistency.

Until 1998, Bell's baked goods were marketed only to stores on the East Coast and were made with the recipes that the family has used for fifty years. Then Warren met a Japanese distributor at a trade show sponsored by the Brooklyn Chamber of Commerce's Brooklyn Goes Global program, which helps Brooklyn manufacturers reach broader markets. He set out to create a bialy that would appeal to the Japanese proclivity for sweets, but was more successful in adapting the bagel recipe. It was re-engineered by adding chocolate chips, peanut butter, and such flavorings as apple-cinnamon, blueberry, and curry. Twelve flavors have been developed in all.

The specialty bagels, sold only in Japan under the brand name Bagel K, have been flying out of the freezer cases. The company has had to double its freezer space and hire additional employees to keep up with demand. In 2000, the factory was turning out two thousand bialys and thirty-six thousand bagels a day. ■

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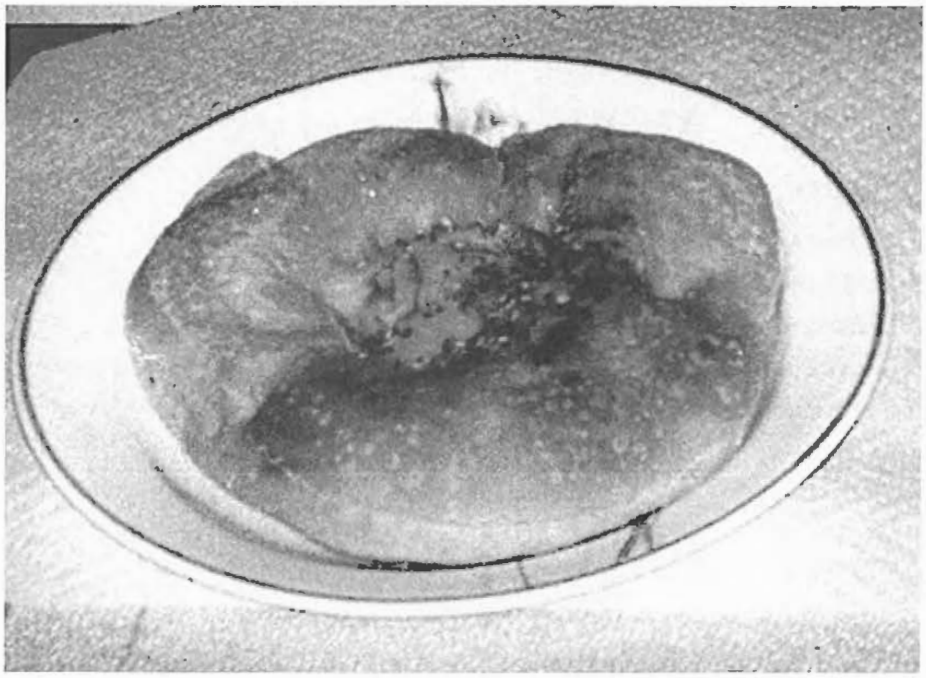
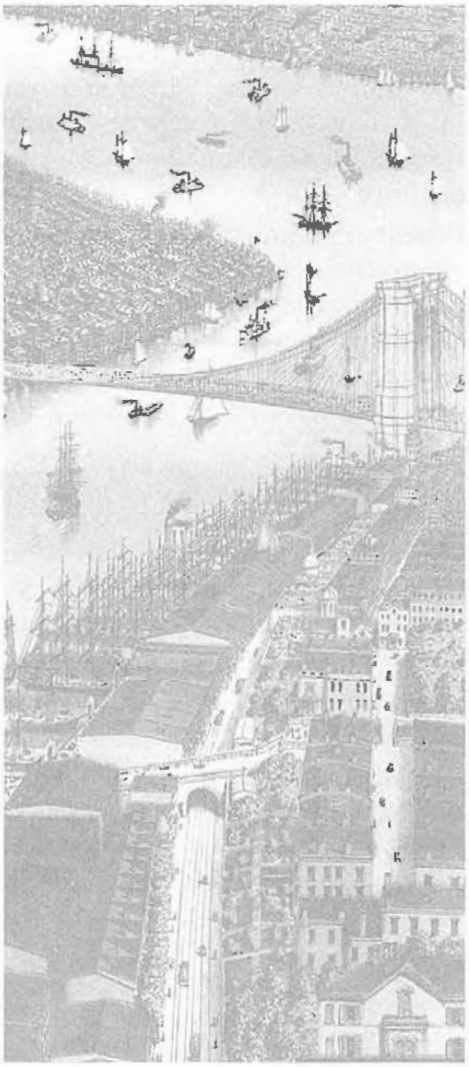


So, this is a bialy. Katherine Bartczak.

North Brooklyn

Brooklyn Navy Yard – Flushing Avenue & Clinton Avenue	**1**
Pfizer, Inc. – 630 Flushing Avenue	**2**
Domino Sugar – 266 Kent Avenue	**3**
Williamsburg Bridge – Spanning East River	**4**
Highways of the Robert Moses Era – Gowanus & Brooklyn-Queens Expressways	**5**
Pulaski Bridge over Newtown Creek – McGuinness Boulevard	**6**

CHAPTER SIX
NORTH BROOKLYN



INTRODUCTION: WILLIAMSBURG & GREENPOINT

By Justin M. Spivey

Brooklyn's northern waterfront, between the Navy Yard in Wallabout Bay and Newtown Creek at the Queens border, historically has been home to some of its heaviest industries. Smokestacks can still be seen among the church steeples and bank domes that define the northern Brooklyn skyline. In the early nineteenth century, long before municipal consolidation, it consisted of separate villages and cities. Three of these – Bushwick, Williamsburg, and Greenpoint – became known as the Eastern District upon their annexation to the city of Brooklyn in 1855. Whereas downtown Brooklyn is located southeast of lower Manhattan, this district lies directly east. Ferries crossing the East River served each separately, so their early development occurred somewhat independently. Downtown had its own complement of manufacturing, but given its greater proximity to New York Harbor, concentrated on terminal and warehouse facilities. Northern Brooklyn, on the other hand, was home to what historians Joshua Brown and David Ment called the "five black arts": glassblowing, metalworking, pottery, printing, and refining.

Bushwick was one of the original Dutch settlements on Long Island, dating to the early seventeenth century. The portion closest to the river, still called Williamsburg, became an independent village in 1827. It takes its name from Jonathan Williams, the surveyor who laid out a town site for ferry operator Richard M. Woodhull in 1800. Greenpoint grew up along the Ravenswood, Green Point, and Hallett's Cove Turnpike established by Neziah Bliss in 1838, but did not have ferry service until the following decade. Bushwick Creek once ran between the two villages, but has since been buried beneath McCarren Park, which now forms the neighborhood boundary. During the nineteenth century, Williamsburg grew into a working-class tenement neighborhood just as crowded as the Manhattan's Lower East Side, but its population has declined along with manufacturing activity. Today, the neighborhood is home to a large Hasidic Jewish population, the descendants of Latin Americans who came for manufacturing jobs in the 1950s, and urban professionals commuting into Manhattan. Greenpoint, which began as a mostly English and Irish village, is now New York's most thoroughly Polish neighborhood.

It is difficult to summarize the Eastern District's industrial history in a brief introduction, but the "black arts" categories provide a good framework. Today's Dow-Corning had its beginnings as Brooklyn Flint Glass in 1823, which became Corning Glass when it moved upstate in 1868. Metalworking has had a long history in Williamsburg and Greenpoint, from fabricating the *Monitor* at Continental Iron Works and Bliss's Novelty Iron Works, to casting the Iwo Jima monument for Arlington National Cemetery at Bedi-Rassy foundry. Two Scandinavian stonemasons, Niels Paulson from Denmark and Charles M. Eger from Norway, exploited the decorative potential of cast iron at Hecla Architectural Iron Works (founded 1876 in Williamsburg), named after a volcano in Iceland. Greenpoint was home to several potteries, ranging from short-lived craft operations like Charles Cartlidge & Company (1848-56) to the large, highly mechanized Union Porcelain Works (1861 into the twentieth century). Printers such as David Appleton moved from Manhattan into larger plants across the river.

Refining is perhaps Williamsburg's best-known industry, if only for the enormous Domino Sugar plant that still fills the view from the Williamsburg Bridge. The petroleum refining industry, however, has all but disappeared from the Eastern District. Newtown Creek is considered to be the birthplace of kerosene in 1854. Charles Pratt's Astral Works once occupied the mouth of Bushwick Creek, receiving Pennsylvania crude by barge and then by a pipeline completed in 1879. Two enormous gasholders, imploded in 2001, were part of the Brooklyn Union Gas Company's coal gas works, largest in the world when constructed in the 1920s. Pollution caused by Newtown Creek's many chemical industries captured headlines as early as the 1880s, when a grand jury investigated Peter Cooper's glue factory, and persists even today. Mobil and Amoco are pumping oil from beneath Greenpoint – not from natural deposits, but from a 17-million-gallon (64 million L) spill discovered in 1978.

The late twentieth century has seen a transition from large-scale manufacturers to smaller industries located in the buildings they left behind. One notable resurgent is the Brooklyn Brewery, which in 1992 remodeled an old foundry to make the first beer in Brooklyn since F. & M. Schaefer closed its Williamsburg plant two decades earlier. ■

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BROOKLYN NAVY YARD
(NEW YORK NAVAL SHIP YARD)

By Thomas Flagg

This shipyard is Brooklyn's oldest operating industry; ships are still repaired here. It started as a private shipyard in the 1790s, building one frigate for the Navy in a section of Wallabout Bay. The bay is a large indentation off the East River south and west of what later became the Williamsburg area. Seeking its own shipyard, the U.S. Navy acquired the 42-acre (17 ha) facility in 1801. Living quarters were soon added, including the Commandant's House (1806), the design of which has been attributed to Charles Bulfinch. The Navy added land over the years to accommodate a growing number and variety of facilities, including a naval hospital. As a result, the shipyard grew to occupy the entire perimeter of Wallabout Bay.

The yard's Dry Dock No. 1 (Dock Street at the foot of Third Street) was built between 1841 and 1851, with William J. McAlpine as engineer. Its granite walls had great foundation trouble, as they were built on mud with bedrock being far below. Despite initial difficulties, the dry dock was considered a wonder of its age and attained a glorious record serving such ships as the ironclad *Monitor* and the frigate *Niagara*. (The latter vessel laid the first transatlantic cable.) Originally it required four hours to pump the water out of this dry dock, using a condensing engine with a 50-inch cylinder, 12-foot stroke, and 32-foot beam (1.3 m cylinder, 3.7 m stroke, and 9.8 m beam). The engine worked two pumps of 8-foot (2.4 m) stroke and 63 inches (1.6 m) diameter, one at each end of the beam.

During the Civil War, the number of workers here was 6,000; during World War I it was 18,000; and in 1944 there were 71,000 men and women working here. The shipyard by then included six dry docks, two building ways, eight piers, 270 buildings, 19 miles (31 km) of streets, and 30 miles (48 km) of railroad track. The Navy Yard's tracks were reached only by carfloat, as they were not connected by land to any other railroad. Some of the most famous vessels built at the yard were the battleships *Maine* (1895), *Arizona* (1916), *Iowa* (1943), and *Missouri* (1944).

The yard continued to serve during the Korean War, but after 1960 shipbuilding operations were shifted to southern ports. Most of the yard was decommissioned by the U.S. Navy in 1966. The city subsequently took over 255 acres (103 ha) for redevelopment as an industrial park, supervised by a community group called CLICK. CLICK in turn leased space to thirty-five tenants, of which the largest three were Seatrain Ship Building Company, Coastal Dry Dock & Repair (servicing mainly U.S. Navy ships), and Marsel Mirror, Inc. ■

The empty basin of the Navy Yard"s Dry Dock No. 4. John Bartelstone.

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PFIZER, INC.

