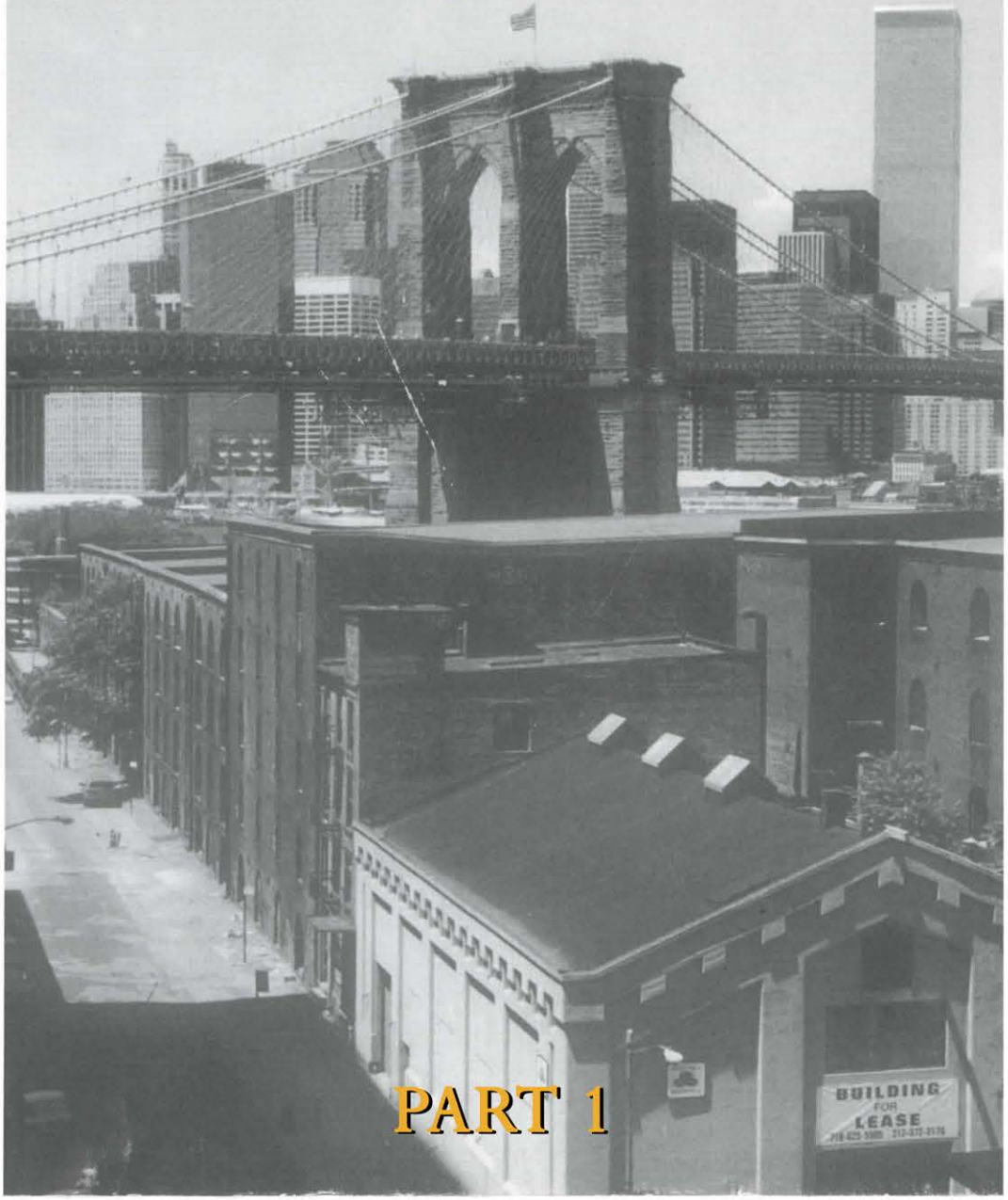
ROEBLING CHAPTER

SOCIETY FOR INDUSTRIAL ARCHEOLOGY

Brooklyn

31ST ANNUAL CONFERENCE

EAST of the RIVER SOUTH of the SOUND

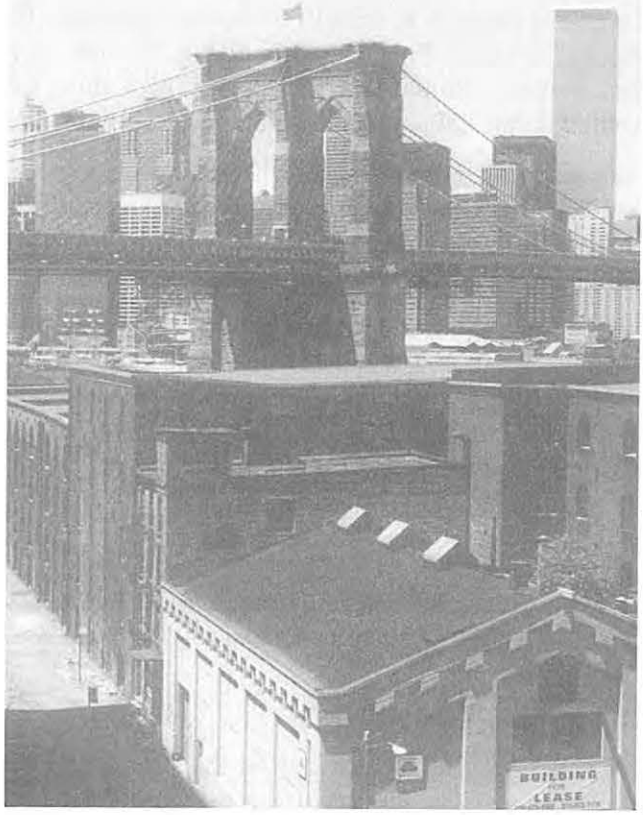


PART 1

Brooklyn

31ST ANNUAL CONFERENCE 2002

EAST of the RIVER SOUTH of the SOUND



ROEBLING CHAPTER

SOCIETY FOR INDUSTRIAL ARCHEOLOGY

NEW YORK, NY

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A NOTE ABOUT IMAGES

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THE SOCIETY FOR INDUSTRIAL ARCHEOLOGY

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EAST OF THE RIVER, SOUTH OF THE SOUND

East of the River, South of the Sound is the tour guidebook for SIA's 31st Annual Conference, held June 6-10, 2002, in Brooklyn, New York. This book is intended to provide a reference for those sites visited as part of the conference, but it does not claim to be a comprehensive catalog of all the industrial sites and structures in the area.

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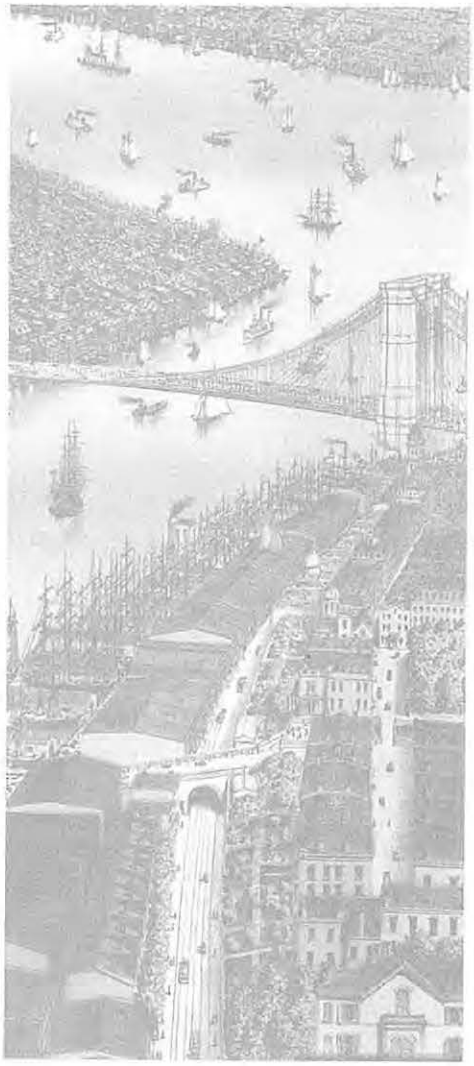

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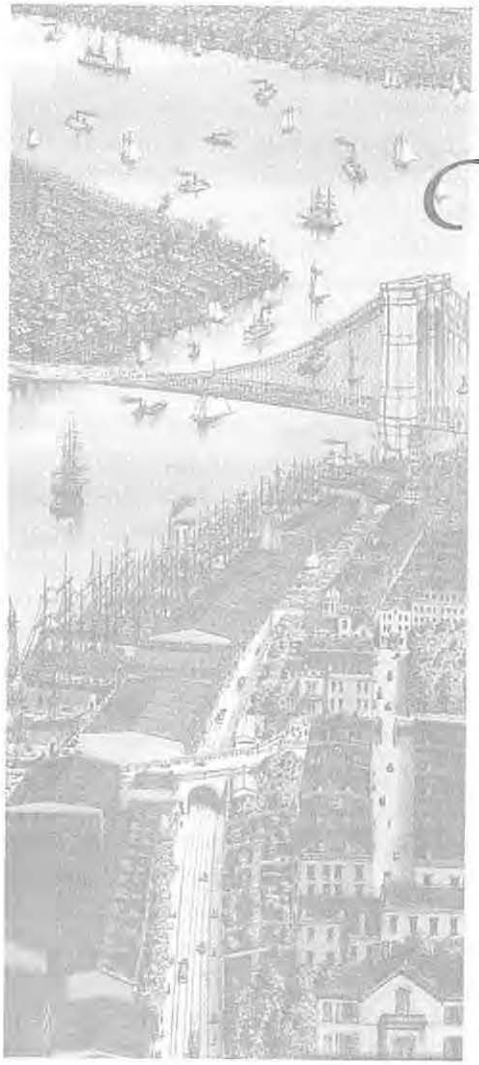


By Margaret Latimer

When Walt Whitman wrote in *Crossing Brooklyn Ferry*, "On the neighboring shore the fires from the foundry chimneys burning high and glaringly into the night," he was celebrating the burgeoning industrial development of Brooklyn in the mid-nineteenth century. Although outsiders tended to view Brooklyn as a quiet residential suburb, it was growing rapidly into one of the country's largest industrial centers. Enormous variety characterized Brooklyn industry, and while some manufactures exemplified long-standing reliance on skilled labor, others epitomized the country's most advanced technical innovations. In spite of precipitous declines through the second half of the twentieth century, Brooklyn's commercial and industrial base remains significant nationally.

New York City's borough of Brooklyn is situated on the southwestern corner of Long Island. The original mid-seventeenth century European settlement of what is now Brooklyn took the form of six towns, four Dutch and two English. Although England took control of the entire New York colony in 1664 and designated the six towns as Kings County in 1683, the Dutch influence remained strong for at least another century. Two of the Dutch towns, Breuckelen (Brooklyn) and Boswick (Bushwick), lay directly across the East River from New York City (which was then limited to the island of Manhattan). While the rest of Kings County slowly evolved as agricultural communities, the portion of these two towns closest to the river grew more rapidly as market centers. Brooklyn's market area was incorporated as a village in 1816, and in 1834, the entire town of Brooklyn was incorporated as a city. In 1855, Brooklyn annexed the town of Bushwick, what had become the city of Williamsburgh in 1851, just to the north of Brooklyn, and the Greenpoint section between Williamsburgh and Newtown Creek, which became the city's new northern boundary. The former Bushwick soon came to be known as Brooklyn's "Eastern District"; the "h" at the end of Williamsburgh did not disappear until the early twentieth century. With nearly 267,000 residents in 1860, Brooklyn became America's third-largest city and maintained that position almost until its consolidation with New York City in 1898.

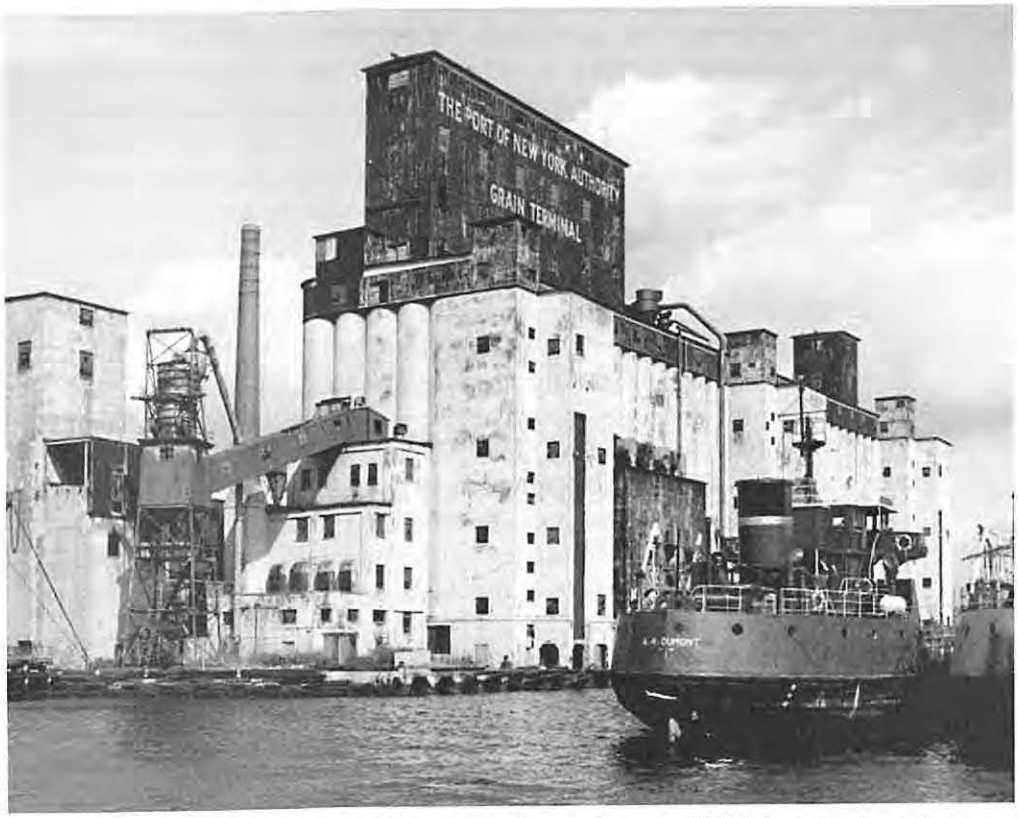
For more than seventy years, Brooklyn has been New York City's most populous borough (2.5 million in 2000). If still

independent, it would be the country's fourth-largest city. In 1950, Brooklyn's population peaked at 2.7 million. It then experienced significant decreases, reaching a low of just under two and a quarter million in 1980. Recent growth results from both new immigrant populations seeking employment and young individuals and families in search of affordable housing. Brooklyn has long been a harbor for immigrant populations. In the mid-1800s, nearly half of its population was foreign-born. Continuing ethnic diversity gives the borough much of its energy.

Kings County's industry developed largely along the East River shores of the towns of Brooklyn and Bushwick. Initial industrial presence occurred in Brooklyn's market area, where a ferry service to New York City had begun in the early 1640s. Over the next century and a half, a small community developed, and several slaughterhouses and meat markets, a brewery, a distillery, and a ropewalk located here.

The opening of the Erie Canal (1825), increased foreign commerce, and the emerging economic predominance of New York City greatly affected Brooklyn's industrial growth. Soon after Robert Fulton introduced steam ferry service from New York in 1814 came the incorporation of Brooklyn village and formal street mapping (1819). By the 1820s, more ropewalks, distilleries, and slaughterhouses; a number of factories producing such wares as white lead, glass, and glue; an iron furnace, two tanneries, and several warehouses; and some commercial shops had opened up in the ferry district. In 1801, the federal government purchased a shipyard just to the north on Wallabout Bay for the New York Naval Shipyard (Brooklyn Navy Yard). In 1825, at the southwestern corner of Kings County, construction of what would become Fort Hamilton began on the site of earlier fortifications.

New York City became even more prominent with the country's growing industrialization and a marked increase of maritime and railroad traffic. As New York's waterfront and industrial districts grew overcrowded, many manufacturers found it economical to move to Brooklyn. Entrepreneurs saw that Brooklyn's shore was ideal for such heavy and bulky industries as grain storage, sugar refining, and glassmaking. Owners often maintained their offices in New York; a short ferry ride across the East River took them to their plants. Between the 1840s and 1860s, two large port facilities were built in Red Hook in South Brooklyn. The protected dock areas of the Atlantic and Erie Basins were surrounded by masonry warehouses, and grain elevators served barges coming down from the Erie Canal. Development of the Gowanus Canal at the tip of Red Hook and Newtown Creek further extended the region's industrial capacity.



The Port Authority's Grain Terminal, shown here in 1984, is one of many terminal facilities surrounding Gowanus Bay. Gerald Weinstein, Photo Recording Associates.

The new activity generated a demand for a sizable workforce of laborers and skilled artisans. An Apprentices Library, founded in 1823, offered educational stimulation to local workers. Emerging as the literary center for the entire village, it also was the antecedent to many of Brooklyn's major cultural insti-

tutions. By the 1840s, thousands of immigrants had arrived, many seeking employment in factories and on the waterfront.

The thriving community also required an appropriate urban infrastructure. A dozen new ferry routes were established in Brooklyn and Bushwick between the mid-1820s and 1850s, and a steam railroad running from the harbor through Brooklyn to Jamaica, Long Island, began operation in 1836. The Brooklyn Gas Light Company began operation in 1849, and the Brooklyn City Railroad Company introduced horse-drawn street railways in 1854. A Board of Water Commissioners established a new supply system with a series of reservoirs on Long Island, beginning with the Ridgewood Reservoir in 1858.

As the old ferry district and the South Brooklyn waterfront also became filled to capacity, more new enterprises concentrated along the shores of the Eastern District. Christian Dorflinger, for example, established glass works first near the Navy Yard and then in Greenpoint. The Continental Iron Works in Greenpoint was best known as the builder of the *Monitor*, the U.S. Navy's first ironclad warship. (It was outfitted at the Navy Yard.) Charles Cartlidge relocated from Staffordshire, England, to New York City and then to Greenpoint, winning an enviable first prize for his fine porcelain at the "Crystal Palace" exhibition in 1853.

Manufacturing employment in Brooklyn reached almost 14,000 by 1865, and many more thousands worked in related service industries. More than 6 miles (10 km) of docks, warehouses, basins, grain elevators, dry-docks, and freight terminals lined the waterfront from Gowanus Bay in South Brooklyn north to Newtown Creek.

In the last decades of the nineteenth century, Brooklyn was handling more waterborne tonnage than New York. More large-scale companies moved into the Eastern District, including Pfizer Pharmaceuticals, printing firms (D. Appleton, A. S. Barnes, and McLoughlin Brothers), oil refineries (the largest being Pratt Astral Oil, later part of the Standard Oil

Company), and iron foundries (Hecla Architectural Iron Works and Cheney & Hewlett). Entrepreneurs Charles Pratt and Alfred T. White built apartment blocks for their workers. By 1890, with more than 10,000 factories, 110,000 workers, and goods valued at $269 million, Brooklyn ranked as the nation's fourth-largest industrial city.

