PENNSYLVANIA STATION,
NEW YORK TERMINAL SERVICE PLANT
(Penn Station, Service Building)
250 West 31st Street
New York
New York County
New York

HABS No. NY-5471-A

HABS
NY
31-NEYO,
78A-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN BUILDINGS SURVEY
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
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HISTORIC AMERICAN BUILDINGS SURVEY

PENNSYLVANIA STATION, NEW YORK TERMINAL SERVICE PLANT
(Penn Station Service Building)

HABS No. NY-5471-A

Location: 250 West 31st Street, New York New York County, New York

UTM Coordinates: 18.584900.4511240 Brooklyn, New York Quadrangle

Present Owner: National Railroad Passenger Corporation (Amtrak)

Present Occupant: National Railroad Passenger Corporation (Amtrak)

Present Use: Electric power, steam and water distribution for Pennsylvania Station and traction power control, compressed air system and electric distribution for operation of the rail terminal systems.

Significance: TheNew York Terminal Service Plant was constructed as an integral component of the original Pennsylvania Station complex and served as a power generation and control center for the station, its tracks and signal systems. The facade was designed by McKim Mead & White to complement the exterior of Pennsylvania Station. While much of the original service equipment has been dismantled or abandoned, some of the original power distribution equipment is still in use and a significant portion of the interior remains intact. The building has been determined National Register Eligible by the New York State Historic Preservation Office.

PART I HISTORICAL INFORMATION

Historical Context

At the turn of the century, New York City was the nation's center of international commerce and shipping and the largest city in the United States with a population of three and a half million people. The city suffered major transportation problems, due in part to the location of its business and residential core on Manhattan Island. Passengers and freight arriving from the south and west had to be ferried between train terminals on both sides of the Hudson River, an arduous and time-consuming process.

By the 1890s, the Pennsylvania Railroad began advancing plans aggressively for rail extensions to Manhattan by constructing a bridge over the Hudson River north of its present tunnel crossings. With the Pennsylvania Railroad's acquisition of the Long Island Rail Road in 1901 and a charter that allowed the Long Island to construct a direct rail link into Manhattan, the stage was set for construction of a tunnel system linking the Pennsylvania Railroad through Manhattan and on to Long Island. This system was later joined with the New York, New Haven & Hartford Railroad, allowing direct access to New England and Boston.

The railroad selected McKim Mead & White, the preeminent architectural firm of the day, to design a station complex for the Pennsylvania and Long Island railroads. The new station was to be a grand presence in the city and was to serve as a magnificent gateway to both the city and the railroad. By all accounts, the firm succeeded by creating an elegant Beaux Arts Neoclassical structure of international significance. The architectural detailing relied heavily on Roman precedents, with the details and spatial configuration of the Main Waiting Room recalling the Baths of Caracalla. The building embodied principles of the City Beautiful Movement, first demonstrated in 1893 at the World's Columbian Exposition in Chicago.

The concentration of railroad lines at the new station site also made it a desirable location for a mail-handling facility, and the U.S. Postal Service took advantage of the available air rights over the depressed tracks west of the station to build the Penn Terminal Post Office (later the General Post Office; presently the James A. Farley Building) between 31st and 33rd streets and Eighth and Ninth avenues. McKim Mead & White were the architects for this building as well. The post office and train station shared connections at the platform level, and the mail-handling equipment utilized power generated at the New York Terminal Service Plant.

Pennsylvania Station (later commonly referred to as *Penn Station*) was officially opened on September 8, 1910. It served the public well for over 50 years. Between 1911 and 1945, the annual number of passengers using Pennsylvania Station increased nearly nine-fold, from 12,549,164 passengers in 1911 to 109,349,114 passengers in 1945. From the time of its construction, Pennsylvania Station was one of the busiest train terminals in the country.

In the years following World War II, the growth of the interstate highway system and the use of the private automobile, coupled with developments in commercial aviation, led to the decline of the nation's railroads as the primary means of long-distance passenger travel. Railroads, increasingly operating at deficits, made drastic cutbacks in services and sought new ways to increase their revenues. As early as 1951 the Pennsylvania Railroad considered plans to sell its air rights over the tracks near Penn Station for a proposed world trade center. Although that particular project never materialized, it set in motion a series of development proposals that climaxed in December 1954, when a prominent New York City real estate development firm purchased air rights between Seventh and Eighth Avenues, the site of Pennsylvania Station.

By 1960 plans had been developed for the Madison Square Garden complex, but little was divulged to the public about plans to demolish Pennsylvania Station. In the meantime, the station was allowed to fall into a state of decay and disrepair. Architects concerned about the loss of this McKim Mead & White masterpiece formed the *Action Group for Better Architecture in New York* (AGBANY) and brought national attention to the station's proposed demise. Despite the group's extensive efforts however, the demolition of Pennsylvania Station began in 1963. By late 1966 the old station had entirely vanished; a modern station had been built underground; and the Madison Square Garden Sports Complex and a high-rise office tower known as Two Penn Plaza had been erected on the site.