By Terry L. Bailey

Cousins Charles Pfizer and Charles Erhart emigrated from Ludwigsburg, Germany, in the mid-1840s. In 1849, they founded Charles Pfizer & Company in Williamsburg, with the strategy of making medicinal chemicals not being produced in the United States. Their first success was to develop a palatable form of an anti-parasitic drug called Santonin. Within ten years, the company was manufacturing more than a dozen other chemicals and medicinals including borax, camphor, tartaric acid, cream of tartar, and iodine.

One of the company's most successful early products was citric acid, which is used for medical purposes, as well as in cleaning fluids, foods, and soft drinks. Pfizer originally made it from limes and lemons imported from Italy, where political instability and weather made output unpredictable and prices volatile. In 1919, the company pioneered mass production of citric acid by a fermentation process, which freed the company from fluctuating prices.

In 1928, the British bacteriologist Alexander Fleming discovered penicillin, but it was scarce and hard to make. Amidst the German Blitz of Britain, Winston Churchill asked President Roosevelt for American know-how in mastering this miracle drug. Several companies went to work on the project, but Pfizer's experience with fermentation processes proved key in developing mass production of the drug.

The Pfizer factory on Flushing Avenue. Gerald Weinstein, Photo Recording Associates.

The government recognized the superiority of the Pfizer process and, desperate for massive quantities of penicillin for the war effort, authorized nineteen companies to produce the antibiotic using the process developed by Pfizer. Despite access to Pfizer's technology, 90 percent of the penicillin that went ashore with the troops on D-Day was made by Pfizer, and this marked Pfizer's first major pharmaceutical success.

Over the last fifty years, Pfizer has grown into the largest pharmaceutical company in the world, with a host of widely recognized drugs including Terramycin, Norvasc, Diflucan, Zyrtec, Zoloft, Lipitor, Aricept, Celebrex, and Viagra. In 2000, the company merged with Warner Lambert. Pfizer is headquartered in Manhattan but has facilities all around the globe and its products are available in 150 countries, with 45 percent of sales abroad. Last year the company had revenues of $32 billion and a research and development budget of $4.7 billion.

The Brooklyn facility produces a broad range of prescription pharmaceutical products including Cardura XL, Glucotrol XL, Viagra, Zithromax, Zoloft, and Zyrtec. The facility's products are used to treat illnesses including depression, arthritis, bacterial and fungal infections, allergies, and hypertension. The plant produces more than two billion tablets and capsules, more than fifty million blister packages, and more than fifty million bottles each year. The facility is classified as a drug product plant, or dosage form plant, because it formulates active ingredients into dosage forms, including tablets, capsules, oral suspensions, powders, syrups, ingestible solutions, and ointments. Another large segment of the operation is devoted to product packaging. In this area, bulk dosage forms are put into containers, labeled and packaged, ready for distribution to customers. ■

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DOMINO SUGAR

By Conrad Milster

Brooklyn has a long connection with the sugar industry, its first refineries being started in the 1850s. Today, like brewing, all of the smaller plants have vanished, but unlike brewing, one major plant still processes sugar on the waterfront: Domino Sugar Corporation.

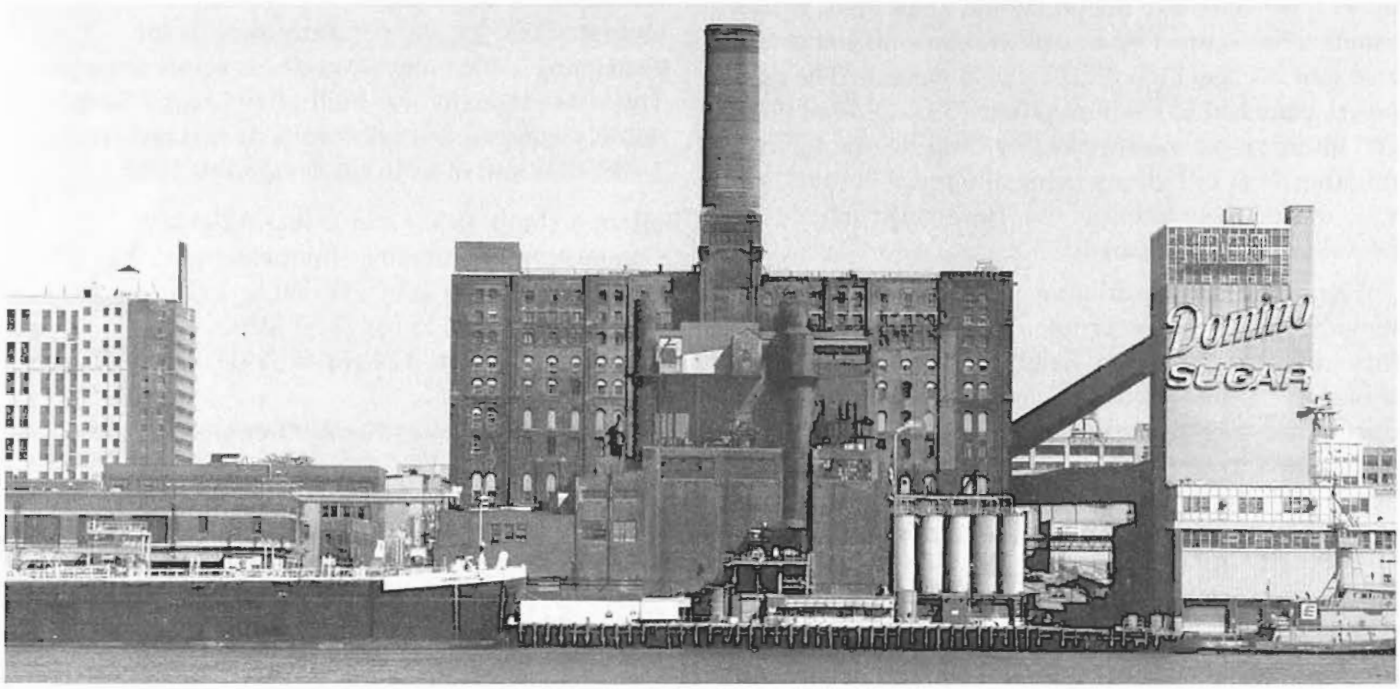
The company can trace its origins back to the early nineteenth century. William Havemeyer and Frederick Christian Havemeyer came to New York in 1799 and 1802 respectively. In 1807, they built a small refinery on Vandam Street in Manhattan. After several changes of management and structural enlargements, John C. Havemeyer, in partnership with Charles E. Bertrand, built an entirely new plant in 1856. They chose a waterfront location on First (now Kent) Avenue in Williamsburg, which only one year prior had been annexed to Brooklyn.

The company's history is a record of continuous change, as it combined with other refiners, bought them out, was bought in turn, and demolished and constructed buildings as the refining process became more efficient. This continued until as late as 1988, when the company was taken over by Tate & Lyle, who reinstated the Domino name. Domino was sold to the current owner, the Fanjul family's Florida Crystals, in 2001.

The early refining and packaging process was apparently quite labor-intensive. In 1882, when a fire destroyed the original complex, it was stated that the refining plant alone employed 1,200 men and had an output of 4,000 barrels of sugar per day. The company's total employment was given as 2,500 to 3,000 men. The plant, like many other New York industries, tapped the huge body of newly arrived immigrants settling in the fast-growing city of Brooklyn for its labor force. Several articles about the plant described the workers as German, Low Dutch, Polish, and Hungarian.

Working conditions in parts of the plant, especially the sugar boiling and drying rooms, were apparently quite appalling even for the Victorian period. In 1894, during an intense heat wave, the New York Herald Tribune reported that up to two hundred cases of heat prostration were occurring daily. The statistic's validity is hard to assess, given that physicians had been brought on site to eliminate the frequent and visible visits of ambulances, and that all of the reporter's attempts to enter the plant were rebuffed.

Secrecy was apparently not an unusual situation, for



The Domino Sugar refinery, with its distinctive oval smokestack. John Bartelstone.

the plant used certain proprietary processes that their competitors would no doubt have liked to observe. As for the heat, however, it was also stated that almost naked men would be seen gasping for air at open windows near the drying and boiling rooms. An 1882 article mentioned that even Havemeyer's daughter was not allowed to visit the plant. After much pleading, she was allowed in, but only after production was shut down and she was guided through areas where employees were decently dressed.

At one point a bar was installed in the plant, and workers could receive beer chits in lieu of some of their salary if they so wished. The chits could be redeemed for up to one "bucket" of beer per two hours. It was apparently sold near cost, with one dollar buying twenty-five chits. No fewer than six men were employed to bring beer to the workers, stringing the pails on poles 5 to 7 feet (1.5 to 2.1 m) long. When the carriers arrived on a floor, they blew a whistle, whereupon the workers would exchange chits for pails.

The 1882 fire did an estimated $1.5 million in damage, but Havemeyer, a typical Victorian industrialist, was drawing up plans for a new, larger plant as the ground was cooling. Completed in 1884, the new building contained the refinery and a filtering house and occupied a plot measuring 250 by 150 feet (76.2 by 45.7 m). Built like the proverbial brick privy, it still stands today, topped by an oval chimney 40 feet at the base and 200 feet high (12.2 by 61.0 meters). The new power plant had 4,000 horsepower (39.2 MW) of boilers. Illumination was supplied by "400 electric lights," no other form of lighting being allowed. The building was considered so fireproof that Havemeyer stated that he did not plan to insure it!

The company's operations were vertically integrated, including at one time or another a 50-mile-long (80 km) railroad, a railroad freight station in Brooklyn served by carfloats, wharves, paper mills and printing operations, special sugar-carrying ships, a cooperage with a capacity of 8,000 barrels per day, and its associated timberlands. A full barrel weighed 350 pounds (160 kg). Another piece of Americana vanished in 1945, when the company, then known as American Sugar, stopped using wooden barrels. The sugar barrel and cracker barrel, once fixtures of every general store, probably were the forums for more political debate and tall story telling than anywhere else.

Little is known about the early power plant equipment. Today, Domino still generates some of its own power, but boiler and electric loads have dropped somewhat as raw sugar has not been refined at the Brooklyn plant since the 1970s. The early stages of refining are carried out in Baltimore and liquid sugar is brought to New York for final processing and packaging. The plant's power requirements are met by three turbine-driven generator sets. ■

TECHNICAL SPECIFICATIONS

Elliott Turbine Model 2 NV-7
Output: 5,000 kW at 3,600 rpm
Steam supply: 400 psi at 650 °F (2.76 MPa at 340 °C) with 20 psi back pressure

Elliott Generator
Output: 6,250 kW, 80 percent power factor
Generating 2400 volts, 60-cycle, three-phase current.
This unit was built in 1959 and installed in 1963.

Westinghouse Turbine
Output: 5,000 kW at 3,600 rpm
Steam supply: 400 psi at 650 °F (2.76 MPa at 340 °C) with 20 psi back pressure

Westinghouse Generator
Output: 5,000 kW, 80 percent power factor
Generating 2,400 volts, 60-cycle, three-phase current.
This unit originally was built in 1959 for a Boston refinery, generating 13,800 volts. It was rewound to 2,400 volts and installed at Domino in 1992.

Boilers A (built 1951) and B (built 1952)
Combustion Engineering Company Model VU-50X
Capacity: 140,000 lb/hr (64,000 kg/hr)
Design Pressure: 525 psi (3.62 MPa)
Operating Pressure: 420 psi at 650 °F (2.90 MPa at 340 °C)
Dual Fuel: Low-sulfur No. 6 oil or gas

Boiler C (built 1984)
Nebraska Boiler Company Type NC-G-87
Capacity: 120,000 lb/hr saturated steam (54,000 kg/hr)
Design Pressure: 300 psi (2.07 MPa)
Operating Pressure: 265 psi (1.83 MPa)
Dual Fuel: Low-sulfur No. 6 oil or gas

WILLIAMSBURG BRIDGE

By Mary E. McCahon

When completed in 1903, the Williamsburg Bridge earned the title of world's longest suspension bridge, being a respectful 4.5 feet (1.4 m) longer than the Brooklyn Bridge, and with a deck half again as wide. It was the first suspension bridge constructed with towers entirely of steel. This was not only intended to speed construction, but also motivated by a requirement for six railway tracks in addition to roadway traffic. (Masonry towers would have resulted in an inordinately wide deck.) A pair of elevated train tracks runs down the center, originally with two-track streetcar lines on either side. The cantilevered outer roadways, which pierce the towers, each carry two lanes of automobile and truck traffic. During the 1920s, the streetcar lines were removed to accommodate four additional lanes of automobile traffic. Pedestrian promenades were located above the center roadway on the west approach, but then split above the streetcar tracks at the west tower.