Transportation advances accompanied industrial growth. A state-authorized survey commission published a street plan for much of the rest of Kings County in 1874. The Brooklyn Bridge, the first physical link between New York and Brooklyn, opened in 1883. Steam railroads succeeded the horsecar lines. In the 1860s and 1870s, railroad owners extended their lines out to the county's beaches, where they constructed lavish hotels. Construction began on a network of elevated railroad lines in the mid-1880s. As the railroads reached the county's outlying areas and residential population rose, the city of Brooklyn annexed the other towns. Street railways were electrified in the mid-1890s; over-extension of company finances and deteriorating working conditions, however, led to a volatile strike in 1895.

Brooklyn industry of the nineteenth century was known for the introduction of innovative methods of production and organization. Dorflinger, for example, was utilizing extensive division of labor in his glassworks; at the same time, working conditions were often unsafe, and about forty percent of the work force were children. Operations in Appleton's Williamsburgh plant were substantially mechanized by the mid-nineteenth century. Hecla, which fabricated important elements of many New York structures, established an evening school to improve the quality of design and construction.

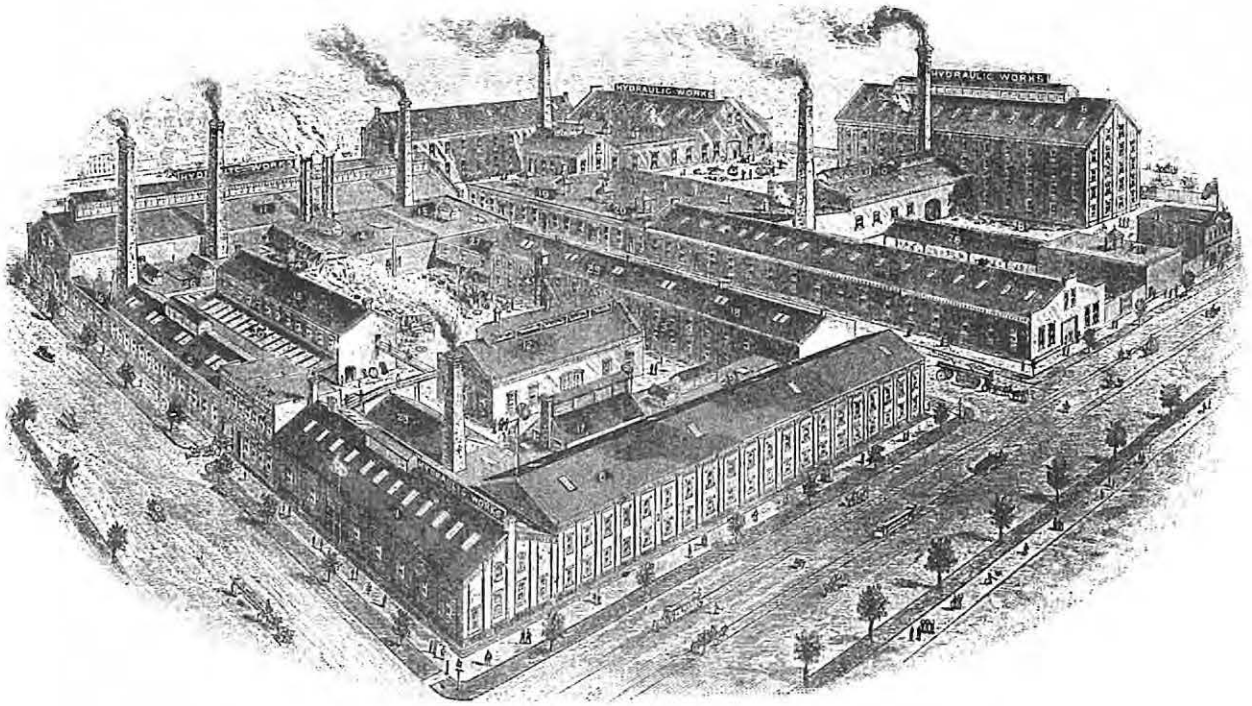
The turn of the twentieth century saw further growth of residential and industrial Brooklyn. Its population passed one million. Subways from Manhattan reached the borough in 1908. Two more bridges crossed the East River. The takeover of many transit lines by the Brooklyn Rapid Transit Company (later the Brooklyn-Manhattan Transit Company or BMT) led to improved connections between numerous routes.

Brooklyn industry continued to flourish. As American journalist Julian Ralph wrote in an 1893 issue of *Harper's New Monthly Magazine*, "There is a view of Brooklyn which gives it the appearance of a smoky seat of manufactures." Companies sought space in industrial complexes such as Bush Terminal (1902) that combined docking, manufacturing, warehousing, and transportation functions. In the 1920s, Brooklyn had more than 165,000 factory workers. The freight railroads operated free lighterage service across New York harbor to maintain access to Brooklyn's port facilities and keep its industry competitive. The Pennsylvania Railroad constructed a car-float terminal at 65th Street and extended its Bay Ridge Line through Brooklyn, into Long Island City, Queens, and across the Hell Gate Bridge. South Brooklyn received another boost when the U.S. Army built the huge Military Ocean Terminal (Brooklyn Army Terminal, 1919) between 58th and 64th Streets. During World War II, the Navy Yard operated around the clock, employing 70,000 men and women. Businesses such as the New York Dock Company consolidated ownership of various facilities. Many firms also found sites for their plants away from the waterfront.

New modes of transportation replaced the old. The Fulton Ferry ceased operation in 1924. The Independent Subway (IND) reached Brooklyn in 1933, replacing several elevated lines. New York City's first municipal airport, Floyd Bennett Field, opened in 1931. Beginning in the 1940s under Robert Moses' command, large swaths of Brooklyn neighborhoods were demolished and split apart with the construction of the Gowanus and Brooklyn-Queens expressways and the Brooklyn-Battery Tunnel. Brooklyn's last bridge, the Verrazano-Narrows Bridge, opened in 1964.

After a decade of postwar prosperity, the borough suffered serious population and industrial decline, symbolized by the loss of both Brooklyn's major newspaper, the *Brooklyn Eagle*, in 1955 and the Brooklyn Dodgers in 1957. Manufacturing employment peaked at more than 235,000 in 1954, but then began falling through the '60s, dropping to less than 120,000 by the late 1970s. Companies sought larger expanses of vacant land; cheaper labor, utilities, and transportation; and lower taxes and special tax credits. Whole industries such as shipbuilding and brewing simply abandoned the borough. In late 1950s, the Port of New York Authority purchased and renovated two miles (3.2 km) of deteriorating waterfront south of the Brooklyn Bridge, but it was underutilized for lack of adequate container facilities. The Brooklyn Navy Yard closed in 1966. By the 1970s, large areas of industrial Brooklyn were desolate. New technologies, public policy, and corporate consolidation all were working against the survival of urban industry.

Both the public and private sectors have endeavored



The Henry R. Worthington Hydraulic Works in Brooklyn, ca. 1884. **From Worthington Pumping Engines, Steam Pumps and Hydraulic Machinery Catalog, *1884*. *Courtesy archiveofindustry.com.***

to revitalize Brooklyn's depressed industrial sector. Neighborhood industrial development corporations are encouraging the start-up or relocation of firms. Efforts also include finding new uses for vacated sites. In the late 1970s, the Lutheran Medical Center spurred the renewal of the Sunset Park area of South Brooklyn through its conversion of the former American Machine & Foundry Company into a modern 532-bed facility. Prior to September 2001, the Port Authority of New York and New Jersey and New York State and City were giving high priority to rebuilding the waterfront to the south and north of the Brooklyn Bridge. There were even proposals for a freight railroad tunnel to Staten Island or New Jersey. Several barges have been transformed into cultural facilities. And the abandonment of factory and warehouse districts is providing studio space for artists and skilled craftspeople.

For several centuries, Brooklyn products have been well known throughout the country, but as Julian Ralph pointed out, "many of the goods that the people of the country buy as of New York make are really made in Brooklyn." Barton's Candy; Domino Sugar; Dutch Boy Paint; Eberhard Faber pencils; Knox Hats; Rheingold Beer; Sperry Gyroscopes; Squibb pharmaceuticals; Standard Oil; Topps Chewing Gum; Worthington steam pumps; Yuban coffee; films such as Little *Nemo, Do the Right Thing*, and *Saturday Night Fever*; and the battleships *Maine* and *Missouri* are just a few of the items that can claim the label, "Made in Brooklyn."

Even a Brooklyn burying ground – the grand Victorian Green-Wood Cemetery – contains the graves of many associated with American industry as well as some whose words or images have championed its technological creativity. They include: James Gordon Bennett, James Bogardus, DeWitt Clinton, William Colgate, Peter Cooper, Nathaniel Currier, Marcus Daly, David Bates Douglass, John Ericsson (for a time), Eberhard Faber, Horace Greeley, various Havemeyers, Charles Higgins, Elias Howe, Walter Hunt, James Merritt Ives, Leonard Jerome, Frederick Otto Kampfe, Edwin Clark Litchfield, Pierre Lorillard, John and Clarence Mackay, John Matthews, John McComb, Jr., Samuel F. B. Morse, J. Wrey Mould, Charles Pfizer, Henry J. Raymond, James Renwick, Jr., Elmer Sperry, Edward Squibb, David Stewart, Richard M. Upjohn, Webb family members, George Washington Whistler, and Stephen Whitney.

Surviving artifacts of Brooklyn – that "neighboring shore" – provide much rich testimony about its industrial past. From Java Street to Force Tube Avenue, and from DUMBO (Down Under the Manhattan Bridge Overpass) to Coney Island, Brooklyn's technological accomplishments are distinguished by the merging of past mementos with present vitality. ■

Downtown Brooklyn

Brooklyn Borough Hall – 209 Joralemon Street	**1**
Fireboat House at Fulton Ferry – Old Fulton Street & Water Street	**2**
DUMBO Neighborhood	**3**
Vinegar Hill Neighborhood	**4**
P.S. 157 *(Franklin School)* – 850 Kent Avenue	**5**
Cascade Laundry – 835 Myrtle Avenue	**6**
Pratt Institute Power Plant – 200 Grand Avenue	**7**
Gowanus Canal	**8**
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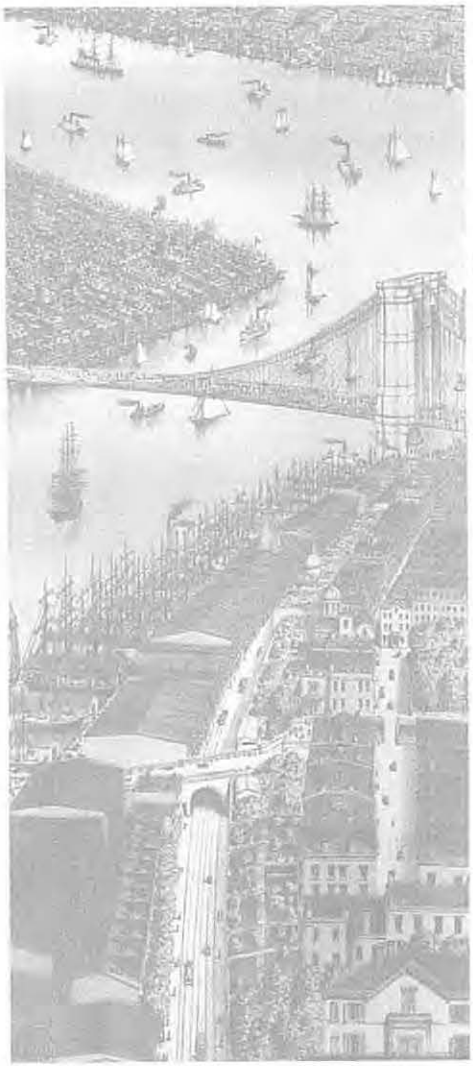
CHAPTER ONE
DOWNTOWN BROOKLYN AND BEYOND



INTRODUCTION

By Margaret Latimer

Brooklyn's first "downtown" was the area along the East River closest to New York (lower Manhattan). By 1814, when Robert Fulton began his steam ferry service there, the area was developing into a bustling market and industrial center for all of Kings County. Foreseeing the ferry's potential, local entrepreneur Hezekiah Pierpont bought up much of the heights south of the ferry for residential development.

After Brooklyn became a city in 1834, Pierpont convinced the city fathers to erect a city hall partly on his property at the eastern end of Brooklyn Heights. Completed in 1848, the city hall stimulated the founding of new cultural institutions in the Heights. Other public buildings, financial institutions, and newspaper offices rose around the city hall. Schools such as the Brooklyn Collegiate and Polytechnic Institute, opened nearby.

As the residential areas nearest the East River filled up, new communities emerged: the hill now known as Fort Greene and Clinton Hill to the east of City Hall, and South Brooklyn to the south. Edwin Clark Litchfield was the principal incorporator of the Brooklyn Improvement Company, established in 1866 to develop the Gowanus Canal in South Brooklyn. New schools, such as oil baron Charles Pratt's pioneering technical institute, opened in Clinton Hill.

Fulton Street became a major thoroughfare, being the main road from the ferry to the civic center, running between the hill and South Brooklyn, and passing close by the Brooklyn Bridge. By the early 1880s, retail stores such as Wechsler & Abraham (later Abraham & Straus), and eateries such as Gage & Tollner, established themselves on Fulton Street.

Brooklyn's center of population continued to move further east and south. After a fire destroyed its building in the Heights, the Brooklyn Academy of Music (BAM) constructed a new facility in 1908, close to the Long Island Rail Road's Atlantic Avenue terminal. Street railroad suburbs developed along the grand Prospect Park, including the neighborhood now called Park Slope. Even before the park was completed in 1873, speculative builders were constructing rows of townhouses in the popular architectural styles of the day. Litchfield was one of the earliest

investors. The museum, botanic garden, and main public library all located adjacent to Prospect Park.

Fulton Street remained Brooklyn's retail center, and, around the turn of the twentieth century, peaked as one of the country's largest. In the late 1970s, the city erected a mall several blocks long in an effort to stem a serious business decline. The present Polytechnic University was the catalyst for the development of MetroTech, a technology office center begun in the early 1990s north of Fulton. Abraham & Straus is now a Macy's. Downtown revitalization is expanding along Fulton Street to the east of the mall and to the Atlantic Terminal area around BAM.

Many of the structures in Brooklyn's original downtown have survived, intact, bypassed by long approaches to the Brooklyn and Manhattan bridges and finally deprived of ferry service. This long-dormant area was rediscovered in the last decades of the twentieth century. The factories, warehouses, and rowhouses of Fulton Ferry and its neighbors to the north, DUMBO (Down Under the Manhattan Bridge Overpass) and Vinegar Hill, have become vibrant havens for artists and other urban dwellers seeking new adventures. ■

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Downtown Brooklyn, with 1848 Borough Hall at center. Estelle Haferling.

BROOKLYN BOROUGH HALL

By Margaret Latimer

Soon after Brooklyn was granted a city charter in 1834, local officials hurried to select a site for a city hall: up the hill from the Fulton Ferry and somewhat inland at the junction of Fulton, Joralemon, and Court streets, appropriately located between the former village area to the west and newly developing communities to the east. The press intimated that the two entrepreneurs who sold the land to the city owned considerable property in the vicinity and undoubtedly envisioned the substantial development such a structure would stimulate. In 1835, New York architect Calvin Pollard won the design competition for the building. His plan called for an imposing, Classical-Revival edifice, a smaller imitation of Mangin and McComb's New York City Hall. Work began based on a revised, somewhat trimmed-down Pollard structure, only to be halted during the financial panic of 1837 with just the foundations in.

Construction did not resume until 1846. With changing fashion and several other proposals rejected, this time it followed a slightly less pretentious Greek-Revival scheme by Brooklyn grocer-turned-carpenter Gamaliel King. The rectangular building is sheathed in Tuckahoe marble. A shallow entrance portico, with six, three-story-high Ionic columns supporting the entablature and pediment, is set above a steep flight of steps facing an open plaza to the north. A grand, Doric-columned, two-story central space – the Rotunda – also faces the plaza. Completed in late 1848, City Hall was prominent in the landscape for several decades until other larger civic and business structures were erected around it. A lively civic center and downtown emerged, and from the 1890s until 1941, elevated trains rattled by along Fulton Street.

Fire destroyed the original wooden cupola in 1895. By the time it was replaced in 1898, Brooklyn's consolidation with New York City had taken place, and City Hall became Borough Hall. Vincent C. Griffith and the New York firm of Stoughton & Stoughton designed the new, cast-iron cupola in the Beaux-Arts style.

Over the years, as Brooklyn's population moved further away from downtown, the building suffered structural deterioration, and, depending on the clout of the reigning Mayor or Borough President, received an occasional facelift. In the 1950s, urban renewal came to the civic center, and much of Fulton Street was destroyed to become part of an extended pedestrian plaza. In the 1980s, Conklin Rossant Architects supervised an extensive restoration of Borough Hall. In recent years, a weekly farmer's market on the plaza at the base of the portico steps has brought considerable activity back to the site. ■

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North portico, Brooklyn Borough Hall. Mary Habstritt.

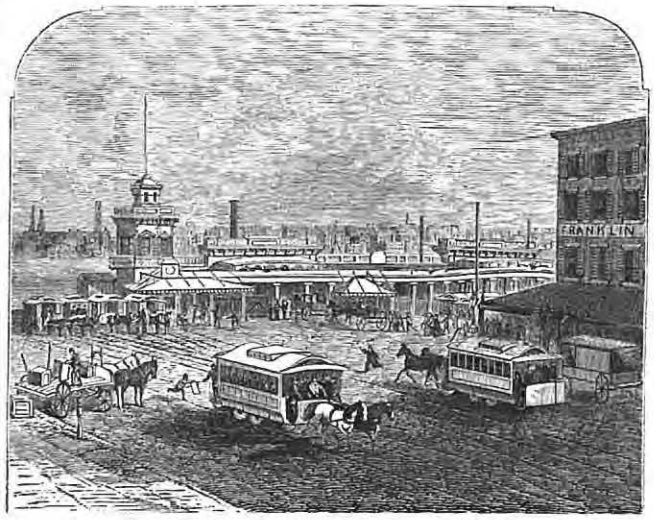
FIREBOAT HOUSE AT FULTON FERRY

By Terry L. Bailey

Brooklyn's earliest settlement by the Dutch occurred in the early seventeenth century, around what became the Fulton Ferry landing. Ferry service began in 1642 and traffic quickly increased as this became the main route for Long Island farm products to be transported into Manhattan. The busy ferry landing flourished and the area teemed with activity long before the Revolution. The Brooklyn landing also has significance as the site of an important retreat by George Washington during the war. Robert Fulton's steam ferry, which started service in 1814, gave its name to streets on either side of the East River. Although Manhattan's Fulton Street has retained this name, the northern portion of its Brooklyn counterpart endured a stint as Cadman Plaza West from the 1950s until the late 1970s, when a portion was renamed Old Fulton Street.

In 1865, a large ferry house was built at the landing, and by the time the Brooklyn Bridge was nearing completion, the ferry was shuttling some 53 million people across the river every year. The neighborhood was home to numerous insurance companies, banks, and professional offices. Brooklyn's major newspaper, the *Brooklyn Eagle*, which Walt Whitman wrote for and eventually edited, was located at two different addresses (since demolished), 25 and 28 Fulton Street.

The Brooklyn Bridge's opening in 1883 sounded a death knell for the neighborhood as the traffic from which it had prospered now bypassed it. The lack of economic activity, however, has helped preserve buildings from the pre-bridge era. The blocks of Old Fulton Street contain some of the few remaining Greek revival commercial buildings remaining in all of New York. On the waterfront are the Empire Stores, warehouses dating to 1870. Ferry service continued for some time after the bridge opened, but was discontinued in 1924 and the terminal torn down.