With the destruction of the original Penn Station, the nation not only lost an important historic landmark, but within a short time, the new underground Penn Station proved to be inadequate and inefficient.

> *The interior space consists essentially of two parts, a large ticket lobby embracing a much greater area than is necessary for the moving traffic, and a combined waiting room and concourse that is an insult to the user: it is too small, too low, contains too few seats, and provides access to all train gates in such a way as to guarantee conflict and confusion.*[1]

The station's shortcomings have become increasingly obvious as the Northeast Rail Corridor has been expanded during the last three decades. In 1991 Amtrak sought proposals for the redevelopment of Penn Station. Early studies and design alternatives for the present station complex revealed that the current layout has severe limitations that negatively affect daily operations. Several projects are currently underway to upgrade passenger services, systems and code compliance at the present Penn Station. The Long Island Rail Road is completing the refurbishment of their portion of the lower level of the station. New Jersey Transit and Amtrak anticipate similar programs to upgrade their facilities within the near future.

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[1] Carl W. Condit, The Port of New York: A History of the Rail and Terminal System from the Beginnings to Pennsylvania Station (Chicago: University of Chicago Press, 1980), p.255.

New York Terminal Service Plant Planning and Construction

The New York Terminal Service Plant was an integral element of the Penn Station complex, such that historian Carl Condit has referred to it as "*the vital heart of the system.*"[2] Fairly early during the design phase of Penn Station it was understood that a separate building would be necessary to house the boilers, transformers and other equipment, as these would require an enormous amount of space.

> *The character and location of the Station precluded their installation in that building, and no central space for a special building was available in the yard without sacrifice of valuable track room. Fortunately, a convenient location was available on relatively cheap property of the Company on the south side of 31st Street, about midway between Eighth and Seventh Avenues, and directly accessible, under 31st Street, from the Station and yard.*[3]

The earliest plans for the New York Terminal Service Plant date to 1904, but construction did not begin immediately. All structures remaining on the site were demolished to accommodate the new building and the site was excavated down to bedrock prior to construction. The Service Plant was finished one year prior to the completion of Pennsylvania Station, and may have provided power for construction activities.

PART II DESCRIPTIVE INFORMATION

Site Description

The New York Terminal Service Plant is located at 250 West 31st Street between Seventh and Eighth Avenues in Manhattan, New York City. It is directly across the street from Madison Square Garden, which occupies the westerly portion of the former site of the original Penn Station building. The Service Plant is surrounded on all sides by low- to mid-rise masonry commercial structures built during the mid-nineteenth to early twentieth century.

According to early maps of the city, this site was largely undeveloped until the middle of the nineteenth century. Between 1840 and 1850 streets were created and the land subdivided into lots. By 1854, approximately nine structures had been built on the future New York Terminal Service Plant site. The surrounding area was occupied by mixed residential and small-scale commercial buildings throughout the remainder of the nineteenth century. In the late nineteenth century, the area was known as "*Hell's Kitchen*," primarily because of a concentration of tenements, saloons and cheap hotels in the neighborhood.

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[2] Ibid., p.302.

[3] George Gibbs, "The New York Tunnel Extension of the Pennsylvania Railroad," Papers and Discussions of the American Society of Civil Engineers 37, no. 5 (May 1911), p.694.

Shortly after the turn of the century, when plans were made for the construction of Pennsylvania Station, 32nd Street was closed west of Seventh Avenue, several blocks of buildings were demolished, and the entire site was excavated down to bedrock as construction began on the new railroad complex.

New York Terminal Service Plant Description

Completed in 1909, the New York Terminal Service Plant is a steel frame structure, clad in brick, with coursed, dressed Stony Creek, Connecticut pink granite ashlar on the street (north) facade returning on the side walls. The building occupies a footprint measuring 160 feet by 100 feet, with a height of 86 feet above grade, and a depth of 49 feet below grade. This structure with its original exterior remains virtually intact. The street facade of the building was designed by McKim Mead & White to harmonize with their designs for Pennsylvania Station across the street. Its formal composition and classical detailing includes Doric pilasters with heavy cornices and a superimposed attic story.

The building's structural system and side and rear elevations were designed by the railroad's engineers while the building's mechanical systems were designed and laid out by Westinghouse, Church, Kerr & Company, engineering consultants to the railroad. A fire wall divides the building into two main parts, with the boiler room on the west side and the engine room for power generation and distribution on the east side. The lower basements contained air compressors for track switching operations, and stationary steam engines and steam turbines to generate power for station lighting, track signaling and traction power within the station. A steam distribution system was employed to heat the entire station as well as the building's domestic hot water supply. At the time of its construction, the system was unique in the world for its scope and complexity.