On the Brooklyn Bridge, the cables support the main span and the side spans, which are roughly half as long. In contrast, the Williamsburg Bridge's cables support only the 1,600-foot (487.7 m) main span over the river, descending directly from the towers to the anchorages without picking up the side spans. Even so, the Williamsburg Bridge's cables support a greater load and are consequently thicker. The four cables are composed of thirty-seven strands each, and each strand has 208 wires of ungalvanized steel. The towers are 350 feet (106.7 m) high. The stiffening trusses, which extend from anchorage to anchorage, are an enormous 40 feet (12.2 m) high. Trussed tower bents support the 600-foot (182.8 m) side spans, originally at their midpoints, and with quarter-point towers added in 1911. The long approaches, originally built-up girders supported on built-up columns, were recently replaced with welded plate girders on reinforced concrete bents.

Residents of Brooklyn's Eastern District discussed plans for a second bridge over the East River, from Grand Street in Manhattan to Broadway in Williamsburg, as early as 1882. A bridge bill authorizing an East River

The Williamsburg Bridge under construction in 1901. From New East River Bridge: Contracts, Plans and Specifications, *1901. Courtesy archiveofindustry.com.*

Bridge Company to build a suspension bridge at Grand Street was passed by the state legislature in 1892, but local politics and competing subway, street, and elevated railway companies thwarted efforts to start construction for five years. In 1897, construction finally began on a design by Leffert Lefferts Buck.

An 1868 graduate of Rensselaer Polytechnic Institute, Buck rehabilitated and strengthened John A. Roebling's 1855 suspension bridge over the Niagara River. In the early 1890s he designed the steel arch bridge to replace Roebling's one-track bridge. Late in 1895, Buck was selected as chief engineer for the new East River bridge. The Williamsburg Bridge was completed in seven years, opening in 1903. It was finished under the direction of Gustav Lindenthal, Bridge Commissioner under Mayor Seth Low, and Lindenthal hired architect Henry Hornbostel to attempt an "aesthetic rehabilitation" of the bridge that has always been criticized for its appearance. Hornbostel is responsible for applied decoration.

The Williamsburg Bridge fulfilled its original purpose as a stronger, cheaper, and more quickly erected alternative to the Brooklyn Bridge, but not without future consequences. To save money, the cables' wires were neither galvanized nor wrapped with soft wire and packed with red lead paste, two common means of preventing corrosion. Instead, the wires were treated with linseed oil, and the cables were wrapped with fabric and covered with a thin steel shell. Corrosion of the cover was evident by 1921, and by the late 1970s, when in-depth condition inspections started, the Williamsburg Bridge's cables were an item of great concern. The city ordered a detailed analysis, and a technical advisory committee was commissioned in 1987 to recommend whether the bridge should be rehabilitated or replaced. Temporary closure of the bridge for emergency repairs elicited concern from many New Yorkers for their infrastructure. Donald Trump even offered to loan the city $250 million for the bridge's repair or replacement, but his offer was declined.

The cable evaluation determined that they were repairable and capable of providing the desired capacity. Late in 1988, the advisory committee recommended rehabilitating the bridge and rebuilding the approaches. Thus began the city's staged, $800 million rehabilitation. The fourteen-year process includes replacing the approach spans, cable repair and corrosion prevention, replacement of suspenders and cable bands, repair of anchorages, installation of an orthotropic deck on the roadways, repairs to deteriorated superstructure members, and safety improvements such as new guide rails and lighting. Reconstruction of the pedestrian promenades will eliminate several flights of stairs, making the bridge more bicycle-friendly. A related project, under jurisdiction of the New York State Department of Transportation, involves replacement of ramps connecting to and from the Brooklyn-Queens Expressway (Interstate 278). These ramps are carried on the first precast, post-tensioned concrete bridge in the state, which is now substantially complete. ■

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HIGHWAYS OF THE ROBERT MOSES ERA

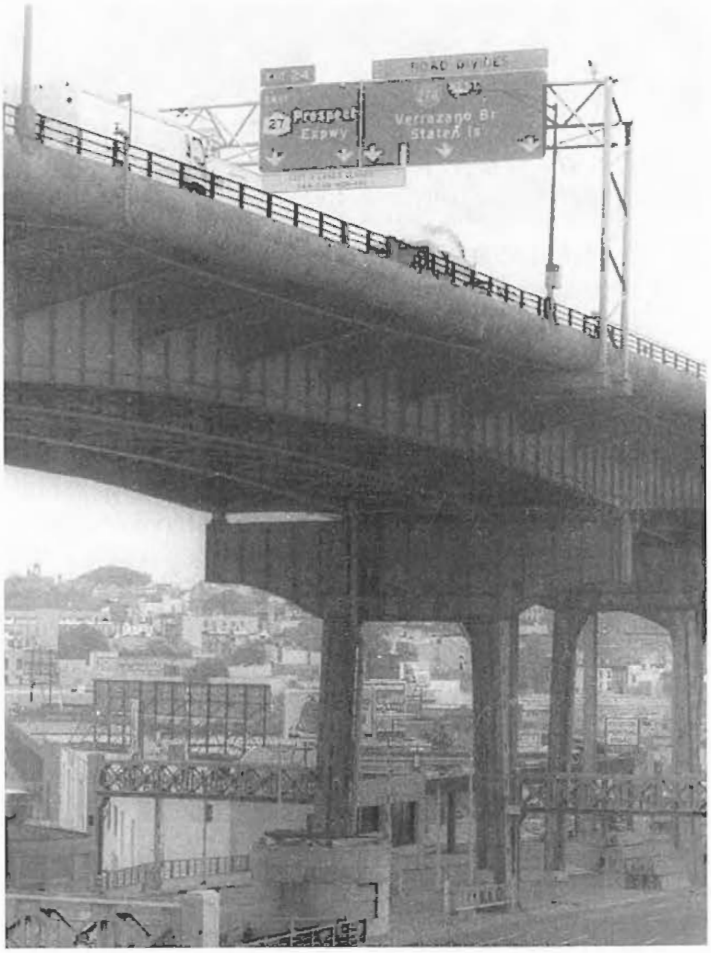
By Justin M. Spivey

Only the luckiest of visitors to New York will travel by automobile without getting stuck in traffic. The city's crowded road network serves not only the population of eight million, but also visitors, commuters, and nearly three million Long Islanders who must pass through New York to reach the mainland. Only a few major bridges, for example the Verrazano Narrows Bridge connecting Brooklyn to Staten Island in 1964, were designed along with the superhighways they carry. Brooklyn's East River crossings, on the other hand, are typically older structures that originally dumped traffic onto local streets. One person in the city's history had the right combination of vision, will, and political means to attempt knitting them together into a coherent highway system. His name was Robert Moses, and his legacy is difficult to evaluate. While his roads provided valuable transportation links and often were accompanied by public park development, they also displaced residents, divided and destroyed neighborhoods, directed funds away from mass transit, and favored only certain groups.

Moses was hardly the first to conjoin park and road construction. Urban parks of the 1860s, such as Chicago's Lincoln or New York's Central, included carriage roads not only for leisurely drives, but also for racing and for through traffic. (Not long after its opening in 1865, Lake Shore Drive became a commuter route from Chicago's wealthy North Shore suburbs.) Roads were a prominent feature in the work of landscape architects Olmsted and Vaux, who designed Brooklyn's Prospect Park along with two wide connecting boulevards, Eastern Parkway and Ocean Parkway. Although the domain of joggers and bicyclists on weekends, New York's park roads are open to automobile traffic during commuting hours.

Following a similar course, Moses' career progressed from parks, to parkways, to major traffic routes. The Yale- and Oxford-educated civil servant gained entrée into New York state politics through reformer Belle Moskowitz, and by 1924 had successfully engineered the creation of a Long Island State Park Commission with himself in charge. In this role, Moses created the remarkable Jones Beach and other oceanfront parks, along with limited-access, truck-free parkways leading up to the New York city line. Over the following decades, he moved into city politics and away from a reform agenda, playing leading roles in the construction of parks, highways, and public housing; expenditure of New Deal and urban renewal funds; and selection of federally funded arterial highway routes. A major source of funding for his projects was the Triborough Bridge Authority, a quasi-public entity that controlled a number of toll bridges. Moses occupied more than a dozen non-elected offices at the peak of his power, and thanks to his political acumen, was well insulated from public criticism. He was a true master builder, responsible for $27 billion worth of public works by the time his career ended in 1968.

In Brooklyn, Moses' most divisive projects share a common feature: the Interstate 278 designation. This highway is known by three names: the Verrazano-



The Gowanus Expressway's imposing high-level viaduct over the Gowanus Canal. Nick Malter.

The steel superstructure rises on the Gowanus Expressway's high-level viaduct. Courtesy archiveof industry.com.

Narrows Bridge approach, the Gowanus Expressway, and the Brooklyn-Queens Expressway. It was built in phases between 1937 and 1964, and connects with other Moses projects including the Belt or Shore Parkway (1934-41), the Prospect Expressway (1953-62), and the Long Island Expressway (1939-58). The Gowanus Expressway (originally Gowanus Improvement) was justified as a defense project, running along the south Brooklyn waterfront and providing truck access to military terminals and equipment manufacturers. A brochure describing the project reflects Moses' trademark arrogance with phrases such as "anyone with half an eye can see...." Portions were built along the abandoned Third Avenue elevated line and subsequently widened, accelerating the deterioration of a once-busy commercial street. The Gowanus Expressway crosses its namesake canal on a high viaduct and then connects with the Brooklyn-Battery Tunnel (I-478) into Manhattan.

From the tunnel interchange northward, I-278 is known as the Brooklyn-Queens Expressway (BQE), originally the Brooklyn-Queens Connecting Highway. The BQE runs depressed along Hicks Street, makes an S-shaped curve across Atlantic Avenue, and then runs above Furman Street on a three-tiered viaduct. The Furman Street section is arguably the most impressive from an aesthetic and engineering standpoint, consisting of three cantilevered concrete decks carrying the westbound lanes, the eastbound lanes, and the Brooklyn Heights Promenade, stacked one above the other. (Despite its location atop a major highway, the pedestrian promenade provides a stunning view of the East River.) The BQE makes a loop around downtown Brooklyn, barely squeezing under the Brooklyn and Manhattan bridge approaches, then continues onto an elevated viaduct above Park Avenue. Ducking under Broadway and the Williamsburg Bridge approach, the BQE emerges again onto the Meeker Avenue viaduct, which leads directly into the high-level Kosciuszko Bridge over Newtown Creek into Queens. The New York State Department of Transportation reconstructed the Meeker Avenue section during the last decade, making safety improvements and eliminating left-hand exits at Metropolitan Avenue. ■

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ROSENWACH TANK COMPANY

By Mary Habstritt

Rosenwach is the only rooftop water tank fabricator still manufacturing in New York City. The company was founded by William Dalton in 1866 and purchased from his widow by Harris Rosenwach in 1894 for $55. Rosenwach was a Polish immigrant and skilled cooper who had begun working for the company, then located on Grand Street on Manhattan's Lower East Side, in 1892.

Julius Rosenwach, son of Harris, moved the company to Williamsburg, Brooklyn, in 1924 when the Brooklyn-Manhattan Transit (BMT) Company completed a subway tunnel from 14th Street in Manhattan to North 7th Street in Brooklyn. This gave them more manufacturing space, and was still convenient to Manhattan, where most of their business was done. The company acquired the current building, a former stable, in 1963. Corporate offices were moved to Long Island City in 1977.