The Ferry House (razed) at the Foot of Fulton Street, built in 1865. From* Historical Sketch of the Fulton Ferry, and Its Associated Ferries, *1879. Courtesy archiveofindustry.com.

In 1931, a shingle-covered frame structure was built as a fireboat house, with a tower used for drying hoses. At the time it opened, the Fire Department owned a total of ten fireboats and four tenders and was responding to a total of 5,968 marine fire calls per year. Records indicate that Engine Company 77 and its fireboat *Abram S. Hewitt* (1903-1958) were originally stationed here. The *Hewitt* had a length of 117 feet, a beam of 25 feet, a draft of 9.5 feet (35.7 m, 7.6 m, and 2.9 m), and a pumping capacity of 7,000 gallons per minute (440 L/sec).

In 1938, the fireboat *Fire Fighter* was assigned to the post. The brand-new boat had a length of 134 feet, a beam of 32 feet, a draft of 9 feet (40.8 m, 9.8 m, and 2.7 m), and a pumping capacity of 20,000 gallons per minute at 150 psi (1,260 L/sec at 1,030 kPa). The *Fire Fighter* went on to become a famous and decorated fireboat and is still in service from its current base on Staten Island. The Fire Department decamped from Fulton Landing in the 1970s and for several years the building housed the now-defunct Fulton Ferry Museum. The building was recently renovated and re-opened as the Brooklyn Ice Cream Factory. ■

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DUMBO NEIGHBORHOOD

By Thomas Flagg

DUMBO is an acronym for Down Under the Manhattan Bridge Overpass, and is the current nickname for the industrial neighborhood east of Old Fulton Street. In the 1980s, Manhattan's Soho (South of Houston Street) district became fashionable and pricey, and the artists whose presence had made the place fashionable in the first place could no longer afford to live there. A number of them moved to this area of Brooklyn, joining others who had moved in earlier as industry in the area declined.

Though other names, such as the Jay Street Terminal District and Gairville, have been used in the past, none of them has stuck; perhaps this one will, especially since the DUMBO Industrial District was added to the National Register of Historic Places in 2000. The western edge of the area, including the Empire Stores, was included in the Fulton Ferry Historic District, designated by the New York City Landmarks Commission in 1974, and that area is often referred to as "Fulton Landing."

The land between Fulton Ferry and Wallabout Bay (which became the Navy Yard) was purchased by the Sands Brothers in 1784, who platted it and named it Olympia, hoping to attract settlers. They lost control of the land after 1801 and others gradually extended the shoreline by filling and built brick warehouses. In 1869, a major fire destroyed these buildings, and the present Empire Stores were erected in 1870 and 1885. They were built in the classic "Brooklyn Stores" fashion, and were used to store raw materials such as coffee beans, animal hides, grains, raw sugar, and molasses.

The rest of the neighborhood filled up with miscellaneous industrial structures, the larger ones using classic mill construction: wooden frame interiors and masonry facades. In 1887, Robert Gair decided to relocate his packaging business from Manhattan to this area of Brooklyn, and acquired six city blocks. He moved into his first building, of mill construction, in the summer of 1888. Gair's innovations, such as corrugated cardboard, together with his marketing ability, were major factors in the country's transition from the "pickle barrel" to pre-packaged foods.

By about 1900, his success forced him to plan a major expansion, but timbers big and strong enough for the building he had in mind had become scarce. His son, George Gair, turned to DeForrest H. Dixon and Henry C. Turner of the Turner Construction Company. These two engineers had worked for Ernest Ransome, the pioneer of reinforced concrete in the U.S., and then formed their own company in 1902. Dixon sold the Gairs on reinforced concrete construction and the Gairs convinced their architect, William Higginson, to try it. Higginson went on to become a leading architect in reinforced concrete construction, designing most of the Bush Terminal buildings.

The new building, at 55 Washington Street, became Gair No. 3. Work started in September 1904, but was delayed by the city building department, which required

One of the Robert Gair Company buildings under construction in 1916. Turner Construction Company. Courtesy archiveofindustry.com.

DUMBO when it was Gairville. Courtesy archiveofindustry.com.

proof that this new material was sound. So a small reinforced concrete structure was set up on the site and subjected to a four-hour fire, water, and load test. During this demonstration, the temperature in the building averaged 1,700 degrees Fahrenheit (930 °C) and water was applied at 60 psi pressure (410 kPa) for four minutes at a time. The building "stood up like steel plate" and the permit was granted. Completed in 1905, Gair No. 3 was, at 170,000 square feet (15,800 m^2) and nine stories, the largest reinforced concrete building in the U.S. up to that time. Gair, evidently pleased by this building, immediately began doubling it, eventually filling the block with what appears to be a single building. This was the first of Turner Construction's multi-storied reinforced-concrete factory loft buildings. It started that firm on a spectacular career in which it built most of the large loft buildings in the industrial areas of the region. Turner is still a major construction firm.

By 1915, five other buildings had been constructed for Gair by Turner Construction, with Higginson as architect. One of these was Gair No. 7 at 1 Main Street, completed in 1914. Often called the Clock Building, it is a sixteen-story structure measuring 200 by 125 feet (61.0 by 38.1 m). According to the Real Estate Guide and Record, this wave of construction "changed the neighborhood from a district of obsolete warehouses, squalid tenements, and buildings of a decidedly questionable character" to a group of solid and safe factory and warehouse towers.

Gair was not the only major industrialist here. The Arbuckle brothers opened a coffee roasting plant on Jay Street in 1891 and a sugar refinery in 1897. Around 1905, they built the Jay Street Connecting Railroad to provide switching service for their railroad cars, and to serve other industries nearby. At a small yard at the foot of Jay Street its float bridge provided connections to the main-line railroads. From here, tracks were laid in the streets to serve many of the buildings in the dis-

trict, as well as a team yard north of Empire Stores. The line probably reached its maximum length by 1917, handling 700,000 tons (635 million kg) of freight per year.

In 1919, the Gair company decided to consolidate its manufacturing business elsewhere, and emptied most of its buildings. Its real estate holdings were spun off as Gair Realty Corporation and the buildings filled with a variety of small manufacturers. Industry in the area declined after World War II. The Jay Street rail line was abandoned in 1959. Consolidated Edison bought the site of the railroad yard and made it into an electric switching yard, adjacent to its large Hudson Avenue power plant. The Empire Stores went out of service in the 1950s and have been mostly vacant since, though many plans have been put forward for their reuse.

In 1981, real estate developer David Walentas fell in love with the area and bought up many of DUMBO's buildings. He is pursuing his own vision for the area, to include luxury residences, galleries, studios, hotels, and high-tech companies. Some in the community would prefer a less commercial future, retaining traditional industries along with lower-key artists and residents. ■

VINEGAR HILL NEIGHBORHOOD

By Estelle Haferling

The area presently encompassed by the Vinegar Hill Historic District, located at the westernmost part of Wallabout Bay, originally was settled by the Dutch Walloons in the 1630s. It lies to the east of DUMBO and to the west of the Brooklyn Navy Yard. Various real estate transactions resulted in the Sands brothers, Joshua and Comfort, selling a portion of the land to the U.S. Navy in 1801. Their surname lives on in Sands Street. Another developer, John Jackson, named the district Vinegar Hill, for a battle that the Irish lost against the British in 1798. (His name did not survive as a street name; Jackson Street became Hudson Avenue.) As Jackson had hoped, Irish immigrants came to the area to work in the Navy Yard and nearby factories and as house staff in wealthier neighborhoods like Brooklyn Heights. The area was also known as the Navy Yard District and as Irish Town.

The area contains vacant lots and a patchwork of historic houses, such as the row houses along Hudson Avenue and Front Street; undesignated but quite old industrial structures; and a public housing project. It has been described by some as a backwater, but was the first working-class neighborhood to receive designation as a historic district from the New York City Landmarks Preservation Commission in 1997.

Vinegar Hill is an example of a neighborhood disrupted by urban renewal and by highway construction. Whereas in DUMBO, construction of the East River bridges demanded demolition of buildings at an early date, wide swaths of Vinegar Hill were cleared during the mid-twentieth century for public housing and for automobile-related development. The latter included not only the Brooklyn-Queens Expressway (BQE) as it curved under the Brooklyn and Manhattan bridge approaches onto the Park Avenue viaduct, but also access ramps between the highway, the bridges, and local streets. Unlike passengers on elevated trains of the previous era, drivers on the viaduct typically do not pay much attention to the neighborhood passing quickly by them.

The neighborhood also provides evidence of what can happen when insufficient attention is paid to treasures in our midst and when poverty results in a lack of political clout. On the other hand, the lack of atten-

A typical Vinegar Hill rowhouse, with the Hudson Avenue power plant stacks beyond. John Bartelstone

tion has resulted in the survival of houses from the early nineteenth century and street scenes that call for remembrance in watercolors, oil paintings, or photographs. There are surprises in this place of contrasts: five smokestacks looming ahead let you know that this is a place of power, but as you ascend the hill, there are cobblestone streets, lilac bushes, and the twitter of birds hard by a water treatment plant. The Commandant's House (1806) overlooks a place where war ships were built and repaired. Here in this place where streets end abruptly, being out of the way can have its benefits.

Like many of Brooklyn's waterfront neighborhoods, Vinegar Hill had a mix of residential and industrial – but nothing comparable to DUMBO's Gair buildings to hold off the wrecker's ball. The "black arts" were represented by Benjamin Moore Paints on Front Street, located in a former warehouse designed by the established Brooklyn architect, William Tubby, in 1908. It was not far from the National Lead Company, down by the river, or John Masury Paints & Varnishes. Sterno lights were made by Sternau on John Street and packaged with Sweeney Manufacturing Company's nickel-plate warmers at Water and Main streets in DUMBO. Borax soap also was made here, the manufacturer leaving vast vats rising five stories and two bays wide. Lampshades and fasteners, boxes and candies too, were produced here. Several blocks to the north of Sands Street, industry of another sort took place in the tattoo parlors, brothels, bars, and gambling halls. Sailors knew where to go when on leave.

Brillo sign on John Street. Estelle Haferling.

When Consolidated Edison's Hudson Avenue Power Station was built in 1924, it was the largest steam electric power station in the nation, capable of generating 770 kW. A switching yard takes up several blocks to the west and south, having replaced the National Lead Company and portions of the Jay Street Connecting Railroad's terminal. Signs on the chain link fence warn of the dangers of the nearby high-voltage lines; the danger from the lead company which occupied this space previously may never have been so clearly recognized. Utility covers in the streets nearby provide the initials of the predecessor companies: Brooklyn Edison Company (B. E. Co.) and Edison Electric Illuminating Company (E. E. I. C.) A map of the area also shows the Kings County Electric Light Company to the west of National Lead.

The Eskimo Pie Building at Bridge and York Streets was designed by Canadian architect Louis Jallade for the Thomson Meter Company and built in 1909 using the Hennebique system of reinforced concrete construction. The rough concrete finish on its exterior is lightened by vividly colored terra-cotta ornament and arched window openings. The structure remains in use, even if in outward disrepair. Because it is adjacent to the Farragut Housing Project (1953), it may have had a harder time getting respect and is not landmarked.

Still visible along York Street are the granite footings for the first elevated line established in 1885 by the Brooklyn Elevated Railroad, which ran along Park Avenue and other points east, south, and west (to Fulton Ferry). It was known as the "Old Main Line" and operated increasingly deeper into Brooklyn as the line was extended. Service on this line ended in 1904. ■

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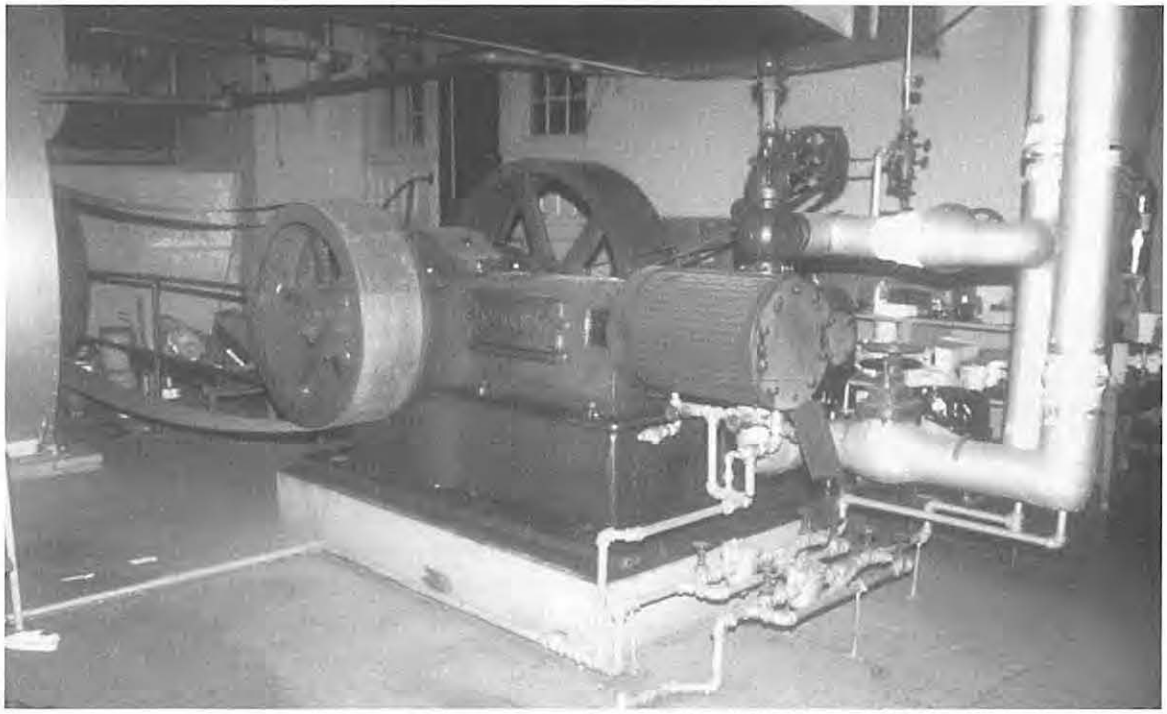
P.S. 157 (FRANKLIN SCHOOL)

By Conrad Milster

The New York City school system is sometimes criticized for the age of its buildings, when in fact structures erected 75 or 100 years ago were models of design and construction excellence. Most schools of this vintage were originally fitted with "high pressure" boilers. In this case "high" means an operating pressure greater than 15 psi (100 kPa), as compared to high-pressure industrial boilers, which ran from 25 to 50 psi (175 to 350 kPa). In the schools, steam was used to operate boiler feed pumps, simplex air compressors, and fan drive engines. These latter were usually low power, 5 to 15 horsepower (50 to 150 kW), due to the low steam pressure carried. They drove large-diameter, slow-speed ventilating fans. In the winter, engine exhaust went into the heating system.

School boilers typically burned hand-fed hard coal. The last coal-fired school boiler did not shut down until April 2001. About ten years ago, the city began a massive replacement program that eliminated hundreds of coal-burning boilers, many – if not most – of which were still in excellent condition. Many of the new boilers have been plagued with tube failures, explosions, gas leaks, and other problems. The engines were usually, but not always, removed at the same time.

New York City Public School 157, also known as the Benjamin Franklin School, is an elementary school located between the Navy Yard and Pratt Institute. The building, which dates to around 1907, still has three fan engines with one still belted to its fan, although they are no longer used. The coal-fired horizontal-return tubular (HRT) boilers were replaced two years ago by packaged scotch gas-fired units. ■



Lycoming steam engine driving fans at P.S. 157. Conrad Milster.

CASCADE LAUNDRY

By Conrad Milster

Brooklyn's industrial base once needed hundreds of steam engines to power its machinery. Until the late nineteenth century, belts and shafts were the principal method of power transmission. As the electric motor became more efficient and reliable, transmission of electrical power (still often generated on site) gradually replaced the less efficient line shaft systems. Whether driving belts directly or generating power for electric motors, a small number of steam engines remain in Brooklyn. Because the main economic criterion in choosing a reciprocating engine was usually whether the engine exhaust's waste heat could be recovered, steam power has survived longer in hospitals, laundries, and other plants where waste heat could be used to meet process requirements.

The Cacade Laundry powerhouse, facing Marcy Avenue. Gerald Weinstein, Photo Recording Associates.

One notable example is Cascade Laundry, established in Brooklyn in 1898 by Russian immigrants Charles and Sarah Bonoff. They began the business as Brooklyn Coat & Apron Supply Company, renting clean white aprons and protective coats to neighborhood butchers and providing laundry service. In 1904, Cascade Steam Laundry was incorporated and, in 1906, the Myrtle Avenue property was purchased. The company now has connections with plants throughout the U.S., but its main plant is still located in Brooklyn. The laundry industry, like so many others, has undergone major changes in the last twenty-five years as people have increased their use of "disposables," from work clothes to diapers. Today their main business is "industrial," primarily uniforms for the barber, beauty, and restaurant trades.

The early history of the Cascade plant is uncertain. During the 1920s, several horizontal uniflow engines driving 230-volt DC generators were installed. Later, a six-cylinder Chicago Pneumatic diesel was added, together with a power distribution panel in the southeast corner of the plant. This equipment remained in use even after DC had been phased out of industry in general during the 1950s.

In the 1970s, the Cascade plant's then Chief Engineer, Anthony Bowser, embarked upon a modernization plan. Several second-hand diesels were reconditioned and installed to drive alternators, their waste heat making hot water. In 1981, a second-hand two-cylinder Skinner vertical Unaflow engine was installed. Its cylinders measure 18.5 by 18 inches (470 by 457 mm) and it runs at 327 rpm, driving a 600-kW alternator. It was normally run at 400 to 425 kW load and its waste steam made twenty-five to thirty thousand gallons (95,000 to 114,000 L) of hot water per day. The Skinner replaced all but one of the horizontal engines.

About 1995, another change took place when two Mitsubishi gas engines replaced the diesels. Shortly after this, the vertical Skinner was placed on standby. Another modernization phase is currently underway. All vestiges of the DC plant are gone and the Skinner is considered the third line of backup power. It probably will be removed in the near future. ■

PRATT INSTITUTE POWER PLANT

By Conrad Milster

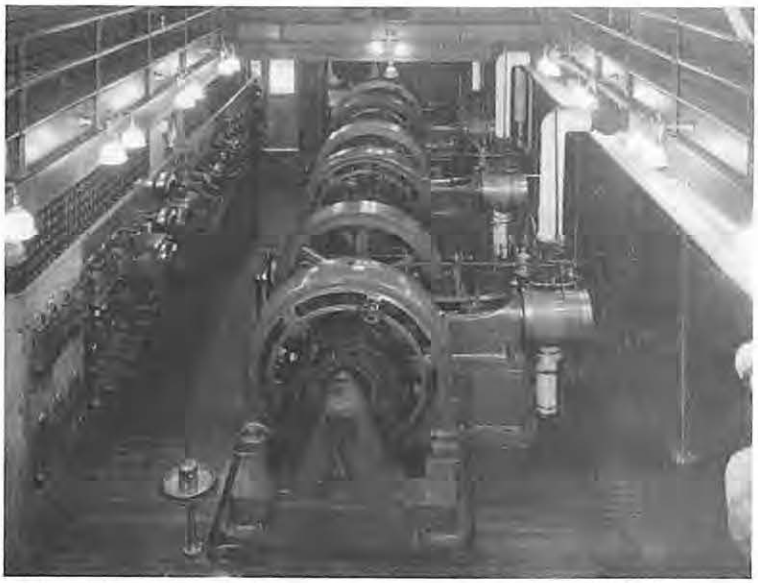
Charles Pratt made his fortune in oil, starting in the Pennsylvania oil fields in the 1850s and then moving into refining with a large plant in Brooklyn. One of his more popular products was Astral Oil for lamps. An advertisement from this period gives a testimonial from a customer who stated that "their clumsy servant girl knocked over the table lamp, but as it was burning Astral Oil it did not explode or catch fire." When he died in the 1890s, Pratt was reported to be the richest man in Brooklyn.