The basement contains foundations for machinery, engine piping and the main entrance to the pipe and trucking subways under the yard. Level 1 contains the engine room which housed the lighting generators, air compressors, hydraulic power pumps, refrigeration compressors, and the heaters and circulating pumps for the station. Level 3 contains miscellaneous air-handling machinery and a pipe gallery to the station. The street floor (Level 4) contains the boiler room, over which were the coal bunkers. The eastern half of the building houses the traction power sub-station. It has three levels below the street for the cable inlets, bus-bar structures, and cabling and switching apparatus. The main floor contains rotary converters, transformers and the sub-station switchboard. The New York Terminal Service Plant was designed to withstand the heavy industrial floor loading imposed by the massive equipment installed within it.

The street (north) facade is clad in Stony Creek granite which was chosen for its similar appearance to the Milford granite used for the facade of Penn Station. The facade features nine pilasters supporting a monumental cornice, above which is an attic story. The pilasters

divide the facade into eight bays. Between the pilasters are large gang-operated industrial windows, designed primarily for regulating air flow to the equipment floors. On the street facade these windows are protected by iron grilles similar to those on the smaller windows centered immediately below them. Horizontally oriented rectangular windows extend along the cornice frieze band. These windows provided light to the office spaces on Level 6. The attic story contains large windows which provide light to the top two floors (Levels 7 and 8).

The east, west and south elevations are treated in a manner appropriate to the industrial character of the building and are clad very simply with brick masonry. These elevations have large openings filled with gang-operated industrial sash at the double-height boiler/sub-station level just above grade. At the top three levels of the building, much smaller double-hung sash have been installed in pairs directly above the hopper sash openings.

The roof has a crown at the center and pitches down to the outside. The low parapet helps form a gutter at the perimeter of the building. The drains at the corners have failed, causing leakage inside the building and damage to the adjacent exterior masonry.

While Pennsylvania Station and the Service Plant shared similar architectural details, the underlying principles of their designs were vastly different. Pennsylvania Station was designed for people where great emphasis was placed on the creation of an architectural masterpiece; the Service Plant was designed for machinery, and its design was dependent upon the layout and operation of equipment.

> *The meteoric pace of power station machinery redesign and the ceaseless trials of new grates, hoists, and ash conveyors mocked the architects' attempts to achieve effects based on 'mass, beauty of proportion, and relations of voids and solids together with texture and color.'*[4] *Engineers insisted on doorways larger than the largest known machinery, on areas for cranes not yet invented, on a thousand and one details that defeated architectural principles. In the years between 1890 and 1930, architectural magazines published only a handful of articles commenting on central station design. Magazines like* Electrical Age, Cassier's, Electrical Review, *and* Western Electrician *published scores.*[5]

The emphasis on machinery over structural form is clearly evident in the design of the street facade of the New York Terminal Service Plant. In keeping with the classical design of Penn Station, the Service Plant's street facade is nearly symmetrical. However, the return at the northwest corner of the building is approximately twice as large as the return at the northeast corner. Although it is not completely clear why the facade was designed this way, the

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[4] Donald Des Granges, "The Designing of Power Stations," Architectural Forum 51 (September 1929), p.372. Quoted in John R. Stilgoe, Metropolitan Corridor: Railroads and the American Scene (New Haven: Yale University Press, 1983), p. 125.
[5] Stilgoe, p.125.

additional length may have been required to accommodate a second bank of boilers on the west end of the boiler room. The second bank of boilers was noted on original floor plans of the building.[6] This was typical of power station design during the first decade of the twentieth century, as evidenced by the following:

> *Two great principles guided power station designers. The first emphasized the primacy of machinery in ordering building form ... The second design principle evolved from the first. By 1910, central stations exhibited faith in the future; engineers designed them to be easily expanded. The "unit system" of making each firebox, boiler, and generator a single, nearly autonomous unit meant that power stations stretched in a series of bays, each bay housing one or more mechanical units. As electricity consumption increased, companies could add new bays at one end of the station, expanding generating capacity quickly and cheaply.*[7]

New York Terminal Service Plant Operation

Completed in six years and seven months, Pennsylvania Station was, in 1910, the largest building in the world constructed all at one time.[8] A structure of this magnitude, with its numerous operations and facilities, required vast amounts of heat, light, water and power.