Manhattan's vertical growth was aided by rooftop water tanks. Water, which is piped by gravity from the mountainous regions surrounding the city, must be pumped to the roof of buildings over six stories high. It is then delivered by gravity to the apartments and offices below. The water tank is basically a barrel with plumbing that connects the reservoir to the building it serves. Wood is the preferred material for tanks because it is less expensive than metal and provides natural insulation. The 3-inch-thick (76 mm) wood staves have the same insulating value as 16 inches (406 mm) of concrete. The wood used is redwood, juniper, or yellow cedar.

All of the tank parts – bottom, staves, and roof sheathing and beams – are fabricated at the Williamsburg plant and assembled on the rooftop site. Wallace, the third Rosenwach to run the company, invented a machine that automated the cutting, shaving, and drilling of the tank staves. It simultaneously cuts both ends of a stave flush, grooves the edges, and drills a small hole halfway along either side. The holes are for dowels that hold the staves together temporarily during rooftop assembly. They are tied tightly together with rope before galvanized iron hoops are applied. A conical roof sheds debris and prevents ice build-up. The lifespan of a water tank is about thirty years. The steel support structure may be brought to the site or constructed on the spot and is put up first.

Wallace's son Andrew now heads a diversified company. From the company's work with wood, a new division, Sitecraft, spun off in the 1950s. Sitecraft manufactures wooden benches and planters. As central air conditioning became widespread, Rosenwach's rooftop experience led to the development of its United Tower subsidiary, specializing in steel cooling towers, in 1964. The Herbert Rose division handles structural steel, roofing, and waterproofing work. AMR Mechanical does plumbing and heating. Other small divisions make hot tubs and install sidewalk bridges to shield pedestrians from construction overhead. ■

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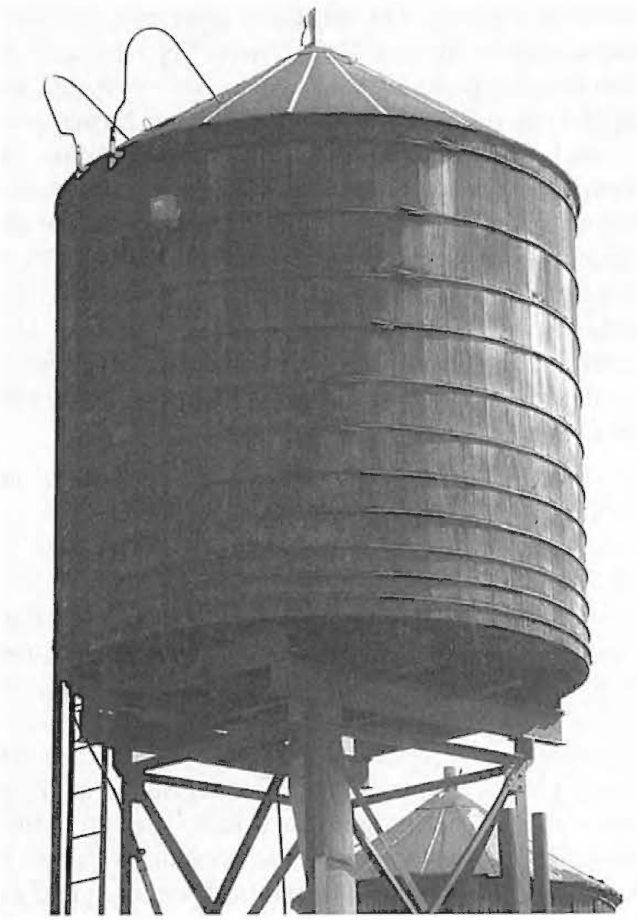

The 1968 vintage, 13-foot-diameter (4.0 m), 10,000-gallon (37,850 L) tank on the roof of General Tools Manufacturing Company on White Street in Manhattan. Gerald Weinstein, Photo Recording Associates.

PULASKI BRIDGE OVER NEWTOWN CREEK

By Justin M. Spivey

Manhattan Avenue, Greenpoint's bustling main commercial street, comes to an inglorious end in a parking lot adjacent to Newtown Creek. A stone abutment on the south shore, and its twin at the end of Vernon Avenue in Long Island City, once supported a pair of Scherzer bascule leaves that rolled back and forth tens of thousands of times a year from their completion in 1905. Even in 1953, when Newtown Creek industry was on the wane, the Vernon Avenue Bridge logged 12,000 openings for watercraft. The bridge's extremely low clearance – insufficient for most barges – was to blame for unnecessarily frequent disruptions of street traffic.

A high-level bascule replacement, constructed by the New York City Department of Public Works from 1947 to 1954, was intended to reduce the number of openings required. The structure represents an incremental improvement of the city's existing street grid by a municipal agency, in contrast to the sweeping new expressway system constructed by Robert Moses' public authorities. In designing the replacement, the department chose an entirely different site that would accommodate approaches to a high-level structure and bypass Greenpoint's commercial heart. The "New Vernon Avenue Bridge," as it then was called, had nothing to do with Vernon Avenue: it connected 11th Street in Long Island City to a widened Oakland Street in Greenpoint (later renamed McGuinness Boulevard after a local political boss).

Although the Oakland Street widening was not yet complete, the span opened with typical fanfare on September 10, 1954. The name "Pulaski Bridge" is screwed onto its cast bronze plaque, apparently as a last-minute decision to honor Revolutionary War hero Casimir Pulaski and, by extension, Greenpoint's growing Polish population. Among the names actually cast into the plaque is that of Frederick Zurmuhlen, Commissioner of Public Works. That Zurmuhlen was both a professional engineer and a registered architect may explain the bridge's remarkable design. Much attention was paid to aesthetics: porthole windows in the operator's tower echo its nautical function, and the railings are finely detailed with horizontal lines and curves in keeping with the Modern style of architecture.

The Pulaski Bridge includes fifteen riveted plate-girder spans of various configurations in its horizontally and vertically curved alignment, which rises to clear 40 feet (12.2 m) over the creek. It carries three 11-foot (3.4 m) lanes in each direction and has a generous 8-foot (2.4 m) sidewalk on the west side, which is rare for city bridges of its era. Two pedestrian stairways descend to 53rd Avenue in Long Island City and to Ash Street in Greenpoint. The main span is a parallel-counterweight bascule with four leaves, two for each roadway. This was intended to provide a measure of redundancy: if one pair became stuck open, traffic could be detoured onto the other roadway. The parallel-counterweight design and the yielding cable-type traffic barriers are remarkably similar to the designs of Chicago bascule bridge pioneer Joseph B. Strauss (1870-1939), the patents for which had expired by the time of the Pulaski Bridge's construction.

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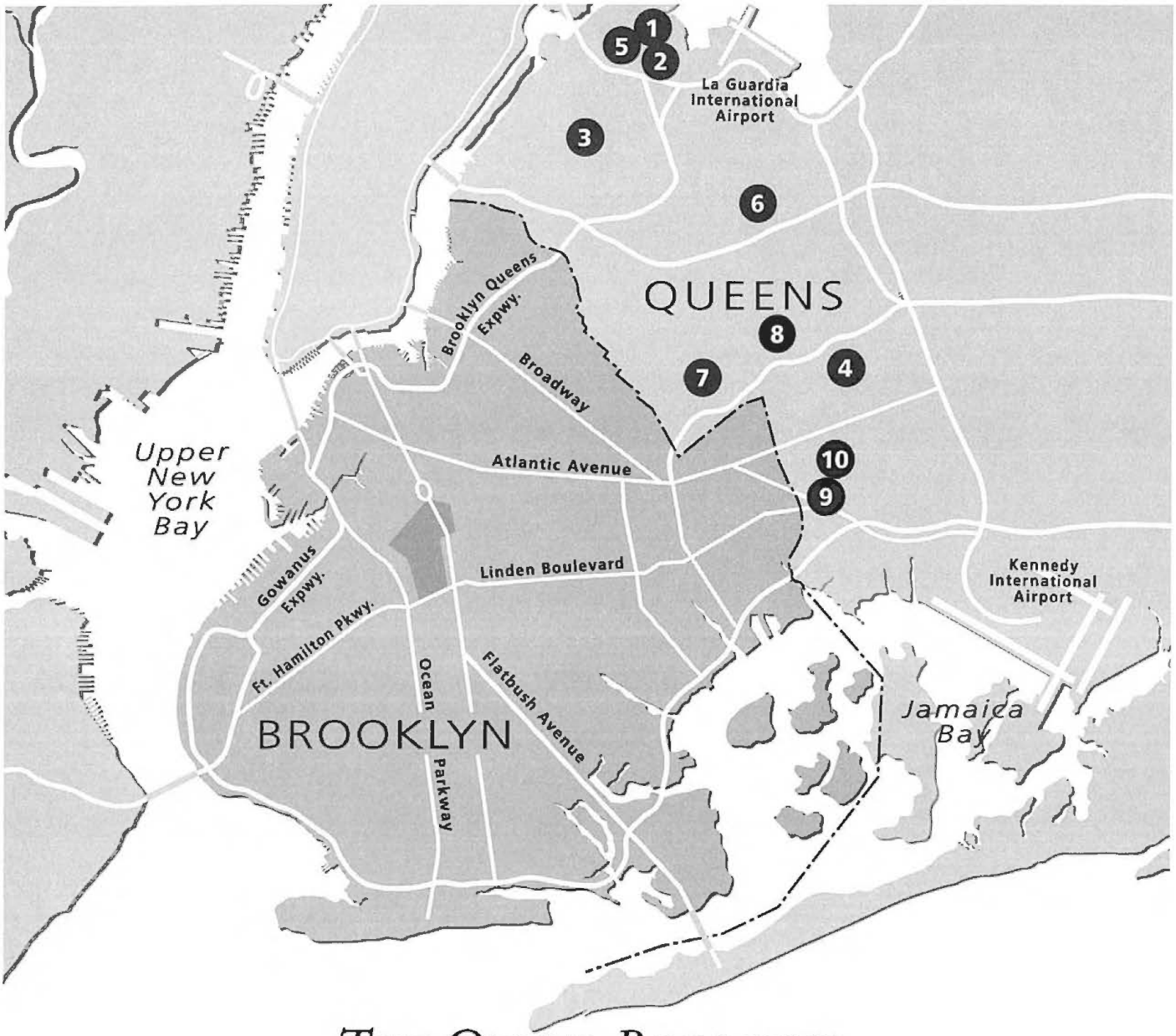
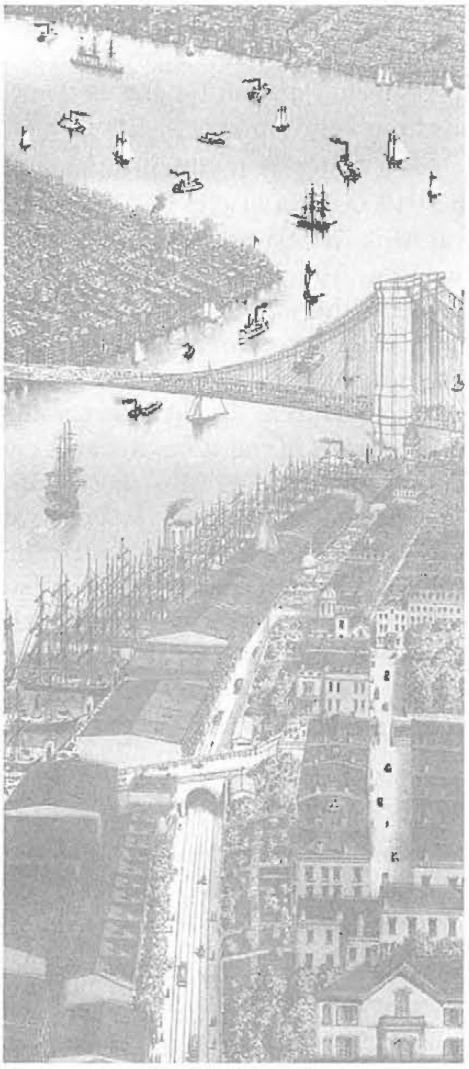
Porthole windows on the Pulaski Bridge operator's tower echo its nautical function. Justin M. Spivey.