In common with many wealthy Victorian industrialists, Pratt spent the first part of his life making money and the latter part doing good works. There was virtually no major charitable, educational, or cultural operation that did not benefit from his largess. His concern with the living conditions experienced by his refinery workers led him to build a large model apartment house in Greenpoint named the Astral. It still stands today.

Pratt's greatest philanthropic concern, however, was for the appropriate education of young people entering the technical world of the late nineteenth century. Using land in the Clinton Hill area of Brooklyn where he had already built his mansion, in 1887 he began construction of Pratt Institute. The first campus consisted of three buildings, all of which still stand: the East Building, the Main Building, and the Student Union.

One did not become wealthy without hedging one's bets. Pratt, unsure of the school's future success, used commercial mill construction so that he would have a potential industrial property if the school failed. Although the first registration in 1888 was disappointingly small, by the 1890s there were four thousand students enrolled in subjects as diverse as carpentry, physics, chemistry, blacksmithing, electrical and mechanical engineering, millinery, dressmaking, and housekeeping, the latter referring to the operation of a large establishment such as a millionaire's mansion. Art was also part of the early curriculum and is the only original subject still being taught.

The school gradually expanded and today covers four city blocks with twenty-eight buildings, yet still has an enrollment of four thousand. Art and architecture are the main areas of concentration today. If Pratt was cautious in his choice of building construction, he was also farsighted on the future of utilities. The school was equipped with not only a boiler plant for heating, but also a generating plant for both arc and incandescent lighting.



Ames Iron Works engines direct connected to 75 kW GE generators at the Pratt Institute power plant. Historic American Engineering Record, Prints & Photographs Division, Library of Congress.

In 1900, the original belt-driven generators and their engines were removed. Three 75-kW DC generators, driven by single-cylinder Ames engines with 14-by-12-inch (356 by 305 mm) cylinders, were installed. A 100-kW General Electric generator, driven by a Curtis turbine, was added in 1907. The electrical end remained static until 1948, when a war-surplus Union Iron Works six-cylinder diesel, driving a 125-kW generator, was added for summer use.

The last major DC load was transferred to Consolidated Edison in 1977. Since then, the plant has only supplied DC to two elevators, using a motor-generator set built in the late 1920s for the electrical engineering laboratories. The current boiler plant carries 120-psi (830 kPa) steam and has two boilers: two three-drum Combustion Engineering boilers from 1941, rated at 12,000 pounds per hour (5,400 kg/hr), and a Foster Wheeler type "D" boiler from 1953, rated at 20,000 lbs/hr (9,100 kg/hr). All burn No. 6 fuel oil.

Despite the many changes in equipment, the lower engine room retains its original varnished wood paneling from 1887. The three Ames engines are still operable and are on standby for the motor-generator set, or run for Pratt public events such as open houses, graduations, or visits by old machinery fanatics. In addition, Pratt's power plant contains many pieces of still-functioning old steam machinery salvaged from other plants. It is also the site of what may be the oldest continuous steam-whistle welcome to the New Year, an event that has been held regularly for over thirty-five years. ■

GOWANUS CANAL

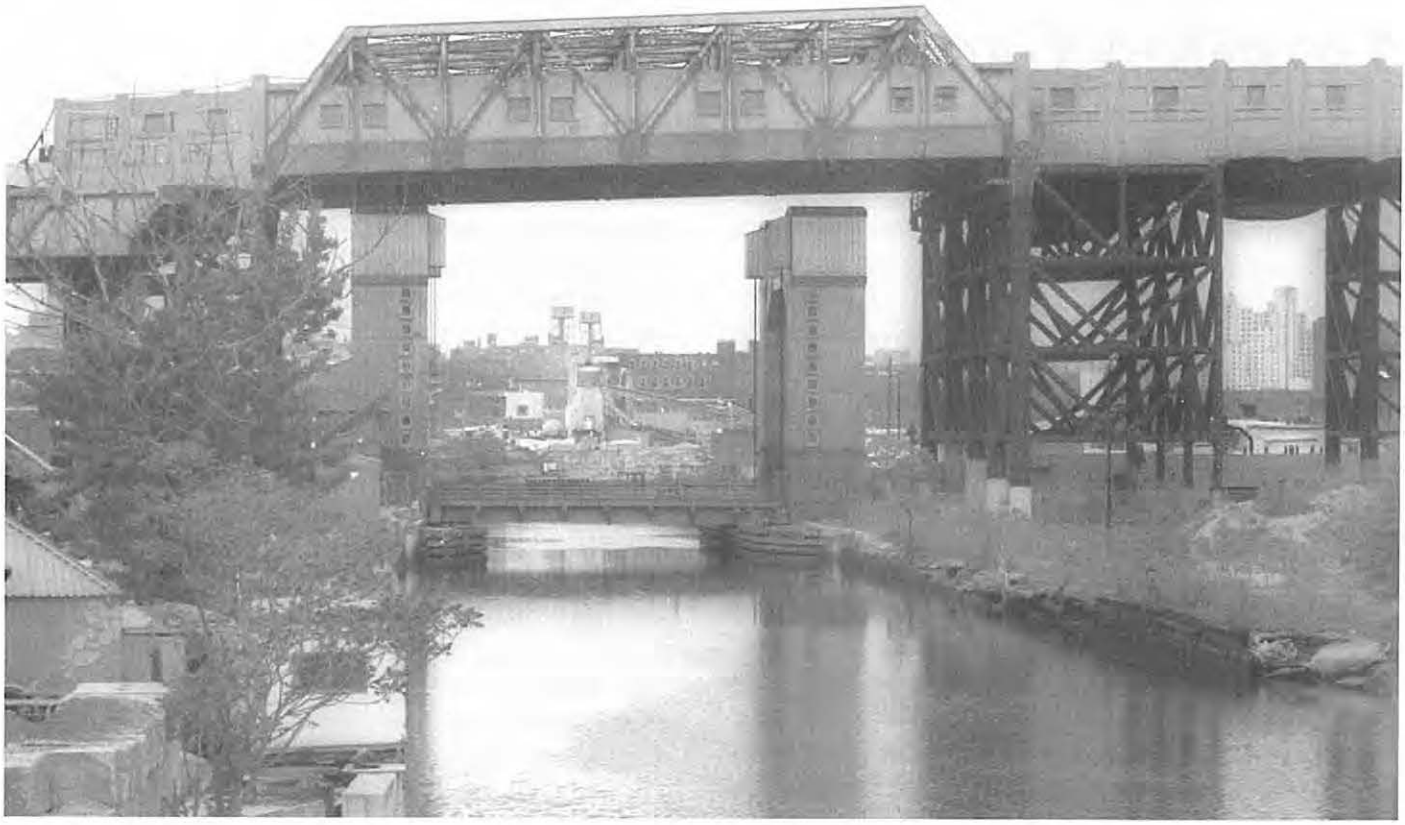
By Michael S. Raber

Until the mid-nineteenth century, Gowanus Creek was a low-lying tidal estuary of upper New York Bay, feeding extensive salt marshes. Native Americans lived near the mouth of the creek in the early seventeenth century, farmed in adjacent higher ground, and probably used the marshes to hunt seasonal waterfowl. Dutch settlers began purchasing land from the Gowanus Indians in the mid-1630s, and along with later English colonists, established dispersed farmsteads around the marshes, which were used for salt hay. Some Dutch settlers were quick to recognize the potential for the development of water-powered mills in this area, establishing three tide mills on the creek by the mid-seventeenth century. Farmers along the creek kept boats to transport their surpluses to market in Manhattan well into the nineteenth century. To avoid the rough waters of Buttermilk Channel in passing around the Red Hook peninsula with grain-laden boats, one mill owner organized a canal project in the 1660s to excavate a channel from the East River to the creek's mouth. This canal remained in use until construction of the Atlantic Docks closed its East River end in the 1840s.

Beginning in the 1830s, Brooklyn's urban growth led to real estate speculation and extension of the city's street grid into Red Hook and to the edges of the Gowanus Creek marshes. The earliest crossing of the creek, a toll bridge at Hamilton Avenue, was built between 1837 and 1844. While residential and commercial construction was limited in this area until the late 1840s, developers began filling marshes and ponds. In 1848, Daniel Richards, builder of the Atlantic Basin and a significant local landowner, proposed channelizing Gowanus Creek to drain the marsh for development and to provide a sewer outlet. Apparently funded privately, this project had by 1860 created a channel about 5 feet deep, 100 feet wide, and 1 mile long (1.5 m deep, 30.5 m wide, and 1.6 km long), corresponding to most of the main canal section. A bridge at 9th Street evidently was built over the canal during this period. To make the canal navigable for canal boats and to allow for development on landfill along the waterway, the City of Brooklyn created a board of Gowanus Canal Commissioners in 1866 to deepen the canal and to start building bulkheads. The private Brooklyn Improvement Company, formed the same year, built and bulkheaded the 100-foot-wide (30.5 m) 7th, 6th, and 4th street basins to Second and Third avenues. The major municipal and private canal projects were complete by about 1870, giving the canal a low-water depth of 12 feet (3.7 m) from Hamilton Avenue through much of the main section and throughout the three basins. The low-water depth diminished to 7 feet (2.1 m) at Douglass Street (the present head of the waterway, which at that time extended to Baltic Street). During the 1870s, the remaining three bridge crossings were first built, and local landowners extended the 4th Street Basin beyond Third Avenue and created the 50-foot-wide (15.2 m) 11th Street Basin with a low-water depth of 6 feet (1.8 m).

Although the canal shorelines were not fully occupied until very late in the nineteenth century, the waterway attracted a large number of bulk-products businesses soon after it opened. By 1880, there were thirty-one firms handling lumber, coal and firewood, hay and grain, oil, building materials, and chemical fertilizers on the canal, participating in the general expansion of Brooklyn industries, commerce, and residential construction. The canal's low land costs, sheltered waters, and accessibility to canal barge and schooner traffic made it an extremely valuable artery into a rapidly developing city. Other canal industries established before the century's end included gas and electric utilities requiring coal and coke, and a small number of other manufacturers. Local interests using Gowanus Bay and the canal urged the United States government to begin channel dredging to support the area's maritime commerce. Restrictions against work between piers along a wharf, however, eliminated the narrow waterway's eligibility for federal support. U.S. Army Corps of Engineers projects ended in Gowanus Bay at Hamilton Avenue, near the canal's lower end.

Because the Gowanus Canal was at sea level, the sewage entering it was drained chiefly by tidal action. Landfilling and bulkheading contributed directly to shoaling and siltation by reducing channel widths and the effects of tidal scouring. The canal soon became something of an open sewer. In 1890, a City of Brooklyn commission reported that the canal was a nuisance and should be closed entirely, or a new outlet built at a cost of $4 million. The local sewer system was rebuilt in 1904 to provide more flushing action, and a



Ninth Street vertical-lift bridge (1905) and Independent subway high-level crossing (1933) over the Gowanus Canal. Nick Malter.

water circulating plant built by New York City in 1911 eased the situation by bringing water from upper New York Bay to the head of the canal (see separate article).

Industrial use of the canal peaked between 1900 and 1932, when between fifty and sixty operations used the waterway, with about 65 to 75 percent of these in bulk products. The number of canal businesses dropped dramatically thereafter, and today only five operations remain handling fuel oil, stone, and other building material. Industrial use of the canal declined in the face of diminishing marine access conditions, completion of pre-World War II urban development in the vicinity, decreased demand for building materials, declining use of coal fuel and manufactured gas production, and increased use of trucks. The same flushing problem which made the canal a sewer also created siltation problems that municipal interests did not address, and limited marine operations to less cost-effective small vessels. Increased use of trucks for products such as fuel oil began in the 1930s, and completion of the Gowanus Expressway in 1964 provided highway access to canalside industries. ■

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GOWANUS CANAL FLUSHING TUNNEL & PUMP HOUSE

By Lynn Rakos

As tidal marshes were filled, and former creek banks were hardened with canal bulkheads, the natural flushing action of the tides ceased to be effective in cleaning the waters of South Brooklyn. Couple that with the effluent of an ever-increasing industrial base and the burgeoning population of the then newly created brownstone communities, and a malodorous disaster was in the making. Waste of every description poured untreated into the Gowanus Canal. As early as 1880, the canal's water quality was a noted problem. The City of Brooklyn constructed a 15-foot-diameter (4.6 m) storm sewer at the head of the canal, intended to force water through, but which only exacerbated the problem by depositing more organic material into the channel. Exceptional stench led the surrounding communities to petition city officials to address the pollution.

The City of New York, of which Brooklyn became a part in 1898, paid heed and began to explore options for cleaning up the Gowanus Canal. They examined flushing systems in cities such as Milwaukee and Chicago. The initial proposal, to pump cleaner water from Buttermilk Channel, in New York Harbor, into the head of the canal and out into Gowanus Bay, was rejected due to a number of factors. One problem was that the flow would hinder full barges entering the canal. It was also anticipated that the water quality would improve more overall if water was pumped from the canal into Buttermilk Channel, as opposed to merely being diluted with clean water.

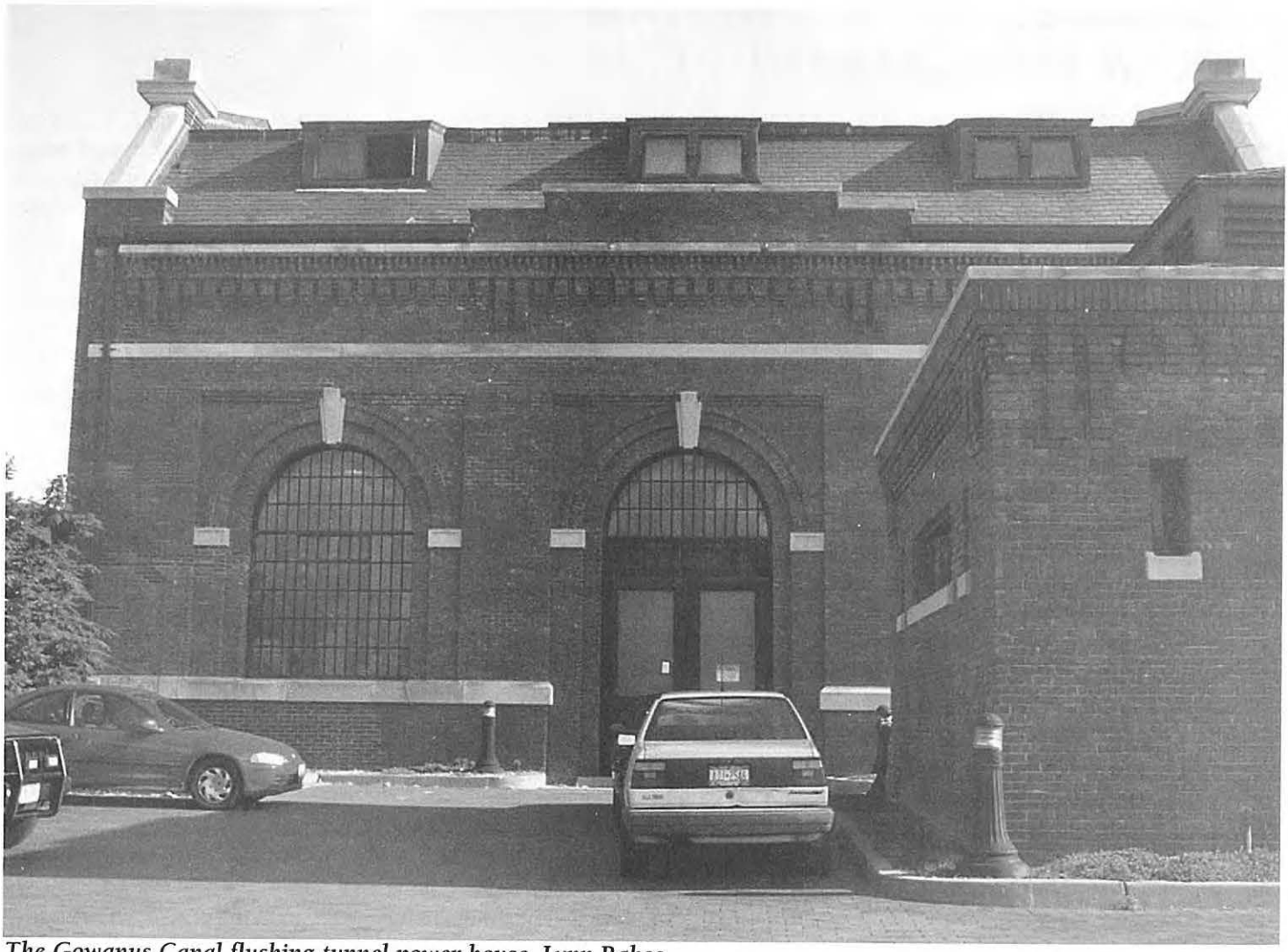
Following years of research, engineering, and design, the final plan that was implemented was to flush the canal waters through a 12-foot-diameter (3.7 m) tunnel running 6,280 feet (1,914 m) and into Buttermilk Channel. Slight controversy over the method of construction developed when the contract was issued. The flushing tunnel, as built, is of brick pointed and smoothed with concrete. The January 11, 1908, issue of *Engineering Record* described the tunnel's construction in detail.

As construction of the tunnel proceeded, design of the pump house was undertaken and was overseen by Edwin J. Fort, the city's chief engineer of sewers. Plans and specifications called for an "alternating current electric motor directly connected to a horizontal shaft driving a screw or turbine pump" to deliver 30,000 cubic feet of salt water per minute (14,000 L/s). At the contractor's suggestion, the tunnel diameter at the wheel pit was reduced to 9 feet (2.7 m) and a 9-foot wheel "similar to a ship's propeller" was installed.

The pump house facility includes a historic power house and gate house, as well as a more recent service building, pump station, and force mains that run into the canal. The red brick power house has a truss-supported roof and 20-foot-tall (6.1 m) arched windows. This building contains the motor pit in which the motor driving the propeller sits at approximately 15 feet (4.6 m) below floor level. Each of the power and gate houses contain a tide gate used to shut off water flow for repairs.

Great fanfare accompanied the opening of the flushing tunnel on June 21, 1911. A young woman, "Miss Gowanus," cast carnations upon the waters as a symbol of hope for a cleaner, and perhaps more fragrant, neighborhood. The tunnel was quite effective for several decades until the early 1960s, when – rumor has it – a disgruntled employee dropped an access manhole cover into the works that ruined the propeller's drive shaft. It may have been an accident, but nonetheless plunged the canal and neighborhood further into a decline that was already under way.

It wasn't until 1987, again through community efforts, that the city built a wastewater treatment plant, finally stemming the tide of domestic effluent entering the canal (except during storms, when rainwater overwhelms the combined sanitary and storm sewers). The city and community worked to reactivate the flushing tunnel, which reopened in 1999. The flow was reversed, bringing fresh water from New York Harbor into the canal at an average rate of 200 million gallons a day (760 million L/day). The maximum rate is 300 million gallons a day (1,140 million L/day) but is dependent on the tide. The tunnel, in operation twenty-four



The Gowanus Canal flushing tunnel power house. Lynn Rakos.

hours a day, has provided many benefits to the environment and to the surrounding communities. ■

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CARROLL STREET BRIDGE OVER THE GOWANUS CANAL

By Mary E. McCahon

Design of the retractile bridge over the Gowanus Canal is credited to Robert Van Buren, Chief Engineer of the Brooklyn Department of City Works. It was constructed between 1888 and 1889 and is the oldest example of its type in the nation. This span replaces an earlier structure on the same site, built when the Gowanus Canal was dredged circa 1870. Its unusual design – known by a variety of names including pull-back draw, traversing bridge, and sliding draw – was used for crossing narrow, navigable channels where more common movable types like swing spans were not feasible. Many retractile bridges slide horizontally along a diagonal path, entering a pocket beside the roadway to clear the channel. Never used extensively, the retractile bridge was described in Otis Hovey's *Movable Bridges* (1926) as "nearly obsolete." Bridge engineer J. A. L. Waddell noted that the pull-back draw was "very unusual" and would always be so, given its high initial cost and expensive operation, which he described as "very clumsy and slow."

The Carroll Street retractile bridge is composed of deck girders supported on carriage truck frames and wheels that move horizontally along three sets of rails. New Jersey Steel & Iron Company, a subsidiary of Cooper, Hewitt & Company, fabricated the original metal components. When closed, the skewed, 107-foot-long (32.6 m) span is simply supported on ashlar abutments. In the retractile type, the span must be approximately twice as long as the channel is wide; in this case, the span's shore arm is shorter than its channel arm. The longer channel arm is balanced by a counterweight affixed to the far end of the shore arm. When in operation, the channel arm is stiffened by eye-bars extending from the built-up, structure-mounted towers. Operating machinery – converted from steam power to an electric motor in 1908 – drives a set of wire ropes, pulling the span back into an area adjacent to the west approach. The machinery and its operator are housed in a shanty located in this same area.

The Carroll Street Bridge over the Gowanus Canal. Lynn Rakos.

The bridge was designated a New York City Landmark in 1987. It had been closed to traffic in 1985, but following emergency closure of the Williamsburg Bridge in 1988, the city undertook a campaign to re-open closed bridges elsewhere. Over the following two years, city forces rehabilitated the bridge, rebuilding the operator's shanty and replacing floor beams, stringers, the timber deck, rails, and operating wheels to match the original design. There were once five retractile bridges in New York City; only two remain today. The other is the Borden Avenue Bridge over Dutch Kill in Queens, built in 1908. Both spans are operated by the New York City Department of Transportation. ■

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BROOKLYN'S BROWNSTONES

By Terry L. Bailey

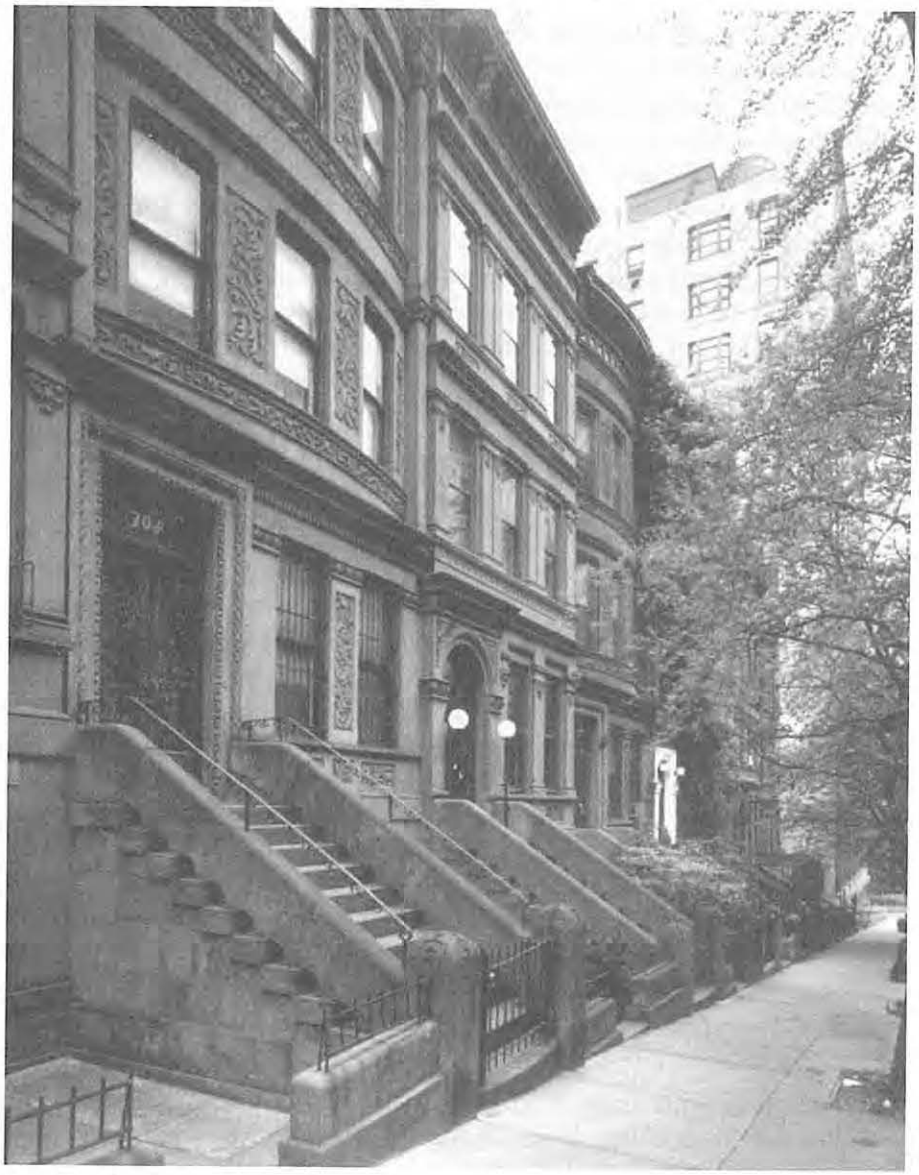
"Our architectural greatness consists of the hundreds and thousands of superb private dwellings, for the comfort and luxury of the great body of middle class people – a kind of architecture unknown until comparatively late times, and nowhere known to such an extent as in Brooklyn." – Walt Whitman

Before widespread use of elevators, New York (Manhattan) and Brooklyn were sprawling cities of four- and five-story townhouses built of a variety of materials in a variety of styles. Typically they were built on lots 22 to 25 feet wide and 100 feet deep (6.7 to 7.6 m wide and 30.5 m deep). As real estate prices increased, narrower houses became increasingly common: three houses, each 16 feet 8 inches wide, would be built on two 25-foot lots. The houses were built to the full width of the lot and were generally 50 to 60 feet (15 to 18 m) deep.

New York townhouses are characterized by a high front stoop, which provides a grandiose ascent to the front door and entry hall located at one side of the house. The hall contained the stair and extended past the formal front parlor to a rear parlor, which occupied the entire width of the house. The front parlor was used to receive visitors and the rear parlor for formal dining. A small butler's pantry was equipped with a dumbwaiter down to the garden level for kitchen access. The two parlors were lavishly finished with decorative plaster and woodwork, leather and velvet wallpapers, oriental rugs, and expensive overstuffed furniture, which might cost $3,000 in a $25,000 house.

Downstairs at the garden level, a door beneath the stoop provided a discreet service and delivery entrance. (New York has very few alleys.) The informal dining room was located in the front room, with the kitchen and laundry at the rear overlooking the garden. Above these two main levels were two to three levels of sleeping floors, typically consisting of front and back bedrooms with a bathroom located between them. The family horse and carriage were kept either in a separate carriage house or in a public stable on a less fashionable street.

In the eighteenth and early nineteenth centuries, townhouses were generally built in classical revival styles using brick and light colored marbles or granite. The term "brownstone" refers to a rich, chocolate-colored sandstone that is soft and easy to carve. The close-



A typical New York City brownstone. John Bartelstone.

grained Triassic sandstone quarried near Paterson, New Jersey, and Portland, Connecticut, had long been used as an inexpensive substitute for granites and marbles. By the 1850s, changing architectural tastes had made brownstone fashionable, and by the 1860s, a brick street front had become passé. Eventually the brownstone street front became so common that the term "brownstone" came to serve as a synonym for townhouse. Brooklyn's brownstone neighborhoods were built mainly during the 1850s, '60s, and '70s.

Brownstones were built in a variety of styles, with the Italianate and the Second Empire most common. The aesthetic of the brownstone block was heavily influenced by the spacious avenues and monumental vistas cut through medieval Paris by Napoleon III and his architect Georges-Eugène Haussmann. New York's middle-class families sought to create a similar effect by building individual homes as part of a cohesive block that would be much more monumental and impressive than anything they could afford individually. This was done by creating a smooth, flat plane at the street front by using the largest blocks of stone that could be quarried, thus minimizing the size and number of mortar joints. The flat plane was then punctuated with the bold decorative relief at the doors and windows. A prominent cornice line was generally maintained, changing in height only when necessary to accommodate changes in street grade. These blocks typically were not constructed by a single contractor, as is commonly assumed, but instead were constructed one or two houses at time by different builders who followed the guidelines needed to achieve this effect.

By the 1920s, rising real estate values and a new fashion of luxury apartment-house living combined to make the brownstone obsolete. In subsequent years, the elevator apartment building edged the brownstone out of the marketplace. Whole neighborhoods of townhouses were cleared to make way for high-rises. Still, the brownstone neighborhoods of Brooklyn Heights, Fort Greene, Cobble Hill, Carroll Gardens, and Park Slope preserve something of what the Manhattan and Brooklyn looked like in the mid-nineteenth century. ■

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CLEFT-RIDGE SPAN IN PROSPECT PARK

By Mary E. McCahon

Generally acknowledged as the first concrete bridge built in America, the 1871-72 Cleft-ridge Span was designed by Calvert Vaux as a landscape feature in Prospect Park. The park was designed starting in 1865 by Vaux and Frederick Law Olmsted and has been described as one of the country's most beautiful urban parks. The bridge carries the main carriage drive through the park over a path. It is one of many important Vaux-designed bridges that permit the complete separation of bridle paths, carriage drives, and walkways. Remarkably, through the stewardship of the New York City Department of Parks and Recreation, the richly detailed bridge survives with its detailing intact.

The glory and technological significance of the Cleft-ridge Span is that it demonstrated the considerable ornamental potential of concrete, which could be molded to produce detail as well as or better than more costly stone. Its monolithic, unreinforced concrete arch ring and spandrel walls are adorned with precast panels in the High Victorian style. The principal material is *beton Coignet*, a concrete mix named after the Frenchman who perfected and patented one of the best "artificial stones" of his day. Coignet's concrete offered strength, durability, crisp architectural detailing, and overall economy – in comparison not only to his artificial stone competitors, but also to other materials of the day such as stone, brick, and terra cotta. The structure is cited by bridge historian William Chamberlin as possibly being the first commercial use of *beton Coignet* in America and "probably the first in which the full ornamental potential of any American-made concrete was exploited."

François Coignet was granted American patents in 1869 and 1870, and started doing business in New York City in 1869. The company responsible for building the Cleft-ridge Span was the New York & Long Island Coignet

Stone Company, and its superintendent was John C. Goodridge. The new material's low cost and ornamental potential must have appealed to the Prospect Park commissioners. Structurally, the bridge proved that the man-made material could be used to replace stone. Chamberlin attributes the superiority of Coignet's concrete to factors like water-cement ratio and mixing time, which are so basic today but generally were not recognized in this country in 1871. Curiously, use of concrete in the Cleft-ridge Span went unnoticed in period technical literature, although no American concrete bridge is known to predate it.

Like New York's Central Park, Brooklyn's Prospect Park also features a host of ornamental bridges in a variety of materials and architectural styles. Rustic wooden rustic bridges like the Binnen Bridge over Binnen Falls recently have been rebuilt to their original designs by the Parks Department. The Lullwater Bridge over Prospect Park Lake is an arched cast-iron bridge supported on a handsome ashlar substructure. Although this bridge is in keeping with the spirit of cast- and wrought-iron bridges designed by Vaux and Jacob Wrey Mould for Central Park, it was not installed until 1905, when the Prospect Park Boat House was built. It replaced an 1868 rustic wooden bridge. ■

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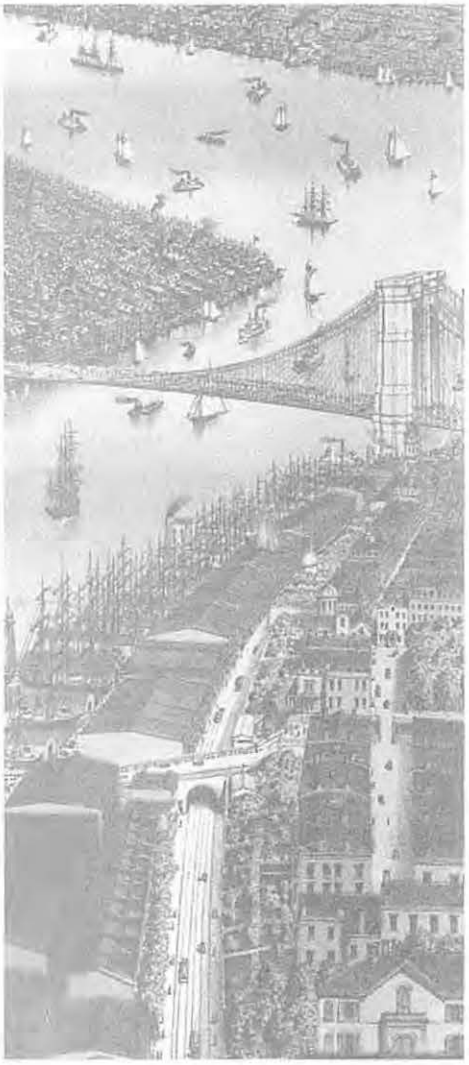
The Cleft-ridge Span in Prospect Park (1872). William P. Chamberlin.

Crossing the River

CHAPTER TWO
CROSSING THE RIVER



INTRODUCTION
By Justin M. Spivey

In port cities, especially those built on islands or peninsulas, the waterways feeding commerce and industry are a common frustration to those trying to get around by land transportation. Throughout its history, New York has struggled with the formidable moat created by the Hudson, Harlem, and East rivers around Manhattan Island. Brooklyn and Queens, located on Long Island, are another step removed from the New Jersey mainland. Different solutions – ferries, highways, subways, and railroads – have come in and out of favor with changes in technology, funding, and politics. Although New York may continue to plan and construct new river crossings, design by committee has replaced the master builders of the nineteenth and early twentieth centuries.

Along with Fulton's revolutionary contributions to ferry travel, and Whitman's contributions to writing about it, the Roebling name is foremost in the history of travel between Brooklyn and Manhattan. Also important is the fact that private investors on both sides of the river wanted to be connected, and would stake their own money upon it. Construction of the Brooklyn Bridge and a desire for unification of Brooklyn with New York progressed together. The great city that resulted played some role in planning, and often assumed part of the financial risk for, subsequent river crossings. The Williamsburg and Manhattan bridges were municipal projects designed to carry several modes of traffic: the latter, for example, had four subway and four streetcar tracks, but only three roadway lanes.

At present, nine pairs of subway tracks cross the East River into Brooklyn, six of them under water. As engineer Arthur B. Reeve elegantly put it, "Manhattan may be described as a body of land surrounded by tunnels." The subways' success hinged on two technological events: development of electric traction by Sprague, and improvement of Brunel's tunneling shield by Baker, Beech, and Greathead. After that, construction could not keep up with demand. Interborough Rapid Transit (IRT), builder of the first Manhattan subway under city-backed Contract No. 1, extended its line to Brooklyn in 1908 as part of Contract No. 2. After years of debate about the city's proper role in subway construction, Contract No. 3 was issued to the IRT, resulting in completion of the Clark Street tubes in 1919. This was one of the "Dual Contracts," 325 new route-miles (520 km) worth $22 billion in current dollars, certainly one of the largest

public works projects of all time. The other contract, No. 4, went to Brooklyn-Manhattan Transit (BMT) for the Montague Street and 14th Street tunnels (1920 and 1924), in addition to links over the Williamsburg and Manhattan bridges. Constructed mainly during the 1930s, the city's Independent (IND) system included the Cranberry Street and Rutgers Street tubes, the Crosstown tunnel under Newtown Creek to Queens, and provisions for a number of future crossings. In 1940, the IRT, BMT, and IND lines were unified under the municipal Board of Transportation, a predecessor of today's Metropolitan Transportation Authority (MTA).

After such phenomenal subway growth, the next era in New York transportation had little to do with rapid transit or municipal control. The 9,117-foot (2,779 m), highway-only Brooklyn-Battery Tunnel was begun circa 1940 by the New York City Tunnel Authority, an entity created by state government but independently funded by toll-secured bonds. Before its completion, the tunnel came under the purview of Robert Moses' Triborough Bridge (and, later, Tunnel) Authority. Moses used the public authority among other means to achieve great influence over New York's transportation network, building almost all of the highways present in the city today. After his fall from power, and placement of his beloved authority under the MTA umbrella, no other person would play such a singular role in determining how the city moves. ■

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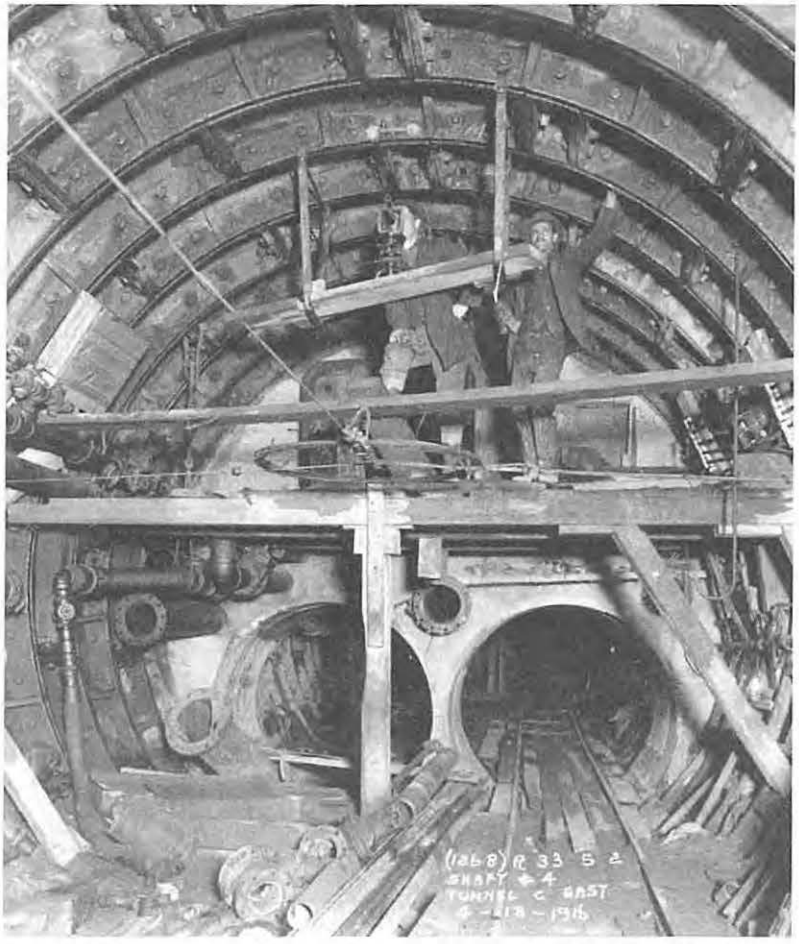

Engineers running a line with a transit under the East River in 1916. Courtesy archiveofindustry.com.