THE OTHER BOROUGH

Steinway & Sons – 1 Steinway Place, Astoria	**1**
Cecilware – 43-05 20th Avenue, Astoria	**2**
Long Island Rail Road	
Sunnyside Yard – Jackson Avenue & Queens Boulevard, Long Island City	**3**
Hillside Shops – Liberty Avenue & 183rd Street, Jamaica	**4**
Astoria Generating Station *(Orion Power)* – 18-01 20th Avenue, Astoria	**5**
NYCTA Substation No. 27 – Roosevelt Avenue & 90th Street, Jackson Heights	**6**
Michael J. Colonna – 79-12 Metropolitan Avenue, Middle Village	**7**
Queens Hospital Center – 82-70 164th Street, Jamaica	**8**
A. Ottavino Corporation – 80-60 Pitkin Avenue, Ozone Park	**9**
Dallis Brothers Coffee Roasters – 100-30 Atlantic Avenue, Ozone Park	**10**

CHAPTER SEVEN
THE OTHER BOROUGH



INTRODUCTION

By Ann N. Dichter

Queens is the largest of New York City's five boroughs, covering 118 square miles (306 km²). Throughout its history, Queens has been a place of distinct communities, a patchwork of ethnicity and religion.

Like Brooklyn, Queens originally was settled by the Dutch as they moved out from the southern tip of Manhattan and from the farms of Brooklyn during the early seventeenth century. The first settlements were in the Astoria, Hunters Point, and Dutch Kills areas of Long Island City. The population centers, such as they were, were divided by major geographical features: Newtown from Flushing by a tidal marsh and estuary, and these areas from Jamaica by the terminal moraine ridge of Long Island. The inhabitants traveled over dirt roads and crossed the waters surrounding Long Island by ferry. In the last quarter of the seventeenth century, the British organized the many villages of the area into Queens County, named after Catharine of Braganza, Charles II's wife. It was much larger than present-day Queens, incorporating what is today Nassau County and parts of Suffolk County as well. At the end of the eighteenth century, the population was less than 5,400; today it is almost 1.9 million.

By the middle of the nineteenth century, land speculation had come to Long Island. Farms were bought up and converted to village lots and Maspeth, Corona, Long Island City, and Winfield were born. And then there were reasons for outsiders to visit Queens. Racetracks were built and a burgeoning hospitality industry developed. In 1848, burial grounds were banned from lower Manhattan for health reasons and the industry moved to Queens. For the living, the Rockaway beaches began to attract affluent summer visitors. Piano manufacturer Steinway & Sons began a move to Astoria in the 1870s, building a large factory and worker housing. The great immigration waves of the mid- and late nineteenth century landed in Queens: the Irish in Astoria, Jamaica, and Flushing and the Germans in Middle Village, having followed Metropolitan and Myrtle Avenues out of Brooklyn.

As mass transit reached into Queens, residential development followed. The Brooklyn City Railroad built its car barns in Ridgewood in 1881 and the population grew. The Myrtle Avenue elevated line, connecting with downtown Brooklyn, fur-

ther enhanced Ridgewood's popularity. A nearby Long Island Rail Road station stop became Hollis. Despite the gains, Queens was still an area of farms and open land. When consolidated with New York City in 1898, its population was barely 150,000. A subway line to Manhattan arrived in 1915 at Hunters Point and had reached Corona by 1917. Development in Jackson Heights, Corona, and Flushing replaced the cornfields and market gardens. Largely built through farmland, the 42nd Street-Flushing line (today's No. 7 train) led the way. Queens is also the home of the old Pennsylvania Railroad passenger yards (now utilized by Amtrak and the Long Island Rail Road).

The opening of the Queensboro Bridge in 1909 ended the borough's isolation, just as the automobile was introduced to the public. A whole new road system grew and Queens Boulevard was laid out. The city promised to make street names and numbers uniform throughout the borough. (Anyone who has tried to navigate in Queens can attest to the utter failure of the effort.) Development in Queens has continued to respond to developments in transportation: the Triborough Bridge, the Grand Central Parkway, La Guardia Airport, with its wonderful Art Deco Marine Air Terminal, and JFK International with its endangered TWA terminal by Eero Saarinen. But equally important was the World's Fair of 1939, which put the borough on the international map.

Even as the roads were paved and mass transit began to knit the villages into greater New York City, residents identified themselves as living in Jamaica, Flushing, St. Albans, or Elmhurst, and do so today. Underdeveloped compared to Brooklyn, Queens provided suburban housing close to offices and factories in Manhattan. From the Dutch and English settlements of the seventeenth century to the German, Polish, and Irish immigrants of the nineteenth century, Queens has welcomed newcomers to America. Malba, Forest Hills Gardens, and Beechhurst were all developed to provide upper-middle class housing in the late nineteenth and early twentieth century. Since the 1970s, Flushing has been a magnet for a diverse Asian community, including immigrants from China, Japan, Korea, and the Indian subcontinent. Jackson Heights is home to large populations from Latin America.

Queens has a 350-year tradition of adaptation and change. In 1919, Astoria briefly was the movie capital of the world, with Astoria Studios making films staring Gloria Swanson, the Marx Brothers, and Rudolf Valentino. Today, the Museum of the Moving Image and Silvercup Studios continue the movie tradition of Astoria. The stonecutters and masons who followed the cemeteries to Queens in the nineteenth century were the predecessors of the stone working companies of the twentieth century. The Museum of Modern Art has moved some collections to P.S. 1, a renovated public school in Long Island City, while their Manhattan home is enlarged and renovated. Within a few blocks you can find the Socrates Sculpture Garden, the Isamu Noguchi Museum, and some of the city's best Greek food. A few more blocks and you can buy a sari or have a Peruvian or Ecuadorian meal; Queens has it all.

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STEINWAY & SONS

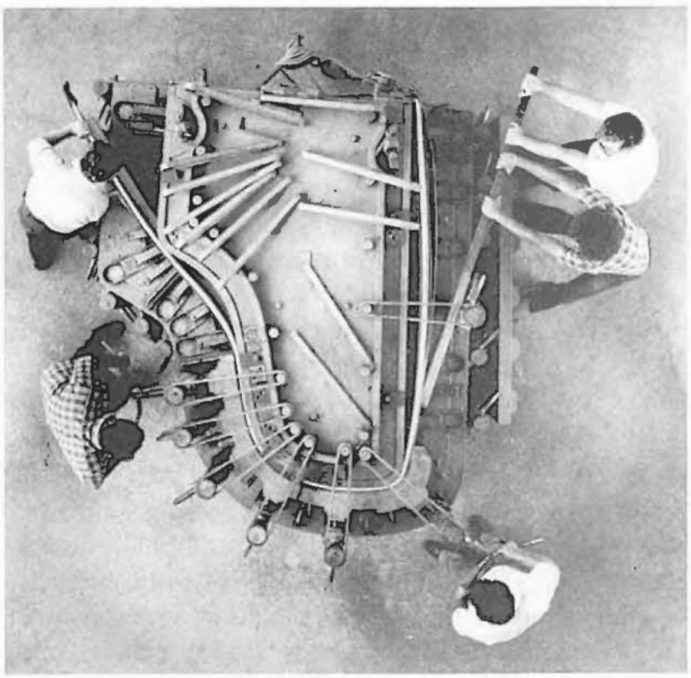
By Terry L. Bailey

In 1849, a German master craftsman named Heinrich (Henry) Englehard Steinweg – who had built some 400 pianos as a cottage industry in his native country – immigrated to America. Landing in New York, he and his sons first worked for American piano makers to learn American business practices. They set up business as Steinway & Sons by 1853, and seven years later, had opened a piano factory on 53rd Street and Fourth (now Park) Avenue in Manhattan. The factory employed 300 workers and turned out 1,180 pianos annually. Two steam boilers powered the machinery, one of the earliest such uses of steam in the city.

In the 1850s, population growth and social changes were creating a demand for music halls seating thousands instead of hundreds. This in turn created a need for more powerful pianos capable of acoustically filling the larger halls. By 1860, Henry Steinway, Jr., had developed a new cast-iron plate that could hold the piano wires in tune under tremendous tension, along with a new arrangement of strings where the longer, heavier bass strings fanned out above the treble and middle registers. This combination revolutionized piano design by allowing longer strings for increased volume, balance, and power, without increasing the size of the cabinet. Subsequent innovations included a vibrant soundboard and a more responsive keyboard.

Steinway & Sons' early marketing strategies included awarding medals at fairs, soliciting artist's endorsements, and managing its own concert halls. The company built Steinway Hall on 14th Street, Manhattan, in 1866 and another in London in 1875. Steinway Hall housed the New York Philharmonic and served as an important artistic and cultural center until Carnegie Hall was constructed in 1891. By sponsoring and promoting famous pianists to play their halls and to tour the country, the company brought classical music to new audiences.

In the 1870s the company began a partial move to Astoria, Queens, where William Steinway bought 400 acres (162 ha) and built a new factory and wood drying and storage facilities. He developed the remainder of the site as home lots, essentially creating a company town. To promote his investment, he eventually ended up owning most of the trolley lines in western Queens, became the largest stockholder of the New York & Long Island Rail Road, and championed a rail tunnel under the East River. He did not live to see its completion, but the twin tunnels now carrying the Times Square-Flushing (No. 7) subway line are known to many as the Steinway Tubes. In 1886, William developed the enormously successful North Beach Amusement Park on the site of today's LaGuardia Airport.



Bending the frame for a Steinway piano. Courtesy Steinway & Sons.

Steinway & Sons was a family business for most of its 120 years, having been run by six family members representing five generations before its sale to CBS in the early 1970s. The company remains dedicated to the principles of fine craftsmanship. Lumber is still dried in the factory, in kilns with a capacity of 450,000 board-feet (1,060 m^3). The remainder of the plant is dedicated to piano construction and assembly. Today's Model D concert grand piano has been called "perhaps the most complicated piece of machinery built by hand in the world today" by *Invention & Technology* magazine. Each one is composed of some twelve thousand parts – ranging from inch-long bits of maple to a 340-pound (154 kg) cast-iron plate – and the year-long assembly process requires over three hundred craftspeople. The plant now employs six hundred people and produces three thousand pianos per year, ranging in price from $16,100 to $137,100. ■

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CECILWARE

By Mary Habstritt

Cecilware is a vertically integrated manufacturer of food service equipment, with an emphasis on beverage brewers and dispensers. The company was founded by the Cecil brothers in 1911 to manufacture holloware dishes for sundaes and banana splits. The business changed in the early 1950s to become a manufacturer of coffee brewing equipment and countertop cooking equipment. No Cecil family members were involved after 1953.

During the 1980s and 1990s, the company acquired several competitors in the beverage equipment industry, including J. H. McKie, Aenco, and Cory. New products were added to the line, including hot chocolate dispensers, iced tea brewers, and syrup pumps. In response to the development of powdered cappuccino by Superior Products, a coffee-roasting division of Sara Lee, Cecilware converted its hot chocolate machines to dispense this beverage. Its powdered cappuccino machines now make up the company's largest product category, expanding from one model in 1995 to forty-five models in 2002, and are popular appliances in convenience stores.

Cecilware works primarily with stainless and electro-galvanized sheet steel to produce approximately 350 different types of food service products, including fryers, pizza ovens, electric griddles, and slicers. Twelve to fourteen assembly lines run daily and the factory is fully computerized to control its complex operation. Manufacturing equipment has been updated with state-of-the-art Amada computer-controlled shearing, punching, and bending equipment, including two Pega 345 and one Pega 244 punch presses, that run twenty-four hours a day, five days a week. A full welding department performs heli-arc welding, soldering, and spot welding. Other functions include sandblasting to remove weld marks, foaming-in-place packing, and degreasing.