BROOKLYN BRIDGE

By Robert M. Vogel

Now almost 119 years old, the Brooklyn Bridge is a structure of superlatives. From the day of its opening on May 24, 1883, it indisputably has been the most widely recognized bridge in the world. It remains one of America's most celebrated structural and architectural icons. When completed, its 1,595'-6" (486.3 m) main span was the longest of any bridge in the world, remaining so (with a few minor exceptions) for nearly forty years. It joined the nation's largest and third-largest cities into what shortly would become components of a single, even greater metropolis. And by employing steel, the relatively new, stronger material in both the main cables and the suspended deck, it brought conclusively to an end the era of structural wrought iron.

For all these reasons the bridge has been the subject of several books, and countless technical and popular articles, paintings, photographs, drawings, prints, poems, essays, stories, reports, analyses, critiques, and myths; surely more, collectively, than devoted to any other modern structure on earth. But above all else, The Bridge, from its birth, has been preeminent among Brooklyn's many distinct symbols, standing well above the Navy Yard, the Dodgers, the accent, or the remarkably diverse demography. Brooklyn and The Bridge essentially are one.

Assuming that to the Society for Industrial Archeology, the bridge's structural basis is of the greatest interest, that is what will be described here, principally the evolutionary designs of the foundations for the massive granite towers and of the suspended superstructure – the deck.

Of the many problems facing John Roebling, the bridge's designer, the most critical was securing solid, reliable foundations for the towers, for here there would be no second chance for correction should the work fail part way through. The problem lay not just in the swift river current, or in the water's depth, or even in the depth of the riverbed silt above bed rock on which the foundations were to rest (107 feet [32.6 m] below high water on the New York side). None of these factors alone were of unusual magnitude. Rather, it was the extraordinary scale of the masonry masses – far greater than anything that had gone before, laid against the inhospitable natural conditions – that presented so unparalleled a challenge.

Roebling was open-minded in his approach to the problem. In evolving a solution, he prepared a series of designs examining the pros and cons of all possible options. His inevitable conclusion was that only the recently introduced pneumatic-caisson method was suitable. This employed air under pressure to prevent water from entering an open-bottomed timber chamber that rested on the riverbed. Within this caisson, workmen could excavate the soft material as the tower masonry was laid up directly on its roof. The increasing weight of the stone and the simultaneous removal of the silt would cause the caisson to sink, until it reached bedrock. The working chamber then would be filled with concrete to form a permanent foundation. The wood, always saturated and in the absence of oxygen, would not be subject to decay.

The technology had been developed principally in Europe during the previous two decades. To learn how best to employ it at Brooklyn, in 1867 Roebling sent his son and chief assistant Washington – himself a formally trained civil engineer then aged thirty – to Europe. Washington was to examine all major bridges currently under construction employing the pneumatic foundation method. This exercise assured the Roeblings that no other means would be feasible for establishing the towers, and that indeed, it could be practically applied at Brooklyn.

With John Roebling's untimely death in July 1869, the mantle of the bridge's chief engineer passed to Washington, who became its actual builder, and whose first task was the difficult one of sinking the two giant caissons – each 170 by 102 feet (51.8 by 31.1 m).

First the Brooklyn tower was undertaken, then the New York, the work proceeding as planned but plagued by mishaps. Most persistent was the difficulty of working in the atmosphere of compressed air, which gave rise to what became known as caisson disease or, more commonly, the bends. Its painful and disabling symptoms were little understood at the time, and as a result many of the excavators sickened and died. Washington himself was stricken, suffering permanent crippling. But withal, solid footing in time was reached, the great Gothic-arched towers rose 276 feet (84.1 m) above high water, their corresponding massive cable anchorages were completed, and on August 14, 1876, a single wire rope was passed from anchorage to anchorage, the first physical connection between the two cities.

Laying up the four main cables and hanging the vertical suspender ropes that transmit the vertical load of

the deck to the towers, and thence to the earth, occupied four years. The next and final major step in building the bridge saw the only significant modification of John Roebling's design effected by his son. The suspended superstructure as planned by the senior Roebling was to accommodate two lanes of common road traffic in each direction, a line of cable cars in each direction, and between these, the famed, elevated pedestrian "promenade." The total cross-sectional width of this was about 86 feet (26.2 m). All was to be of wrought iron, in the late 1860s the only material suitable and available for the purpose. But twenty years later, when the time came for hanging the deck structure, two major things had occurred to alter the original design. The bridge's board of directors, in their determination to exploit as fully as possible its profit-making potential, had ordered Roebling to increase the deck's capacity to accommodate main-line railroad cars, including heavy Pullmans. And the production of Bessemer steel had expanded to include not only rails, but also a considerable family of rolled structural sections. The availability of this stronger material allowed a redesign of the deck to permit the increased loading with no addition to its dead load.

And so the bridge was built and stood essentially unaltered for some seventy years, until in the 1950s the two outer of the six lines of longitudinal stiffening trusses were raised to the height of the inner lines, and two of the inner lines and the tracks were removed to provide the present three road lanes in each direction. But mercifully the elevated promenade was retained, remaining, as it has since 1883, one of New York City's most used and beloved assets.

Of the many things written about The Brooklyn Bridge, there is only one complete account of the political background surrounding its genesis; the biographical backgrounds of its proponents, its opponents, its designer and builder, and all others involved; its predecessor bridges, its structural rationale and its construction; its position as a sacred icon; and all else there is to know about this extraordinary work: David McCullough's *The Great Bridge* (New York: Simon & Schuster, 1972). ■

The Brooklyn tower of the Brooklyn Bridge in 1982, framed by concrete warehouses. Historic American Engineering Record photograph by Jet Lowe, Prints & Photographs Division, Library of Congress.

MANHATTAN BRIDGE

By Mary E. McCahon

With its slender metal towers and Prussian blue and white paint scheme, the Manhattan Bridge stands in marked contrast to the stocky masonry towers and earthy tones of its neighbor, the venerable Brooklyn Bridge. Although the two spans spring from different neighborhoods on Manhattan island, they land within two blocks of each other in downtown Brooklyn, certainly close enough for comparison. The Brooklyn Bridge is indisputably a masterpiece of nineteenth-century engineering, but by the time the Manhattan Bridge was completed in 1910, the changes in design, construction, and loading of suspension bridges were nothing less than revolutionary.

The Manhattan Bridge was the first of the great suspension bridges both designed and built within the twentieth century. It was the highest capacity suspension bridge yet conceived. Early schemes considered carrying rail traffic exclusively, but as built, its paired outer trusses each carried two trolley tracks on the upper level and two subway tracks on the lower, with a single-level center section accommodating three roadway lanes. (The upper-level tracks were converted to roadways in the 1940s, providing the current total of seven lanes.) The relatively shallow, 26-foot-deep (7.9 m) Warren stiffening trusses with verticals were of a novel design. So were the 322-foot-tall (98.1 m) towers, each consisting of four nickel-steel columns arranged in a line and braced in pairs. The towers deflect along the line of the bridge to allow for thermal movement and deflection under load. During construction, the Manhattan Bridge marked a clear advance in cable spinning, and its towers were erected using vertically movable derrick platforms.

Despite these achievements, design and construction of the Manhattan Bridge were plagued by acrimonious controversy. The present bridge reflects the last of three designs. The original 1901 scheme developed under the supervision of R. S. Buck (no relation to the Williamsburg Bridge's L. L. Buck) had four freestanding towers with pyramidal roofs and 55-foot-deep (16.8 m) stiffening trusses. The plans never received official approval. When Gustav Lindenthal was appointed Bridge Commissioner in 1902, Buck resigned. Lindenthal took over as chief engineer and designed a nickel-steel eye-bar chain bridge reflecting his philosophy that "in a bridge it is not possible to separate the architectural from the engineering features." He and architect Henry Hornbostel collaborated on a handsome design that would be stronger, less expensive, and more quickly erected than a cable suspension bridge.

The Manhattan Bridge in 1979, looking toward Brooklyn. Historic American Engineering Record photograph by Jet Lowe, Prints & Photographs Division, Library of Congress.

Lindenthal's innovative engineering met with skepticism, so Mayor Seth Low appointed an impartial board, consisting of five members from the American Society of Civil Engineers, to examine the soundness of his scheme. They approved his design, as did the city's Municipal Arts Commission, but a public spat with the Roeblings over delays in fulfilling their cable-spinning contract for the Williamsburg Bridge and a change of mayor stalled the project. New bridge commissioner George Best hired Leon Moisseiff and architects Carrere & Hastings to prepare yet another set of plans. Lindenthal's eye-bar chains were discarded in favor of a cable suspension bridge. Fortunately, many of the aesthetic refinements, such as the well-formed towers and classical architectural detailing of the approaches, were retained from the Lindenthal-Hornbostel design. Construction on the Manhattan Bridge finally began in 1906.

Lindenthal did not go quietly, and he maintained his assertion that the cable suspension bridge could not

provide the intended capacity. History has proven Lindenthal was right, although not necessarily for the reasons he imagined. The bridge was the first to be designed using the Deflection Theory, a structural analysis method pioneered by Moisseiff. (Application of the theory resulted in more and more slender suspension bridge decks, which, coupled with an incomplete understanding of aerodynamic behavior, led to the Tacoma Narrows Bridge collapse in 1940.) Because it was the first use of the new theory, however, the Manhattan Bridge's proportions are conservative and have more in common with the previous generation of suspension bridges. Its main span of 1,470'-0" (448.1 m) between towers is, in fact, 125'-6" (38.3 m) shorter than the Brooklyn Bridge's.

One bizarre – and as it turns out, flawed – design decision was to omit lateral bracing above the central roadway, leaving it open to the sky. Unlike later suspension bridges with railways in a closed box cross-section (such as the Philadelphia-Camden or San Francisco-Oakland bridges), the Manhattan Bridge has a U-shaped cross-section, with two parallel railway boxes carrying the roadway between their lower chords. The U shape does not provide nearly as much torsional resistance as a closed box would, so trains on the outermost tracks put high twisting loads into the deck, especially when starting across opposite ends at the same time. As a result, the bridge has suffered cracked floor beams and bracing members that have had to be replaced.

In 1982, the city began a staged rehabilitation of the bridge that is ongoing. The repair design, by Weidlinger Associates of New York, includes the addition of new bracing and strengthening of existing truss members to increase its torsional resistance. The repair process, scheduled for completion in 2005, involves closing, one pair at a time, the subway tracks on each side of the bridge. Roadway decks are being replaced. Sidewalks, absent from the bridge for a number of years, are being restored to provide a pedestrian way on the south side and a bicycle route on the north. ■

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Looking southwest down the East River, with Manhattan Bridge in foreground, in 1982. Historic American Engineering Record photograph by Jet Lowe, Prints & Photographs Division, Library of Congress.

ARCHITECTURE OF LOWER MANHATTAN

By George M. Bulow

New York, prior to consolidation with Brooklyn, was Manhattan. Lower Manhattan's singular geographic position made it an ideal entrepôt, which, coupled with an enterprising class of merchants, ultimately became the financial capital of the United States. The downtown that grew around Wall Street, due to the scarcity of land and its relatively high value in relationship to alternative locations, was suited to commercial activity, but not to industry. New York's greatest industry, then, as now, has been the real estate business. Some great manufacturing companies did have humble origins in lower Manhattan, however. Dutch Street, only one block long, was where William Colgate established his soap and candle business, today's Colgate-Palmolive, in 1804. The company remained there until 1847, when it moved its manufacturing activities across the Hudson River to Jersey City while retaining corporate headquarters in Manhattan.

Herman Melville also lived on Dutch Street. His novels were published in the area which, at the time, contained many printing and related trades. As late as the 1950s, some printers maintained plants in or near the Financial District, where they could produce proxies and other financial materials requiring rapid distribution to Wall Street. Some small, highly specialized factories (making personalized cigarettes, for example) could be found in lofts interspersed through the area into the 1970s.

The narrow, irregular streets radiating from the Battery reflect the original layout of Nieuw Amsterdam, the Dutch predecessor of New York. As the city and its water-based trade grew, landfill was added to accommodate them. No original commercial structures remain from the Dutch, early colonial or Federal periods, but some churches and former residences can still be seen along State Street, which roughly follows the original shoreline.

The Whitehall Building at 17 Battery Place was designed by Henry Hardenburgh in 1902, with a rear addition by Clinton & Russell in 1910. This building was home to many New York-based shippers. The finest view of harbor activity used to be from the private Whitehall Club near the top, but along with the shipping industry's retreat from lower Manhattan, the Club recently went bankrupt and closed, and its extensive collection of maritime artifacts was dispersed. The building has since been converted into a dual-use structure, with private residences replacing commercial offices on the upper floors.

The steel and masonry canyon of Wall Street. Gerald Weinstein, Photo Recording Associates.

Originally known as the Washington Building, 1 Broadway, designed by Edward H. Kendall in 1884, became known as the International Merchant Marine Company Building and was the subsequent home of United States Lines. The booking hall is now a Citibank branch.

At Bowling Green stands a Cass Gilbert masterpiece, the U.S. Custom House. This building was constructed between 1899 and 1907. It is now the home of the U.S. Bankruptcy Court for the Southern District of New York, as well as the Heye Foundation and Smithsonian Institution's Museum of the American Indian. The exterior has monumental sculptures by Daniel Chester French, most famous for the seated Abraham Lincoln in

Washington, D.C.'s Lincoln Memorial. Two interior rooms are of particular note: the Custom Hall, with WPA-commissioned murals by Reginald Marsh of New York Harbor in its heyday, and the stunning Collector's office.

The west side of Broadway was home to major trans-Atlantic steamship lines' offices and ticket halls until the mid-twentieth century, when they were superseded by air travel. Conversion of the Cunard Building's Great Booking Hall into a post office by Handren Associates in 1977 preserved many of its most interesting elements, including a ceiling sculpture by C. Paul Jennewein, paintings by Ezra Winter, and iron gates by Samuel Yellin. The building, built 1917-21, was designed by Benjamin Wistar Morris, with Carrère & Hastings as consulting architects.

Across the street is one of New York's most famous business addresses. No. 26 Broadway was the home of the Standard Oil Company, which moved to the site in 1886. The current expanded structure, built 1920-28, was designed by Carrère & Hastings and by Shreve, Lamb & Blake, predecessors of the Empire State Building's designers. Following the breakup of the Standard Oil trust in 1911, the building became the home of Socony-Vacuum Oil Company, later Mobil. The 480-foot-tall (146.3 m) building is capped by a pyramid aligned with Manhattan's uptown street grid, rather than with the jumble of streets surrounding it.

East of Bowling Green is Broad Street, built over *de Heere Gracht* (The Gentleman's Canal), which was filled during the seventeenth century. The canal originally reached northward to Exchange Place, where a ferry to Brooklyn docked. On Broad Street between Bridge and Pearl is a one-story 1962 building by Rogers & Butler, home of the New York Clearinghouse Association, where a unique spectacle takes place each weekday. Couriers from New York's major banks, none of which has an account with any other, exchange checks worth hundreds of millions of dollars each to settle their accounts.

On the curb opposite, a red marble plaque denotes where the Curb Exchange, as it was originally known, functioned. Traders would congregate at a bend in the street and trade in securities smaller than those listed on the New York Stock Exchange, which is about one block to the north. Brokers would lean out of their windows and, after getting the attention of their representatives trading below, send hand signals indicating the size and type of trade, as well as the bid or sale price. Trading took place at this site until moving indoors in the 1950s, to become the American Stock Exchange (AMEX). To this day, AMEX has retained these hand signals.

The architect of the New York Stock Exchange (1901-03) was George W. Post, with J. Q. A.Ward and Paul Bartlett sculpting the classical pediment above the main trading floor. Trading activities can be seen from a visitors' gallery entered through 20 Broad Street, a 1923 addition to the Exchange by Trowbridge & Livingston. Unfortunately, the AMEX viewing gallery is currently not open to the public.

The former headquarters of J.P. Morgan & Company (1913) standing at 57 Wall Street and Bankers Trust Company (1910-12) at 14 Wall Street were both designed by Trowbridge & Livingston. An addition to the latter (1931-33) was by Shreve, Lamb & Harmon. The stepped granite pyramid on its roof was the Bank's logotype until it was merged into Deutsche Bank in the 1980s. The beautiful, marble-clad Art Deco lobby of 1 Wall Street, currently the headquarters of New York's oldest bank, the Bank of New York, was originally built for the Irving Trust Company (1928-32) by Ralph Walker of Voorhees, Gmelin & Walker.

The Equitable Building (1913-15) at 120 Broadway is remembered best for the greed of its owners, who built such an enormous volume on such a small site, without setbacks, that the public outcry over its density (thirty times the site's area) led to New York's adoption of the world's first comprehensive zoning regulation in 1916.

The present Regent Wall Street Hotel (1836-41) at 55 Wall Street originally was the Merchants Exchange building by Isaiah Rogers. Rogers built a three-story Greek Revival temple with twelve monolithic Ionic columns of granite so expensive that it financially doomed the enterprise. The building remained vacant until 1863, when it was converted into the U.S. Custom House. When the Custom House moved to Bowling Green in 1907, the building was remodeled for its new owner, the First National Bank of New York, by McKim, Mead & White, who doubled the volume of what became its great banking hall by superimposing a row of Corinthian columns.

The neo-Renaissance, fortress-like of the New York branch of the Federal Reserve Bank (1919-24), mod-

eled on the Pitti Palace, was designed by York & Sawyer, the leading bank architects at the time. The decorative ironwork is by Samuel Yellin. This is the main depository for most of the gold owned by foreign governments. The quantity of gold held here is equal to, if not larger than, the entire supply of gold held in the U.S. reserves at Federal Depository at Fort Knox, Kentucky.

At Old Slip, the original 1st Precinct (1909-11) by Hunt & Hunt, with its rusticated Renaissance Revival palazzo, was the first "modern" police station built for New York City. It now houses the offices of the New York City Landmarks Preservation Commission.

Wall Street Plaza (1973) at 88 Pine Street, designed by I. M. Pei, is a straightforward example of the International School. At the time of its construction, owner and developer C. Y. Tung had recently purchased the luxury liner Queen Elizabeth from Cunard Lines. He intended to convert it into a floating school, but the ship caught fire in Hong Kong harbor, burned, and capsized. All that remains of that great ship are the enormous bronze "Q" and "E," which remain on display in the building's plaza.

The 127 John Street Building (Emery Roth Sons, 1969) is interesting because its developer, Mel Kaufman, is famous for adding subtle humor into what are otherwise relatively undistinguished buildings. This building, for example, has an unusual lobby entrance designed by Corchia-de Harak Associates. At the side of the entrance is a sculpture entitled *Hours and Minutes*. What cannot be seen from the street, is the green Astroturf roof of this building, designed by Kaufman to look like an airport landing strip, with the number 127 surrounded by a circle. At the other end, he placed a replica of the Sopwith Camel, a World War I bi-plane.