The company's 60,000-square-foot (5570 m²) facility was constructed for its use in 1960. The company is located in the Steinway Industrial Park, which derives it name from the Steinway & Sons piano factory located a few blocks away. Many of the homes on 20th Avenue were originally built by Steinway to house its factory and supervisory workers at the turn of the century. ■

The Cecilware factory on 20th Avenue in Astoria. Gerald Weinstein, Photo Recording Associates.

LONG ISLAND RAIL ROAD

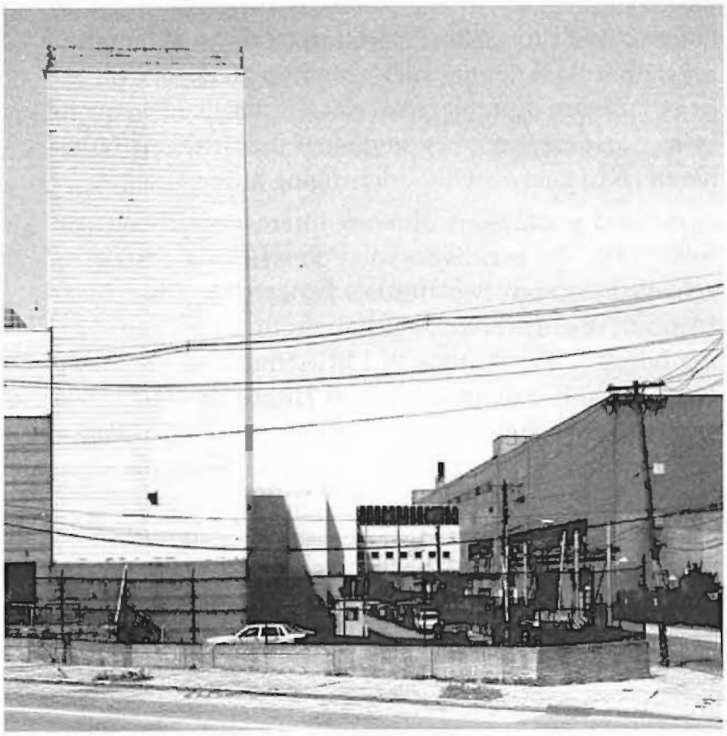
By Sanford E. Balick

The Long Island Rail Road (LIRR) is an arm of the Metropolitan Transportation Authority (MTA). It is the largest commuter railroad in the nation, and boards about 300,000 riders a day at its 124 stations. For a large part of its existence it was a subsidiary of the Pennsylvania Railroad.

The LIRR's westerly anchor is Manhattan's Pennsylvania Station, although an ongoing project is due to bring some service directly into Grand Central Terminal later in the decade. This will involve the yet-unused lower level of the 63rd Street Tunnel, an immersed prefabricated four-track tunnel completed in 1989. The LIRR operates eleven so-called "branches." With the exception of its Port Washington line, all LIRR service travels through a series of junctions located on either side of the Jamaica Station, located in Queens. The timetable admonition "Change at Jamaica" must rank right behind such common New York phrases as "You got a problem wit dat?"in terms of frequency of use. One wag once suggested that it wasn't possible to go to heaven without changing at Jamaica.

Jamaica is only one of many interesting features on this LIRR. Its occupancy of Pennsylvania Station is achieved through two tunnels beneath the East River (Amtrak uses two others although, in fact, some sharing occurs). The volume of LIRR's traffic requires two other termini, one in Queens at Hunterspoint Avenue (exclusively a diesel venue) and one at Atlantic Avenue on the edge of downtown Brooklyn (exclusively an electric venue – the bulk of the LIRR is powered by 750-volt third rail). The MTA currently is undertaking an extensive renovation of the Atlantic Avenue terminal and adjacent subway stations.

A LIRR commuter train passes the old Long Island City powerhouse of the Pennsylvania Railroad. Bernard Ente.



The LIRR's Hillside Maintenance Complex in Jamaica. Gerald Weinstein, Photo Recording Associates.

LIRR riders are accommodated on a fleet of 916 look-alike electric motor unit (MU) cars and another 134 locomotive-hauled double-deck cars officially called "bi-level coaches." Some of the bi-levels now serve Penn Station courtesy of twenty-three dual-mode locomotives. Twenty-three additional locomotives are diesel only and spend all of their time on "the Island." Freight service, once substantial, is minimal but growing again. It is operated by the New York & Atlantic Railroad, which scurries out to the Island in between the morning and afternoon rushes, from its yard at Fresh Pond Junction in Brooklyn.

The railroad's 319 route-miles (513 km) cover a remarkably diverse geography and layout. The LIRR starts at the Hudson River's edge in West Side Yard, a relatively new facility that feeds Penn Station, located several blocks to the east. From Penn Station, trains traverse the East River Tunnels and emerge at Sunnyside Yard, where Amtrak and New Jersey Transit trains diverge into a large maintenance facility. The LIRR continues east, first on a six-track main, then on four tracks. The main line joins the terminal branches immediately west of Jamaica Station. Leaving Jamaica, the various lines begin to divide, but the Babylon Branch is no less a main line itself. In fact, the two reconnect just west of Babylon Station.

The LIRR's chief maintenance facilities historically have been located in the vicinity of Jamaica Station. A couple of miles to the east, on Liberty Avenue, is the recently built Hillside Maintenance Complex. Hillside is responsible for keeping the car fleet complex operational, which is a demanding job given the age of the fleet and a history of deferred maintenance.

Operationally, the LIRR combines both new and old. The Claytor-Scannell Control Center (1994) near Penn Station governs movement in the terminal area. Much of the rest of the operation is handled out of Jamaica Station. Rural lines have something of a prairie aspect to them; the outer portion of the Montauk Branch is dispatched via orders "hooped up" from towers and train crews conduct "meets" at passing sidings, some of whose switches are hand-thrown. The influence of the former Pennsylvania Railroad remains, not just in the name of the LIRR's principal terminus but also in its vast collection of three-position lamp signals. The array of signals beckoning traffic east from Jamaica makes for a remarkable nighttime sight.

To those unfamiliar with the LIRR, a few hours spent at Jamaica Station during the morning or evening rush is eye-opening, especially the manner in which connections between the different branches are choreographed so that passengers spend a minimum of time waiting to transfer. Add to this a large number of deadhead operations and the occasional diesel freight, and you have a fine source of entertainment. ■

ASTORIA GENERATING STATION (ORION POWER)

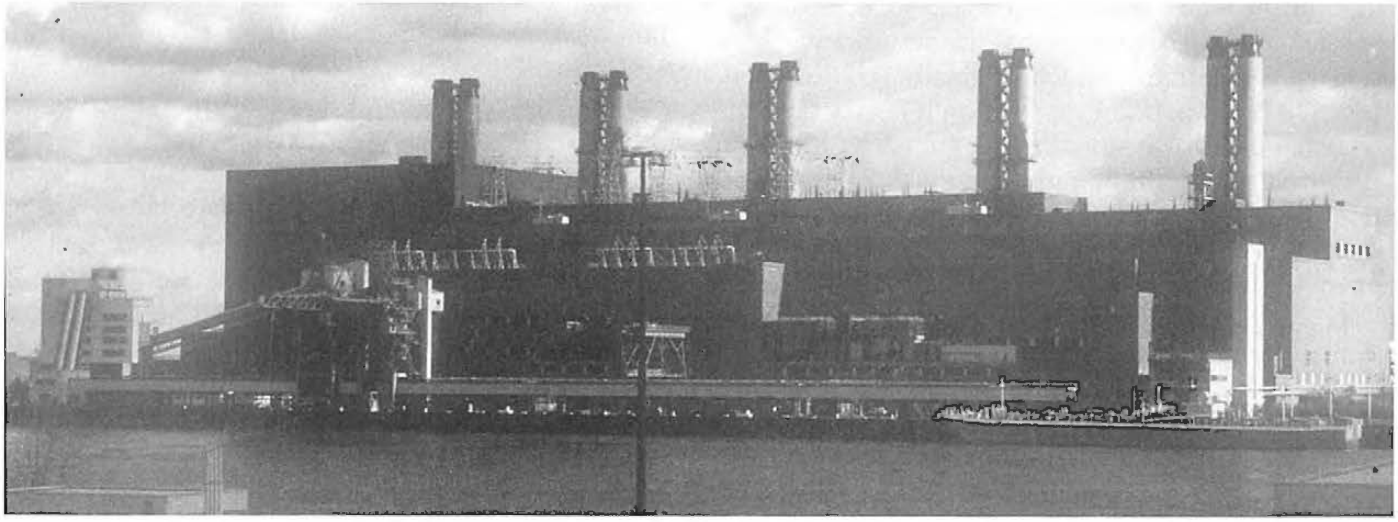
By Gerald Weinstein

The Lawrence Point area of Astoria, near the Hell Gate connecting the East River to Long Island Sound, has been a site of public utilities since the 1890s. In 1899, the Astoria Light, Heat, and Power Company was incorporated and commenced construction of what was to become one of the largest illuminating gas plants in the world. The Electric Illuminating and Power Company had already built a power station at the point. These companies were later taken over by the Consolidated Gas Company of New York, which became the Consolidated Edison Company (Con Ed) in 1936. Con Ed envisioned a power plant there in the late 1930s, but it wasn't until 1953 that construction was started.

The new power plant was south of the point adjacent to the gas plant. Planned to ultimately have six units, the first (southernmost) section had two 1.2 million-pound-per-hour (0.54 million kg/hr), tri-fuel (coal-, gas-, or oil-fired) boilers feeding two 180-MW, cross-compound steam turbine generators. In that design, the high- and low-pressure turbines were separate machines, each with its own generator putting out 1.38 kV. Cooling water for the condensers was drawn from the East River and returned to the river at an elevated temperature. Twin stacks were a unique feature of the station. Due to the proximity of LaGuardia Airport, they were shorter than normal and had special nozzles on top to augment the gas flow. With a residential neighborhood nearby, the station bucked a trend toward outdoor units and housed them in a building.

In 1958, Unit No. 3 continued the architectural look of the plant and contained a 2.4 million-pound-per-hour (1.09 million kg/hr) boiler with twin furnaces feeding a 300-MW cross-compound steam turbine generator set. It was one of the largest in the country at the time. Units 4 and 5, each producing 375 MW, were added around 1960 with similar technology and architectural treatment. None of the units burns coal now. The New York Power Authority (NYPA) built Unit No. 6, called the Charles Poletti Power Project, in 1977. The boiler is a dual-fuel unit running on gas or oil. The 825-MW turbine generator is a single-shaft, tandem-compound unit. It is housed in a modern steel-clad structure.

As a result of energy deregulation, Con Ed decided to sell its power plants and concentrate on distribution. Orion Power is now the owner of this and many other plants in the Northeast. They are about to embark on a re-powering project at Astoria. The original boilers of units 2 through 5 will be removed and replaced with gas turbine powered generators. The waste heat from the turbines will be fed through heat recovery steam generators to provide steam for the original turbines and generators in what is called a combined cycle system. This will raise the efficiency from 30 to 50 per-



The Astoria Generating Station on the shore of the Hell Gate. Gerald Weinstein, Photo Recording Associates.

cent. Condenser water will be cycled through cooling towers to minimize impact on the river. Ultimately the program will produce 500 MW more power with less environmental impact. The NYPA is also starting a combined cycle program at the north end of the property. The Poletti plant will continue to operate at reduced output with its original equipment. ■

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NYCTA SUBSTATION NO. 27

By Gerald Weinstein

Substation No. 27 was built for the Interborough Rapid Transit Company (IRT) in 1923 as part of the 1913 Dual System of Rapid Transit (a.k.a. Dual Contracts) subway and elevated lines organized by the IRT and the Brooklyn Rapid Transit Company. The BRT, which controlled all of Brooklyn's elevated railways, was allowed to bring trains into Manhattan under its subsidiary, the New York Municipal Railway Corporation. Meanwhile, the IRT's lines in the Bronx and Brooklyn also were expanded. Substation No. 27 powered the Flushing elevated line (today's No. 7 train), which originally terminated at Junction Boulevard. The line was built largely through farmland and led to major urban growth in the area. Roosevelt Avenue, running along much of the same route, was not graded until the elevated line was constructed. The line reached Main Street in Flushing, its present terminus, in 1927.

In operation until 1995, Substation No. 27 is among the last of about fifty manually operated rotary converter substations in New York. They formed part of an alternating current-direct current distribution system devised in the late 1890s to reduce the operating cost of long-distance electric railways. Power was economically generated as high-voltage AC and distributed to substations along the lines, which converted the power to DC, the preferred current to run railroad traction motors. The central generating stations that supplied the substations were sold off to Con Edison in the 1950s and were modernized. Thanks to limited budgets and dedicated repair crews, a few of the substations soldiered on until the millennium. They were living museums of early twentieth-century electrical technology.

The former Manhattan Elevated Railway power station on East 74th Street in Manhattan generated 25-cycle, three-phase, 11,000-volt power, which was distributed via underground feeders. Upon entering the substation, it was routed by motorized oil circuit breakers remotely controlled from the main switchboard. Electrical contacts in the circuit breakers were made and broken in tanks of oil that suppressed the arc. The current was stepped down below 500 volts in air blast transformers. These were used instead of more efficient oil-cooled transformers to reduce fire risk in urban locations. The low-voltage AC was then fed directly to the synchronous rotary converters. These were unique machines that combined an AC motor and a DC generator in the same unit. AC entered the

machine from slip rings and spun the armature, producing currents to be picked up from a commutator by brushes as 625-volt DC.

In operation, machines were started as the load began to pick up during the rush hour. The older machines were synchronized with the AC supply by operators using synchroscopes and flashing light bulbs. The DC output was sent to and from the switchboards on massive copper bus bars and through hand-operated carbon circuit breakers and solid copper disconnecting switches. From there, the power was sent through feeders to the contact rail of the elevated train line. The trains collected the power through truck-mounted shoes riding along the contact rail. Though a relatively late station, No. 27 has several generations of equipment including the last example of a 1902 vintage 1,500-kW Westinghouse "Manhattan" rotary moved from a station of the Manhattan Elevated Railway and three 2,000-kW General Electric converters from circa 1910. The persistence of rotary converters in Substation No. 27 is unusual considering that two generations of replacements – mercury arc rectifiers and solid-state silicon diode rectifiers – have been installed elsewhere in the system. ■

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MICHAEL J. COLONNA

By Mary Habstritt

Michael J. Colonna is one of very few monument carvers still cutting stone by hand. He has worked out of the tiny coal-heated shed at this location for over twenty years, but has been carving stone almost since childhood, when he picked up marble chips in his cousin's sculpture studio in Italy.

Michael came to this country in 1938 at the age of sixteen and, unable to break into the strong stonecutters' unions, became a laborer working at construction sites and in a slaughterhouse. Drafted when he was about twenty-three, he served in World War II. A G.I. Bill program helped him obtain an apprenticeship at A. Ottavino Corporation, where he learned to cut granite, the preferred stone for monuments in America, but far harder than the marble he was accustomed to shaping.

In those days, Ottavino employed twelve stonecutters, four sculptors (who sketched their own designs and cut statuary), and a blacksmith to sharpen and repair their tools. Michael is particularly proud of working on the Ottavino team that created the intricately carved window at Saint Anselm's church in Brooklyn. It is unusual in being carved on both sides

Religious statues carved by Michael Colonna in his shop. Katherine Bartczak.

and one of the difficult aspects was cutting slots to support the stained glass. He worked there for thirteen years before starting his own shop.

The shop is equipped with a 2-ton (1,800 kg) electric hoist and a 4-ton (3,600 kg) hand-operated chain hoist to move the blocks of granite. In the small courtyard is a 3-ton (2,700 kg) overhead crane. His pneumatic drills and chisels (made by Bicknell Manufacturing of Rockland, Maine) have carbide steel tips, and though he remembers the days when they were made of tempered steel, no edge lasts long against granite. A small dust collector pulls away the fine granite dust as he works, to protect his lungs from silicosis. (The dust is said to make wonderful fertilizer.)

Most of the monuments that Michael works on now come in with the lettering already cut by computer-guided diamond-tipped drills and sandblasting. He adds custom carved saints, lilies, and roses, based on a description he receives from his monument dealer. The design selected is often based on an old catalog from Da Prato, a long-gone manufacturer of plaster religious statuary. He creates a sketch and transfers the sketch to the stone using carbon paper and then begins his carving.

Many examples of Michael's work can be found just around the corner on the grounds of Saint John's Cemetery, opened in 1880 and administered by the Roman Catholic Diocese of Brooklyn and Queens. Made of granite, with a hardness approaching that of diamonds, his monuments will grace the landscape there for generations to come. ■

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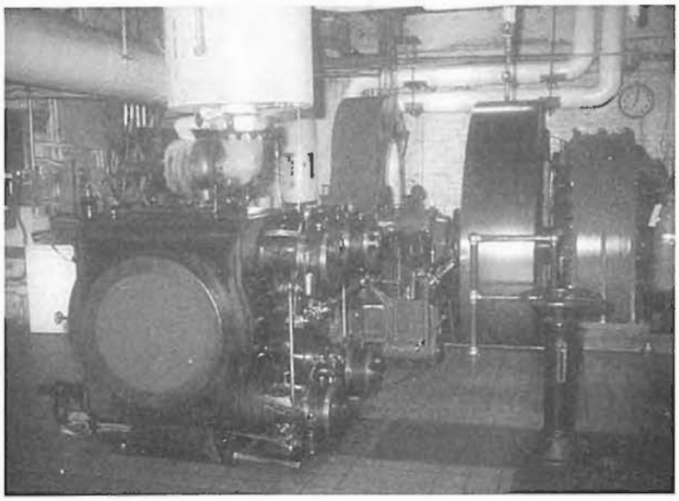
QUEENS HOSPITAL

By Conrad Milster

What is today called the Queens Hospital Center was built in the early 1930s, as is apparent from the architectural style of its original buildings. The hospital and its predecessors have served the Jamaica neighborhood of Queens for nearly a century, and a major renovation campaign is cuarrently under way. Its affiliations include three satellite medical centers in the neighborhood and the Mount Sinai School of Medicine in Manhattan.



A Ridgeway Corliss engine generator at the Queens Hospital Center powerhouse. Conrad Milster.

Hospitals once were prime candidates for on-site steam plants. They required power around the clock and had large hot water and steam loads. For some reason not now known, the Elliot Ridgeway Company seems to have had a lock on New York City municipal hospital plants, their engines being virtually the only ones used in city institutions. The original plant at Queens Hospital Center had four Ridgeway engines, three of 500 kW capacity and one of 300 kW, all supplying dual-voltage, three-wire DC (either 115 or 230 volts). Union Iron Works water-tube boilers supplied steam at 160 psi (1,100 kPa). The 500-kW engines had 23-inch by 32-inch (584 by 813 mm) cylinders and ran at 150 rpm. They were rated for 780 horsepower at 175 psi (1,210 kPa).

As has happened so many times before, the DC plant was gradually phased out and, by 1990, the last engine had been shut down. Today, rectifiers supply DC for the elevators. A replacement of steam lines in the plant has left the two 500-kW machines dead; the third was removed years ago to enable installation of a diesel emergency generator. The 300-kW unit is still available as an emergency standby. ■

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A. OTTAVINO CORPORATION

By Mary Habstritt

The A. Ottavino Corporation has been in the stonecutting business since 1913, and at its current site in Ozone Park, Queens, since 1938. The firm specializes in providing full-service stonework, from drafting to carving to setting, both for monuments and buildings. Most of their current work is in building and fine art restoration.

Adamo (later known as Adam) Ottavino came to the United States from a small town near Pompeii around the turn of the century. He became a stonecutter working for many of the major stone yards then in Brooklyn, such as Tedeschi & Tedeschi, Haskell, Adler, and Benisch. The piers of the Queensborough Bridge and the exterior of the Municipal Building in Manhattan are examples of landmarks he was employed in building.

Fed up with the many strikes initiated by the stonecutters' unions (this highly skilled trade claims to have pioneered the eight-hour workday, achieved by a Chicago local in 1867), he opened his own small shop near Holy Cross Cemetery in Brooklyn where he crafted and sold monuments and expanded into mausoleum work. All the work at this time was done by hand.

Later, Adam purchased the large factory on Pitkin Avenue from the U.S. Small Business Administration. The earliest portions of the building date to about 1915. It was built for a monument carver that served the three nearby Jewish cemeteries, Mokom Sholom, Bayside, and Acacia. The shop includes two 25-ton (22,700 kg) cranes, a diamond saw for cutting large blocks, and polishing tables for putting a high gloss on stone. A small machine shop, used to fabricate fasteners and supports, contains belt-driven equipment.

After World War II, Adam's sons John, George, and Jerry expanded the business into building stone and restoration work. They found a niche importing and making available a wide variety of granite in hues not carried by other stone yards. Quality was assured by handling installation themselves. In the 1950s, they designed fabrication methods for granite surface plates, building upon techniques developed in Ohio for limestone and marble surface plates. These plates provide absolutely level surfaces for mounting sensitive testing and measurement devices. This work has diminished in recent years due to foreign competition.

Their most unique job has been the reconstruction of the two-thousand-year-old Egyptian Temple of Dendur at the Metropolitan Museum of Art. The temple was given to the U.S. in exchange for assistance provided in rescuing ancient monuments from flooding caused by construction of the Aswan High Dam. A. Ottavino was responsible for setting the fragile and porous blocks of Aeolian sandstone, devising support systems for broken stones, and replacing rusted reinforcements from earlier repairs. Upon completion, the Sackler Wing was built around the temple. Other restoration projects have included Brooklyn Borough Hall, the U.S. Custom House in lower Manhattan, the National Maine Monument in Central Park, and reconstruction of the Whitney Museum's granite facade.

The third generation of the Ottavino family, George's daughters Kate Burns Ottavino, Meg Ottavino, and Sallie Ottavino Elkordy, and son-in-law Mohammed Elkordy, now run the company. Kate directs preservation work and the firm's summer intern program and helped design the curriculum for the High School for the Preservation Arts in Brooklyn. Meg runs the monument division, Sallie oversees field operations, and Mohammed supervises construction planning. ■

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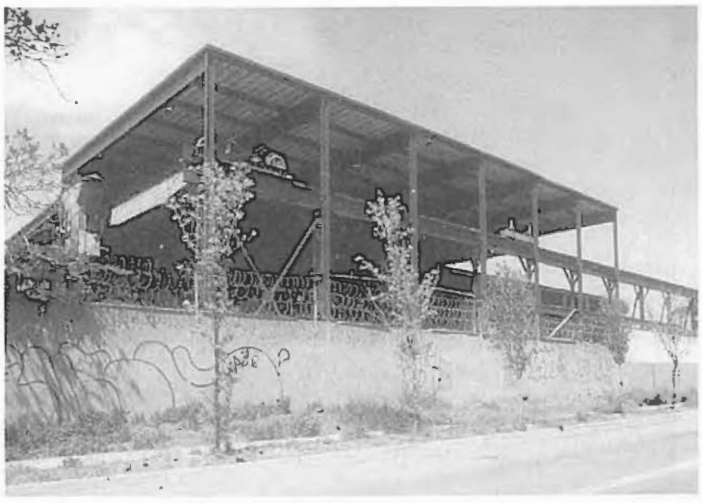


The bridge crane and supporting steel work at the A. Ottavino stonecutting yard. Gerald Weinstein, Photo Recording Associates.