Just around the corner, at 255-57 Pearl Street, the Edison Electric Illuminating Company built the world's first large-scale, commercial power generation facility. It began operations on September 4, 1882, and introduced electric lighting to approximately one square mile (2.6 km^2) downtown. The generator ran until 1890, when it was partially destroyed by fire.

The former head office of the American Telephone & Telegraph Company at 195 Broadway was built in three sections from 1912 to 1932, all by Wells Bosworth. Its profusion of columns makes it the largest façade of its type in the world. When AT&T moved to its new midtown building in the 1980s (now the Sony Building), it took along with it the colossal gilded sculpture *Genius of the Telegraph* by Evelyn Beatrice Longman, which had crowned the stepped pyramid atop the building. The sculpture has followed AT&T through a subsequent move to New Jersey.

Further north on Broadway, Park Row splits off and heads northeast toward the Brooklyn Bridge approach and Foley Square, home of city, state, and federal courthouses. Framing the end of Chambers Street is the Municipal Building (1907-14), the first and only skyscraper designed by the firm of McKim, Mead & White. New York's original Theater District lies just behind Park Row and below the bridge approach.

The New York County Lawyers' Association (1929-30) is another Cass Gilbert building. Adjoining it, several stories above the street, in the original home of the *New York Evening Post*, are several multi-story caryatids of limestone and copper. These statues, in the Art Nouveau style, were designed by Robert D. Kohn and his wife, Estelle Rumbold Kohn, who collaborated with Gutzon Borglum, the designer of Stone Mountain, Georgia, and most famously, Mount Rushmore. These are Borglum's only sculptures in New York.

Cass Gilbert's masterpiece, the faux-Gothic Woolworth Building, known as the Cathedral of Commerce, was the world's tallest building when completed in 1913. President Wilson illuminated the building remotely from the White House. Because there was no income tax at the time the building was built, Woolworth personally paid for it, in cash, out of his own funds. He can be seen, in the lobby transept, counting his nickels and dimes. In another corner, Cass Gilbert holds a model of the building in his hands. Grunwald Aus, the building's engineer, grasps and measures a girder, while another individual contemplates the floor plan. Most amusing of all is Woolworth's accountant, who holds the bill in one hand and has placed his head in the other. The gold mosaic in the ceiling and the figurines adorning the main entrance and lobby staircases also reinforce the concept of a modern "cathedral" dedicated to commerce rather than to religion. ■

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CAST IRON OF SOHO & TRIBECA EAST

By Terry L. Bailey & Mary Habstritt

James Bogardus (1800-1874), a New York inventor, developed a reputation by creating or improving a variety of devices including a clock, a gas meter, engraving machines, eccentric mills, spinning machinery, and a machine for pressing glass. Bogardus spent four years abroad in the 1840s and saw the increasing use of cast iron in British construction of bridges, aqueducts, and railway facilities, and, in Italy, the regularity and repetition of Classical and Renaissance architecture.

These influences inspired him to his most important invention: the self-supporting cast-iron building façade. The system of repetitive parts he developed included a column, a C-shaped hollow beam, a spandrel panel, and a cornice, which, being cast in iron, could be adapted to any architectural style. The beams and columns framed out relatively large window openings as compared to load-bearing masonry construction. According to architectural historian James Marston Fitch, this system "can be said to be the prototype of today's nonloadbearing curtain wall." Bogardus introduced these innovations in the construction of his own warehouse at Duane and Centre Streets in 1848. Interest was so great that he had to suspend construction on his own project to complete commissions for two clients. Building owners were particularly interested because the great fires of New York in 1835 and 1845 had destroyed over 50 acres (20 ha) of the city south of Wall Street.

Soho – an abbreviation of "south of Houston" – is a neighborhood covering an area of twenty-six square blocks between Houston and Canal streets. It is a locally designated historic district due to its high concentration of cast-iron buildings. Once a fashionable residential area, by the second half of the nineteenth century, Soho was feeling the pressure of commercial development pushing northward. Businessmen tore down old three- and four-story townhouses and started to put up five- and six-story warehouses and factories. This occurred just as cast iron was coming into common use for commercial structures in New York and across the country. Most have been destroyed, leaving Soho, an adjacent neighborhood called Tribeca ("triangle below Canal"), and Portland, Oregon, with the largest remaining stock of cast-iron buildings. Bogardus built some sixty cast-iron buildings around the country during his career, but only five remain standing today, four of them in New York at 274 Canal Street, 75 Murray Street, 85 Leonard Street, and 63 Nassau Street.

As manufacturers began leaving Soho and Tribeca in the 1960s, artists began moving into the spacious lofts they abandoned. The large windows, once used to great advantage to showcase products and to provide light to workers bent over their machines, now supply natural light to painters and sculptors. Shuli Sade's studio at 53 Lispenard Street is housed in a four-story 1867-68 Italianate building of masonry construction with cast-iron elements. It was originally designed by William H. Hume to hold a store on the lower floor with lofts above. The back wall was removed in 1879-80 to connect this building to 310 Canal Street. In the 1940s and 1950s, a manufacturer of electrical parts for sump pumps occupied both buildings; meters and pumps could be seen on display in the windows on Canal Street. Sade, a photographer of industrial subjects, is one of several artists now using this building for work space.

The cast-iron building at 79 Walker Street (1868-69) was designed by Herbert Fernbach. In 1902, it was occupied by a pocketbook maker. It was purchased by the Weinstein family, owners of General Tools, in 1980. General Tools' headquarters at 80 White Street is con-

nected through the back wall and uses three floors. The six-story Walker Street building also houses Art in General, a non-profit art gallery for emerging artists. Occupying another floor is Gerry Weinstein's studio, devoted to IA in many forms. In addition to a dark-room for his large-format industrial photography, there is a collection of artifacts ranging from model steam engines to a cast iron fire hydrant to a wooden pattern for a ship's propeller, and an O-scale layout of the 1952 New York Central Croton Station and Harmon Yard. ■

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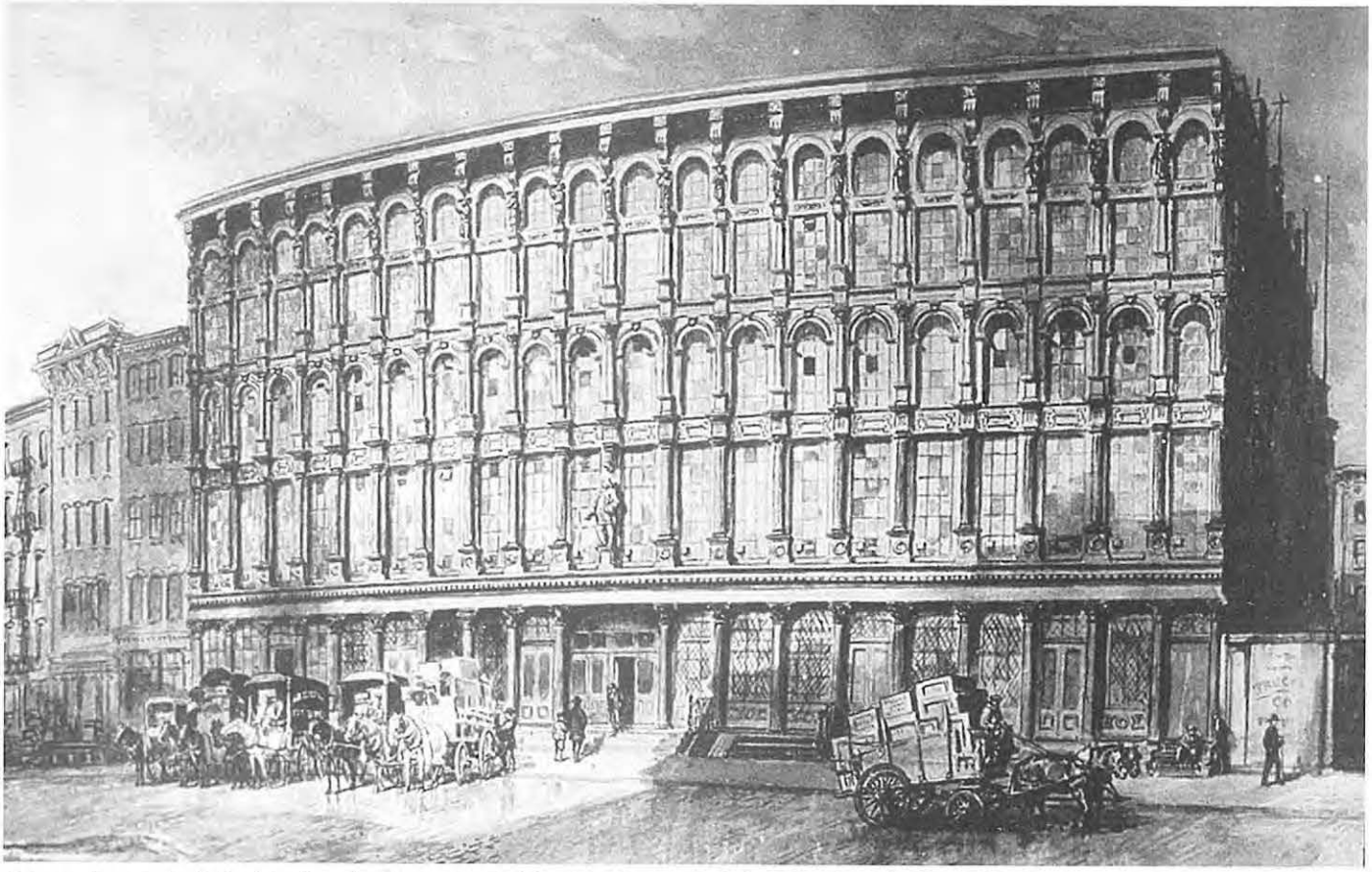
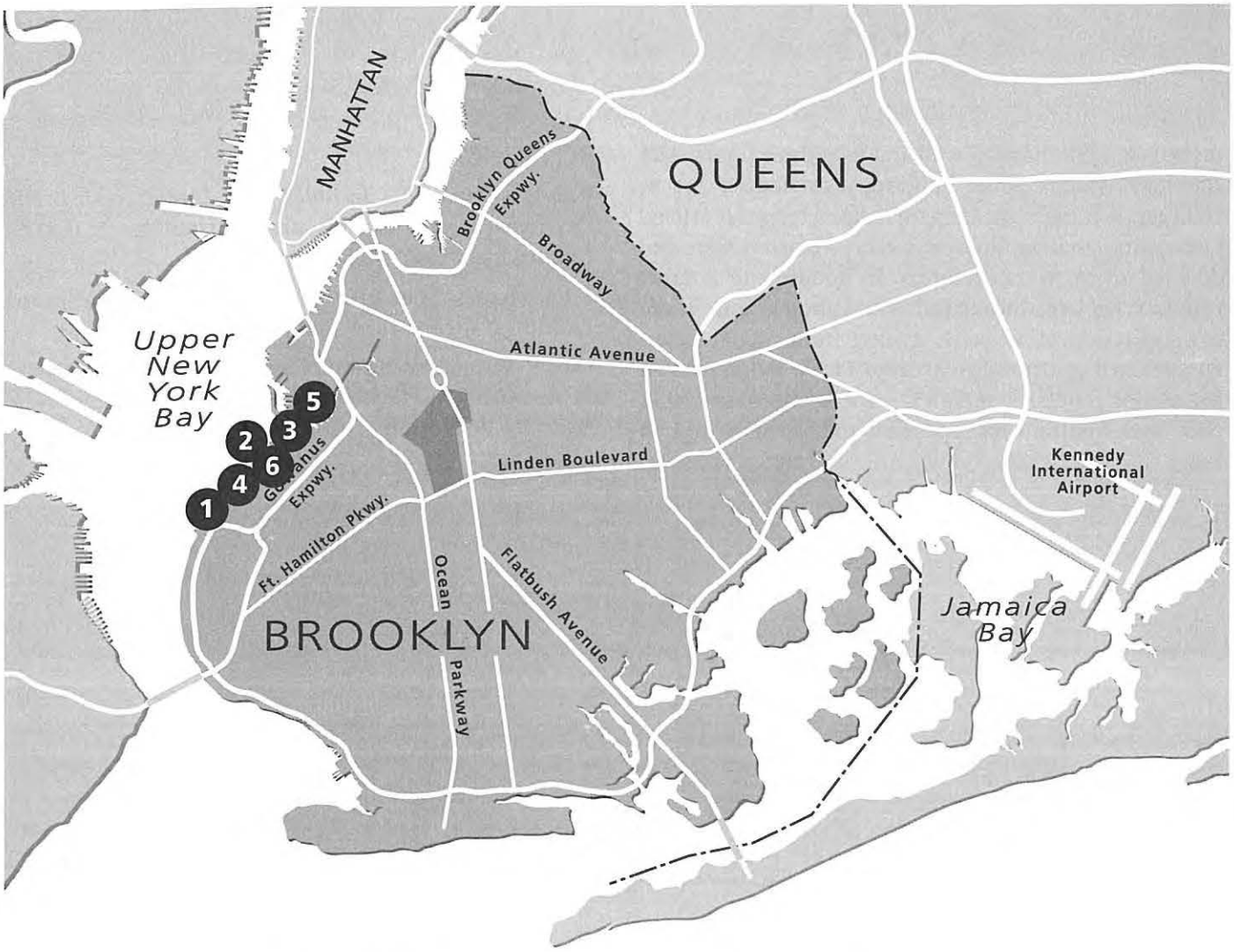


James Bogardus' design for the Harper Building in New York (1854; demolished 1923). Lantern Slide Collection, Prints & Photographs Division, Library of Congress.



South Brooklyn Waterfront

Brooklyn Army Terminal – First Avenue between 58th & 64th Streets **1**

Bush Terminal – First Avenue between 39th & 58th Streets **2**

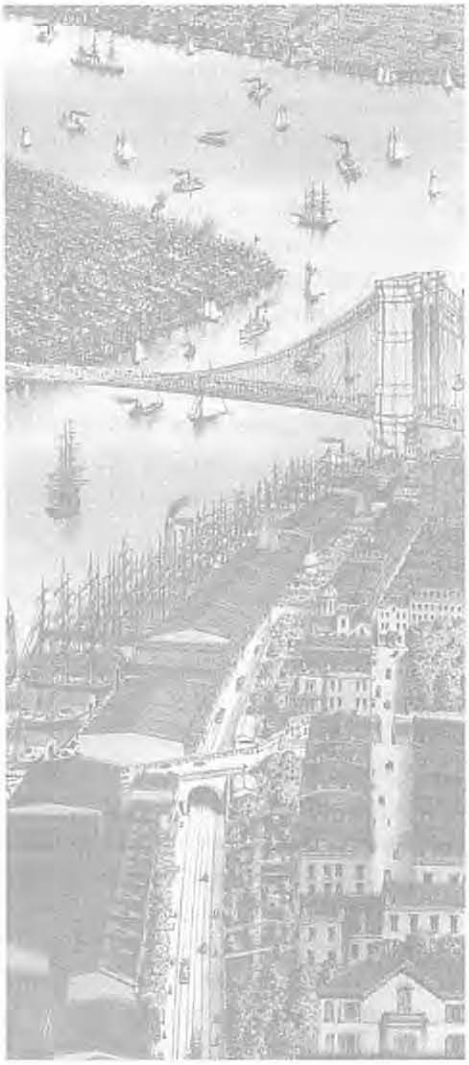
Fixture Hardware – 4116 First Avenue **3**

Mead & Josipovich – 140 58th Street **4**

Now & Later Candies *(Kraft Foods)* – 170 34th Street **5**

Sahadi Fine Foods – 4215 First Avenue **6**

CHAPTER THREE
SOUTH BROOKLYN WATERFRONT



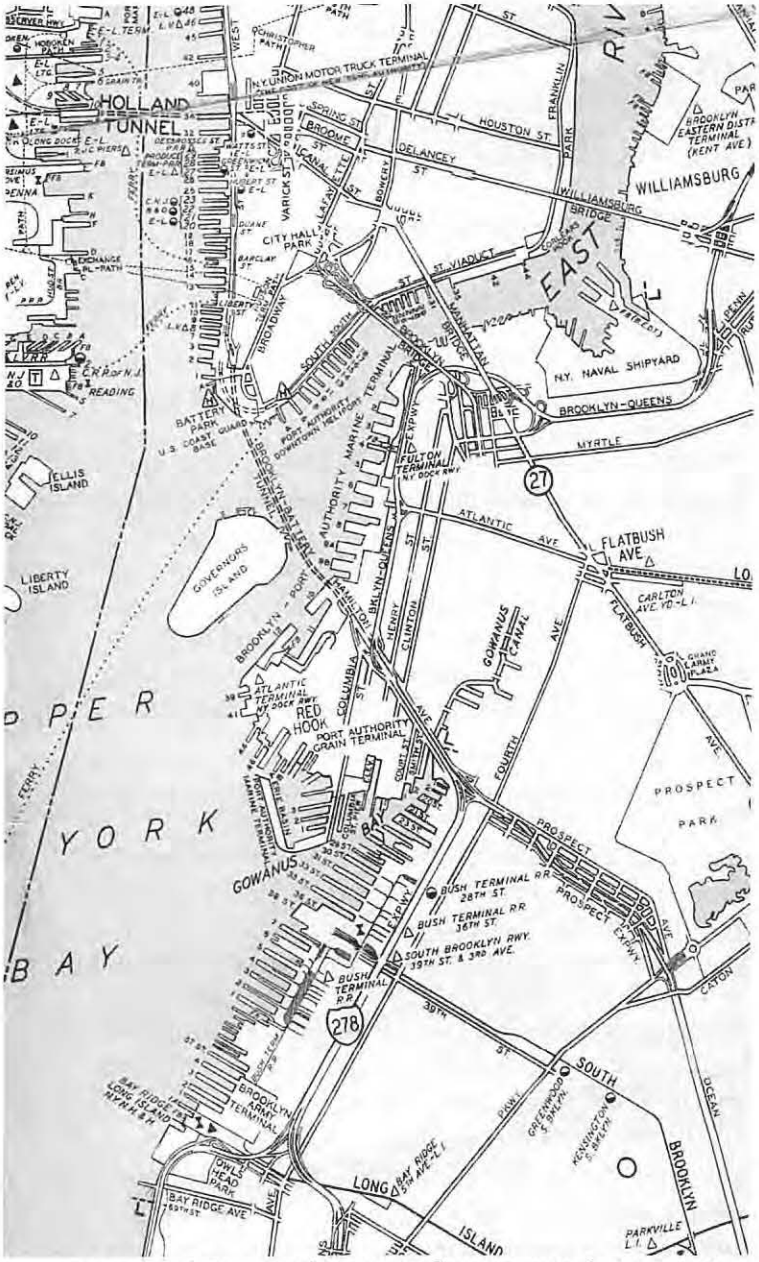
INTRODUCTION: PORT OF NEW YORK

By Thomas Flagg and Michael S. Raber

The Port of New York has been the nation's busiest since the 1820s, handling one-third to one-half of American general cargo in foreign trade during much of the industrial era. The Port also has been the center of the United States' largest "value added" manufacturing region, surpassing Pittsburgh, Cleveland, and even Chicago. For many years, this region and its interactions with the industrialized American heartland (especially Chicago) were the great engine of the national economy. The metropolitan region's huge market for every kind of product brought prosperity to many other areas of the country, from grain-growing trans-Mississippi towns to Pennsylvania's coal fields.