DALLIS BROTHERS COFFEE

By Mary Habstritt

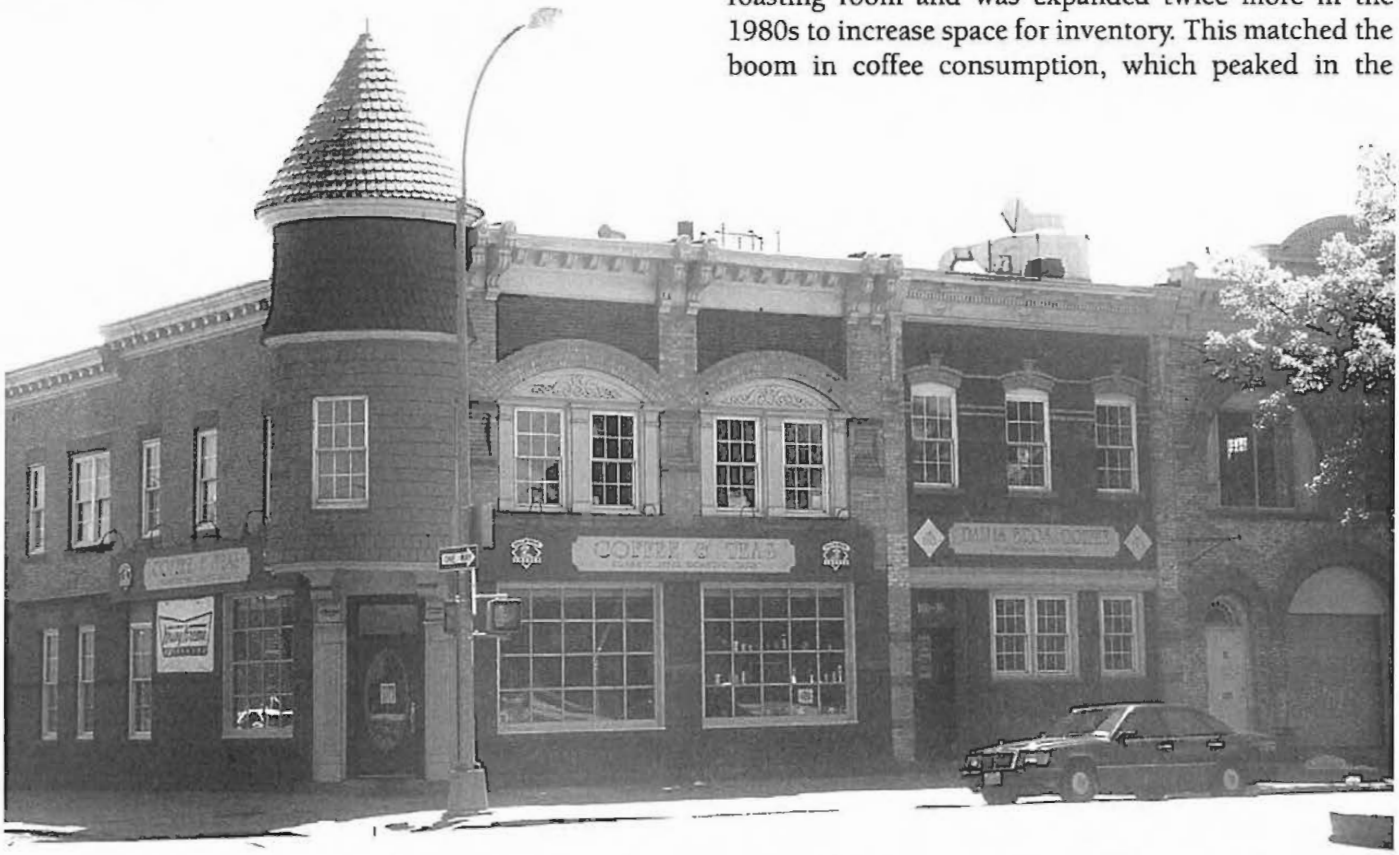
Shortly after emigrating from Russia, brothers Abe and Morris Dallis began a house-to-house coffee business. They bought roasted beans from suppliers in Long Island City, bagged the coffee, and sold it door-to-door in Brooklyn and Queens. The business graduated from a horse cart to a Model T after World War I, allowing an expansion of the business as far as Smithtown, Long Island on the newly paved Jericho and Hempstead turnpikes and Northern Boulevard.

In 1926, wanting greater control over their business, the brothers opened their own coffee-roasting facility. This required moving from their original storefront at 116th Street and Atlantic Avenue to the present site. Their beans were hand-packed in five-pound (2.27 kg) bags at this time. As the coffee business changed, the company's salesmen bought their routes and became distributors and the company began to pack coffee in smaller one-, two-, and three-pound bags (0.45, 0.91, and 1.36 kg).

During World War II, coffee rationing was in effect. The supply of green beans from Brazil had become erratic due to threats to shipping and a series of droughts and freezes that had damaged the crop. However, American coffee drinking habits were changing. Just before the U.S. entered the war, Brazil dumped coffee on the U.S. market as European markets closed. The cheap price may have encouraged a taste for coffee as per-capita coffee consumption in 1953 had increased by one-third compared to pre-war levels. Instant coffee, developed for soldiers, provided the beverage in a novel, convenient form.

After the war, Abe and Morris ventured into the restaurant business in order to supply jobs for a son-in-law, cousin, and close friend returning to civilian life. Morris's son Herb took charge of the business in 1956 and oversaw the phasing out of the house-to-house business due to competition from supermarkets and to the loss of customers to suburban flight.

The business expanded in the 1960s by adding office coffee service and through acquisitions that continued through the 1980s. The factory was expanded with a roasting room and was expanded twice more in the 1980s to increase space for inventory. This matched the boom in coffee consumption, which peaked in the



The restored prize-winning buildings of Dallis Brothers Coffee on Atlantic Avenue. Gerald Weintein, Photo Recording Associates.

1970s at 33 gallons (125 L) per person (twice the 1953 level), fell somewhat during the 1980s, but picked up in the 1990s with the popularity of gourmet coffee and espresso drinks, a trend that Dallis Brothers Coffee has used to its advantage.

The family's third generation came on board with Herb's son David joining the business in 1982 and David's wife, Martha Bear Dallis, arriving in 1986. They were responsible for the opening of the charming 650-square-foot (60 m^2) retail coffee shop in 1990 in a restored Victorian building. The expansion also included space for the "Coffee Conference Center" to educate customers in the roasting, brewing, serving, and retailing of specialty coffees. They have developed a line of gourmet coffee beans, called Kudos, specifically to help small deli owners compete with coffee shops owned by large national chains. They also support their customers by distributing and servicing commercial coffee brewers and espresso machines. ■

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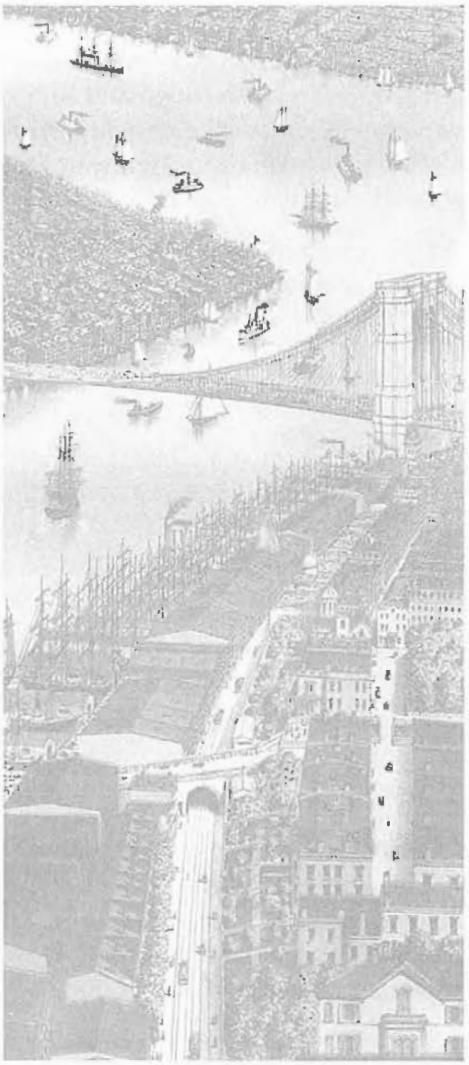

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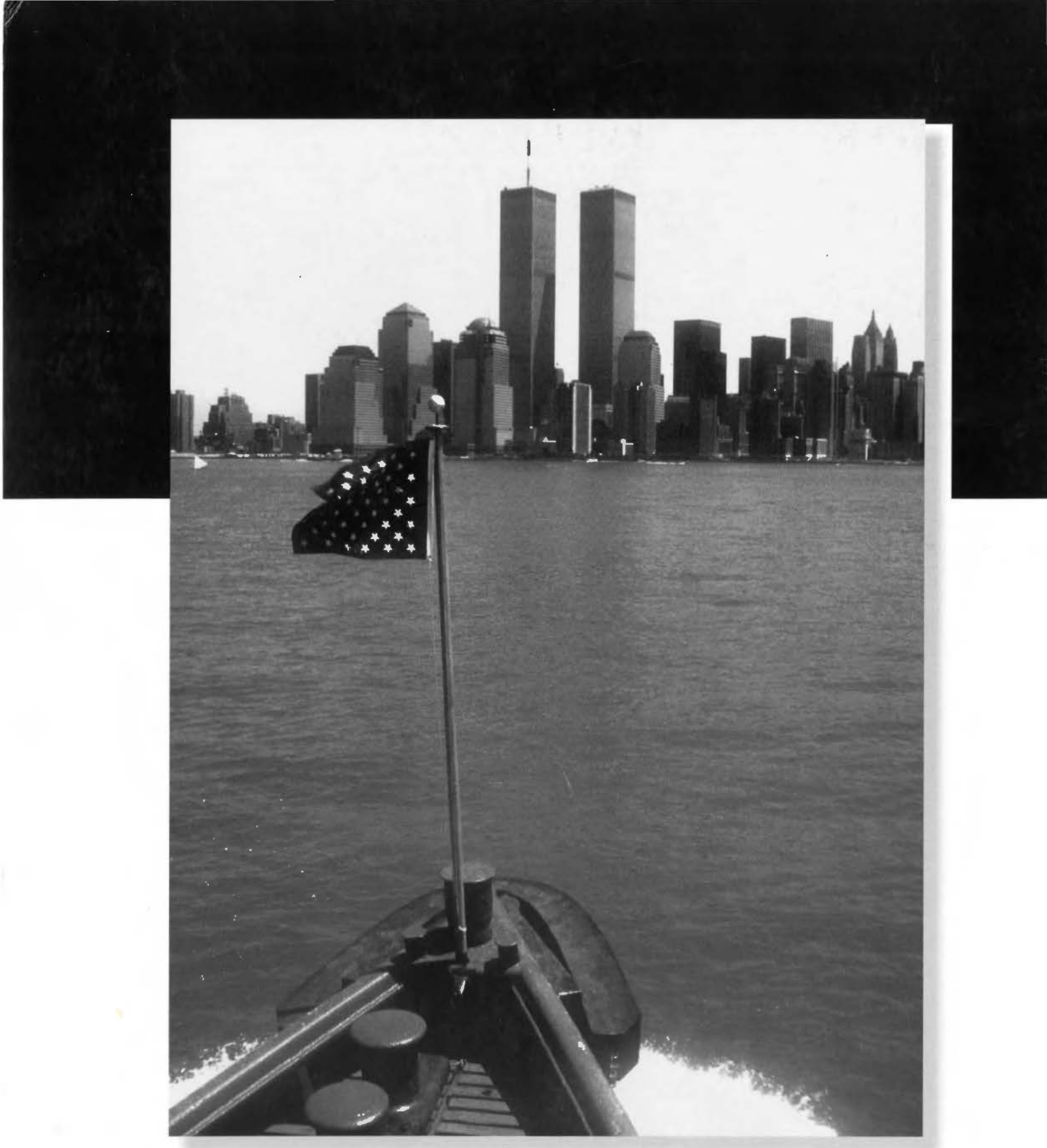

ROEBLING CHAPTER

SOCIETY FOR INDUSTRIAL ARCHEOLOGY