Robert Albion's classic analysis in *The Rise of New York Port* (1939) attributed the region's dominance to a number of factors. By 1815, New York merchants began to outdistance their rivals in Boston and Philadelphia by establishing the "packet lines" – the first true scheduled sailings to Europe from New York – and by providing auctions not available in other ports to capture a large trade in imported British goods. The region's lead was solidified by New York State's 1817-25 construction of the Erie Canal, a colossal enterprise that the federal government refused to support. The hinterland opened to the Port of New York by the Erie and its sister state canals was much larger than any other American port enjoyed.

Once trade outgrew the colonial-era East River waterfront of lower Manhattan, the Port could expand into a vast protected harbor within easy reach of open ocean. After about 1840, other parts of the region grew as Manhattan's congestion and high real estate costs forced shipping and manufacturing activities elsewhere, although passenger liners remained centered on the island's Hudson River waterfront. Brooklyn's extensive upland and deep waters on upper New York Bay made it the regional center for general cargo shipments at a long waterfront of private terminals built ca. 1840-1920, each with piers and nearby warehouses. By 1925, bulkheads along the Brooklyn and Manhattan waterfronts totaled over 68 miles (109 km), while the entire Port had nearly 350 miles (563 km) of frontage measured more than two thousand piers and slips, including two hundred for ocean-going ships. For comparison, the Port of London had 33 miles (53 km) of bulkheads, while Philadelphia had just over 5 miles (8 km). Manhattan's piers were only 17 miles



Detail of Port Authority Harbor Terminals Map, 1965 ed., showing Brooklyn waterfront.

(27 km) from open ocean, while the ports of Philadelphia or Baltimore were each about 100 miles (160 km) from the Atlantic.

In the second quarter of the nineteenth century, New York's frequent sailings attracted the highest value commerce, which in turn attracted more and more steamship lines in a positive feedback cycle. By the 1860s, about half the nation's foreign trade went through the Port of New York. After about 1875, this figure declined slowly as foreign trade with non-European regions developed. Trade with Canada, for example, grew until it became the United States' biggest trading partner, and that commerce naturally took routes more direct than through New York. In absolute levels, however, the Port's volume increased for a century. By 1920, it had become the world's leading port, surpassing London, Liverpool, and Hamburg in the volume and value of its commerce. Other than grain, New York made little effort to capture bulk cargo trade, concentrating instead on "general cargo" consisting of all sorts of package freight. This labor-intensive traffic, needing specialized services such as finance, brokerage, and export packing, was much more profitable to the region than bulk cargo, and could be carried in the liners using America's chief passenger port.

Other ports hoped the coming of railroads would neutralize New York's canal advantage, assuming that any port that built rail lines to the West could open up its own hinterland, but by then the Port's large commercial market made it a premier focus of rail development. The first through railroad to actually reach the Midwest was the Erie Railroad, a New York enterprise opened in 1851. By the century's end, each of the other Atlantic seaports was served by two major railroads from the West. Six trunk lines reached the Port of New York, with another six Class One railroads connecting the region to other areas. Railroads reaching one part of the Port (such as the west shore of the Hudson River) discovered that providing freight service to other parts of the region was essential for competitive reasons but geographically difficult. It was a practical impossibility for each railroad to build lines through the congested urban districts and over the many waterways to reach all sections of the vast Port. The solution adopted by all of them was to establish marine operations for local distribution. By transferring the freight to barges and car floats, they turned water barriers into "water belt lines." This system was especially useful for import-export freight, because barges or lighters could easily move alongside a ship at any pier, and cargo could be hoisted directly into the ship. Most steamship operators strongly preferred this method to loading from railroad cars on the pier. The railroads did not charge for this service, as it was considered equivalent to switching cars onto tracks on piers, and the availability of free lighterage everywhere was a factor in the ability of the Port to attract so many steamship lines.

Several of Brooklyn's terminals included railroads that interchanged with the trunk lines via car float, and by the 1920s Brooklyn's docks and warehouses served

Bird's-eye view of New York Port region, from Port of New York Authority, Port Information Bulletin No. 3, 1913.

more of the steamships carrying freight only than any other sector of the Port. As late as 1960, Brooklyn's piers were handling 60 percent of the import-export railroad freight. Brooklyn's dense urban development and location proved to be its maritime Achilles' heel in the face of the 1960s triumph of containerization, which required extensive upland space as well as better connections with transportation toward the West. Both these factors favored New Jersey. The Port of New York Authority (later the Port Authority of New York and New Jersey), established in 1921 to coordinate and promote port development, started planning for this transition in the late 1950s and created the first large dedicated container port in the United States at a time when containers were still considered an experiment that might fizzle. This facility was placed in Newark Bay, with more open land and better rail and highway connections than were available on the eastern side of the Port. Additional container berths were built in Bayonne and Staten Island, where the same advantages were available, with small container facilities built in Brooklyn partly for political reasons. Thus the Port of New York retained its dominance of the Atlantic seaboard trade well into the container era, along with the economic benefits of that dominance.

Despite regional partisan politics, some economic benefits of today's maritime trade accrue to all parts of the Port. Building a container port in Brooklyn comparable to Port Newark or Port Elizabeth would have involved wiping out whole neighborhoods, and would have severely limited the later expansion that was easily possible in an uninhabited area. The large flows of truck and rail traffic required by a container port would have required building major toll-free highways and rail tunnels from Brooklyn to New Jersey. Aside from the huge investment, it seems unlikely that Brooklynites would have appreciated the additional traffic. If the Port Authority had not built a container port somewhere in the region, the result would have been a disaster for the entire Port, and Brooklyn would have shared fully in the disaster.

The Port of New York is now much less dominant than it was in the nation's foreign trade, but despite having lost ground to other Atlantic ports, it remains the busiest of them. Considering past labor difficulties and related costs, the Port's ability to remain first suggests that over the past two centuries it has done many things right. It now faces tremendous challenges, notably dredging sufficient for the world's largest ships and expedited rail-marine freight handling. ■

BROOKLYN ARMY TERMINAL

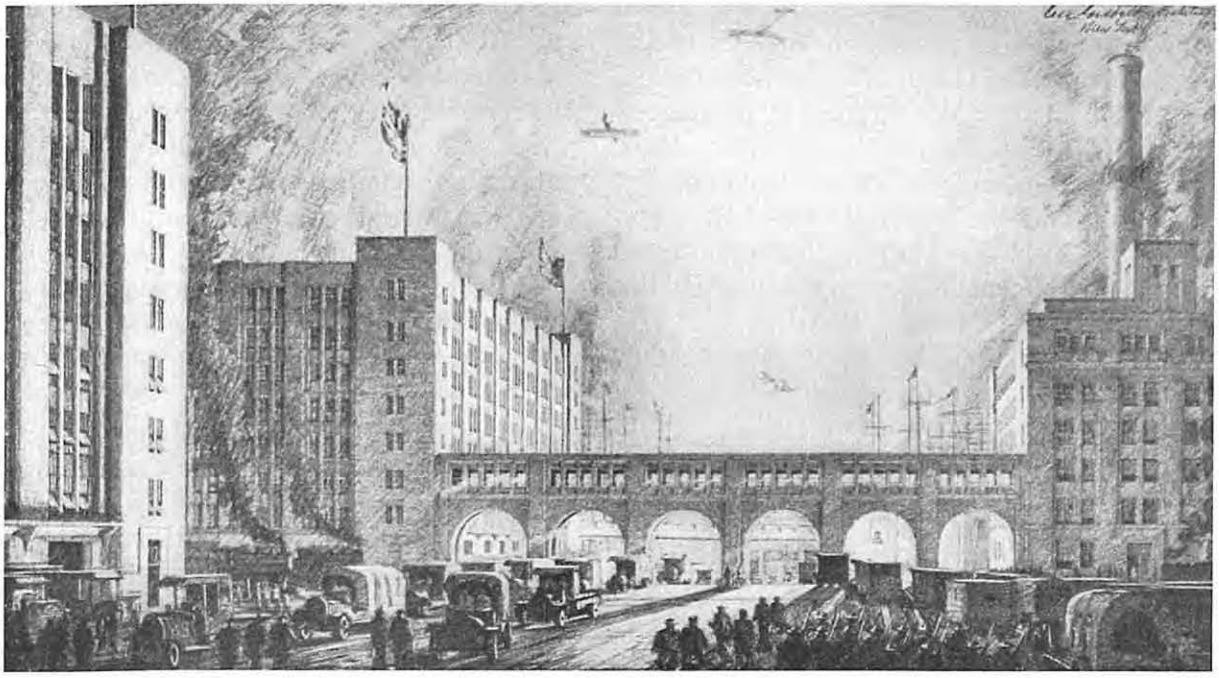
By Thomas Flagg

Construction on this terminal began during World War I, and it had become one of the harbor's largest port terminals by 1919. As shown in *Engineering News-Record* that year, the facility included three piers with transit sheds plus two giant upland warehouses for a total of 91 acres (37 ha) of storage floor space, and a rail yard accommodating 1,300 freight cars. The architect was Cass Gilbert, and the builder was the Turner Construction Company. Of the six port terminals built in record time to handle supplies during World War I, the Brooklyn terminal was the largest and most architecturally significant. The terminal saw heavy use during World War II but was taken out of service in 1960. It is now listed on the National Register of Historic Places.

In 1981, New York City purchased the terminal from the federal government, but could not find a developer to convert it to industrial use. Four years later, the city's own Economic Development Corporation (EDC) took on the job of developing, marketing, and managing the space. EDC began with Building B (the one with the loading atrium) and by 2000 had prepared two million square feet (186,000 m²) of rental space, almost all of which had been rented.

Brooklyn Army Terminal, with Cross Harbor train in courtyard, 1988. Thomas Flagg.

EDC had intended to reuse the piers until it discovered that the wooden piles supporting them were eaten away by the shipworm or teredo. This aggressive marine borer had once been driven away by pollution, but with recent improvements in water quality, returned to destroy piles and other wooden components of piers city-wide. The piers were therefore removed in 2001. ■



Artist's rendering of Brooklyn Army Terminal, from Smith's Port of New York Annual, 1919.

BUSH TERMINAL

By Thomas Flagg

This 200-acre (81 ha) operation in South Brooklyn was the work of one energetic New York industrialist, Irving T. Bush. In his autobiography, Bush relates that he started the terminal in 1895 with six warehouses, one pier, one second-hand locomotive, one leaky carfloat, and an old towboat no longer wanted by Standard Oil, mostly on farmland his family had owned. By 1915, all of the terminal's basic elements were present. Expansion continued through the 1920s, and terminal development reached its peak around 1930.

Bush Terminal buildings No. 9 and No. 10 under construction in 1916. Turner Construction Company. Courtesy archiveofindustry.com.

Bush's intent was to combine steamship piers, warehouses, and manufacturing buildings into a large unified terminal that would provide a place where industry could thrive in the city. He offered every facility desirable in what would now be called an industrial park: modern, clean loft buildings already erected, with all utilities, in which a company could lease one or more floors, with expansion possible. In close proximity, Bush built warehouses and seven deep-water piers, each about 1,300 by 150 feet (400 by 45 m), as well as the Bush Terminal Railroad. Many of the reinforced concrete structures were based on the designs of architect William Higginson, who also was responsible for the Gair Folding Box Company buildings in DUMBO.

Bush Terminal warehouse, 1917. Courtesy archiveofindustry.com.

The railroad made the terminal far more efficient than Manhattan loft buildings, from which freight had to be drayed to crowded pier stations. The Bush Terminal, in contrast, was equipped to take any kind of freight directly from the shipper's elevator door, load it into a boxcar, and deliver it to any of a dozen main-line railroads. Most of these were reached by the terminal's own tugs and carfloats. Trolley cars also operated on the Bush tracks, transporting workers to and from the nearby ferry to Manhattan. The terminal attracted enough business to require continuous construction of new buildings for two decades. By 1937, the terminal handled 16 percent of all import and export cargo at the Port of New York.

Bush Terminal was used very heavily by the military during World War II, for loading ships sent in convoys across the Atlantic. It continued as one of the Port's chief freight terminals after the war, until the advent of containerization in the 1960s made its piers obsolete. Its warehouses and loft buildings nonetheless continue to serve as one of Brooklyn's main industrial centers. ■

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Fortune, February 1937, p. 136.

FIXTURE HARDWARE MANUFACTURING CORPORATION

By Mary Habstritt

Fixture Hardware was founded by Bert Weiss, who grew up in the hardware business. His family owned Weiss Hardware on the Bowery in Manhattan from 1919 to 1995. In addition to the retail store, the family had a small-scale manufacturing operation upstairs. This growing manufacturing operation was moved to Brooklyn's Bush Terminal in 1947.

Fixture Hardware occupies 30,000 square feet (2790 m^2) in a building most likely constructed in the 1920s, according to historic maps. The land on which the building sits is east of the area formerly occupied by the Bush & Denzlow Manufacturing Company pier. Irving Bush inherited the pier from his father and started Bush Terminal in the late nineteenth century.

Fixture Hardware specializes in fabricating display hardware, producing systems of slotted metal standards that hold a variety of brackets and hooks for retail establishments such as Kohl's and Sears. Fixture Hardware is one of the few remaining full-line display hardware manufacturers in the United States.

Since acquiring the company from his father, Kenneth Weiss has made production and equipment improvements that have enabled the firm to update its product line and manufacturing capabilities. The office also has been automated with job-tracking application software. Its twenty to twenty-five employees include stamping machine and punch press operators and tool and die makers. ■

MEAD & JOSIPOVICH

By Mary Habstritt & Allison S. Rachleff

Mead & Josipovich is a custom architectural woodworking firm founded in 1981 by Lawrence Mead and Boris Josipovich. Boris, who was trained as a woodworking engineer in his native Russia, oversees the crafting of the wood, while Larry supervises business operations. The firm generally serves as a sub-consultant to general contractors working to architects' specifications. Hand drafting is the preferred design method at Mead & Josipovich; computer-aided drafting (CAD) is rarely used.

The firm specializes in creating high-end interiors, including moldings, cabinetry, and paneling, for luxury residences and commercial enterprises. For example, Mead & Josipovich is currently working on wood interiors for members of the Schwab (as in the financial services corporation), Bronfman (of Seagram beverages), and Ford families. In addition, the firm has created wood interiors for Barney's New York, a department store at Madison Avenue and 61st Street in Manhattan, and Fred, a high-end jewelry store headquartered in Paris. The majority of their clients are in New York City.

Painting booth where finishing touched are applied to wooden elements. Allison S. Rachleff.

Originally located in Red Hook and then in Park Slope, the firm has been in the Brooklyn Army Terminal since 1989. Mead & Josipovich moved in just two years after the facility re-opened as a light industrial manufacturing and back office complex, and currently occupies 34,000 square feet (3,160 m^2) in Building B. The firm's equipment ranges from a 1913 planer to a state-of-the-art Martin precision saw and shaper made in Germany. ■

Brooklyn Army Terminal's reinforced concrete structure is visible in the Mead & Josipovich workroom where craftsman sand doors by hand. Allison S. Rachleff.

NOW & LATER CANDIES (KRAFT FOODS)

By Mary Habstritt

The Phoenix Candy Company was founded in Brooklyn in 1953, making such products as peanut brittle and Atlantic City saltwater taffy. The recipe for Now & Later candy was devised in 1962 and was originally produced on a single machine for marketing in New York City only. Except for the addition of new flavors, the candy has remained the same over the years. On the corporate level, however, change has been the norm.

Phoenix Candy went public in 1972 and was purchased by Beatrice Foods in 1978. It was subsequently sold to Leaf Confections in 1983, which sold it to Kouri Capital, a private investment group, in 1989. In 1992, it was acquired by LifeSavers, which was by that time a division of RJR Nabisco. LifeSavers had been purchased by Nabisco in 1981 and Nabisco, in turn, was purchased by R. J. Reynolds in 1985. Having divested itself of all its tobacco holdings by 1999, RJR Nabisco became Nabisco Group Holdings with Nabisco Holdings, the manufacturer, its sole asset. In a complicated deal, R. J. Reynolds Tobacco bought back Nabisco Group Holdings in 2000, while selling Nabisco Holdings to Philip Morris. Philip Morris already owned Kraft Foods and combined the operations of the two food companies under the Kraft name. In June 2001, Philip Morris spun Kraft off as an independent company.

Kraft's Brooklyn operation now makes not only Now & Later candy, but also soft LifeSavers Gummies. To do so, the plant is equipped with four semi-continuous cookers with a production capacity of nearly 11,000 pounds (5,000 kg) per hour. Two Hansella 155 cookers and one Bosch 155 can each produce 3,000 pounds (1,400 kg) per hour and the Hansella 145 kicks in 1,900 pounds (900 kg). Fourteen pulling machines specially built for the Brooklyn facility stretch the candy and thirty-three Latini/Hansella batch rollers press it flat. Thirty-one Theegarten Series "U" wrappers can wrap 700 to 1,000 pieces of candy per minute, despite being fifteen to thirty years old. In a year, the plant produces about 19 million pounds (9 million kg) of candy with the help of 140 employees.

The Kraft complex includes the main production facility, measuring 49,000 square feet (4,600 m²), and a small stock/production building of 6,000 square feet (600 m²), both of which are sixty years old. The 60,000-square-foot (5,600 m²) warehouse is twenty-five years old. ■

Some of the yummy gummy factory output of Kraft. Gerald Weinstein, Photo Recording Associates.

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SAHADI FINE FOODS

By Mary Habstritt & Allison S. Rachleff

Sahadi Fine Foods owns and operates a large wholesale distribution warehouse and nut roasting facility across from Bush Terminal. It is one of two divisions of the Sahadi company. The retail arm at 185-187 Atlantic Avenue was opened in 1948, when Robert Sahadi moved it from Little Lebanon on Manhattan's Lower East Side. Construction of the Brooklyn-Battery Tunnel displaced this enclave, and many of the families and businesses moved to Atlantic Avenue between Court Street and Henry Street, creating a "Little Arabia."

Robert's cousin Abraham opened the store in 1898 and Robert had gone to work for him when he emigrated from Lebanon in 1919. Robert's son Charlie and Charlie's wife Audrey now run the store with their son Ron. Daughter Christine Whelan and her husband Pat manage the wholesale distribution operation.

The Sahadi warehouse complex is made up of three buildings and includes a factory built circa 1890 in the Romanesque style. This 68,000 square-foot (6,300 m²) building, at 4201 First Avenue, has a bell tower and appears to have been constructed by National Meter Company. It underwent a gut renovation last year that entailed an environmental clean-up of the site. The building holds such specialty imports as grape leaves, tahini, beans, chocolate, tea, olive oil, grains, spices, dried fruits, nuts, and twenty varieties of olives. It is fully equipped with loading docks for trucks and receives container shipments via tractor-trailer.

The 12,000-square-foot (1,100 m²) building at 4223 First Avenue is an early twentieth-century concrete building with Tudor details. Plans are to rent this building to other commercial enterprises, as it is not equipped for manufacturing. A third structure at 4215 First Avenue, encompassing 38,000 square feet (3,500 m²), was newly constructed as part of last year's renovation. ■

REFERENCE

New York Food Museum. Web site at http://www.nyfoodmuseum.org/, accessed May 2002.

The Regina nut packaging line at Sahadi Fine Foods. Allison Rachleff.