> *A study of the service requirements for this Terminal Station quickly developed the fact that, while the heating of the buildings and cars in the yards was not the most extensive service to be provided, as regards magnitude and cost, it nevertheless determined very largely the makeup of the plant, which would be required to supply the other principal services.*
>
> *The necessary 60-cycle electric current for lighting, and for the power required to operate all the above mentioned services, except that of heating, could easily have been obtained from the main generating station at Long Island City, where power is generated at minimum cost and might have been delivered through transmission cables laid in the railroad tunnels under the East River, but it was not feasible nor desirable to transmit the required heat to the terminal through these tunnels.*
>
> *It was, therefore, decided to provide a steam supply near the terminal to generate all the heat for warming, and for this purpose the service station was built, where all the electric generating apparatus, pumps, compressors and*

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[6] See Appendix B: Historic Plans and Drawings.
[7] Stilgoe, p. 123.
[8] William Couper, ed., History of the Engineering Construction and Equipment of the Pennsylvania Railroad Company's New York Terminal And Approaches (New York: Isaac H. Blanchard Co., 1912), p.14.

auxiliaries required for the terminal station services are operated from steam boilers, the resulting exhaust steam being generally sufficient to provide the desired heating for the buildings, live steam being used for car heating.[9]

The New York Terminal Service Plant was designed to provide the following functions:

(a) Heating and lighting for Penn Station and associated yard buildings;
(b) Steam, compressed air and water supply for railroad cars;
(c) Air supply for the switches and signal system, for tunnel drainage, pumping and sewage ejectors;
(d) Water supply for various purposes in the buildings, and for fire protection;
(e) Hydraulic power for elevators and lifts;
(f) Refrigeration for cold boxes in kitchens and restaurants, and for drinking water;
(g) Electric power for lighting of buildings, tunnels and yards; stationary motors for elevators, heating and ventilating fans in buildings and tunnels; power for car battery charging; operation of telephones and the clock system; and other minor uses; and
(h) Traction power for moving trains within the station area.

These systems were connected to the station by means of pipes and cables which ran from the basement of the New York Terminal Service Plant through a utility passage below 31st Street.

Electric Power

The electric power plant was fueled by coal, which was delivered by railroad cars to Penn Station, Track 1 under 31st Street just north of New York Terminal Service Plant, Level 1. These coal cars emptied into a hopper located below and between the rails of Track 1. The coal was transferred by belt conveyors to the boiler room which contained five Babcock & Wilcox watertube boilers of 525 h.p., designed to carry 200 pounds of steam pressure. The boilers were equipped with A.P. Green economizers which improved boiler efficiency by reducing flue gas temperatures. The boilers used feed water which was drawn from a preheater capable of heating 6,500 gallons of water from 70°F. to 200°F. per hour. Below each boiler was a furnace equipped with shaking grates and designed to burn anthracite coal. Forced draft for the boilers was provided by a pair of 50 hp single-acting, high speed steam engines driving two Sirocco fans. A smoke stack, measuring 11 feet in diameter at its base and rising 50 feet above the roof, was designed to provide sufficient draft for the boilers and to carry smoke above the level of surrounding buildings. Provision was made in the original design for a second bank of boilers and a second smoke stack which were added shortly after the construction of the station. The coal was handled and stored by two belt conveyors, with

[9] Westinghouse Church Kerr & Company Engineers, The New York Passenger Terminal and Improvements of the Pennsylvania and Long Island Railroad (1910), p.12.

a total capacity of 120 tons per hour. The unusually large capacity was required to quickly empty the coal cars so that they would not block tracks which were used for passenger car storage. A motor driven conveyor belt capable of handling 50 tons per hour removed ash from the boilers. Both boiler ash and incinerated garbage ash were discharged directly into hopper cars which also used Track No. 1 under 31st Street.

From the boilers, high pressure steam was piped to the engine room and the turbo-generators. Two 1,000 kw, 3-phase, 60-cycle, 240 volt Westinghouse generators were directly connected to Parsons steam turbines to provide the main power output of the Service Plant. Excitation[10] voltage for these generators was provided by two 40 kw, 110-volt DC motor-generator sets. A 55 cell storage battery backed up the generators for emergency excitation.

Oil filled transformers were used to provide 2,200 volt, 60-cycle power for the signal system. This would be reduced to an operating voltage of 220 or 110 at the signaling device.

Power was transmitted from the New York Terminal Service Plant via cables in tunnels running under the street and the station. Sub-stations in the station yard housed motor-generator sets which provided low voltage DC power for charging passenger coach batteries. Other motor-generators supplied DC power to the arc lights to illuminate the yard.[11]

An incinerator (garbage destructor) for disposal of rubbish was located on the second level.

Elevators and Lifts

The New York Terminal Service Plant provided power for the following elevators and lifts in Penn Station:

	No.	Size	Capacity	Speed	Lift
Passenger Elevators	11	5x10 ft.	2,500 lbs.	200 ft./min.	17 ft.
Baggage Lifts	21	7x15 ft.	7,500 lbs.	100 ft./min.	28 ft.
Mail Lifts	4	6x15 ft.	7,500 lbs.	100 ft./min.	52-70 ft.
Office Elevators	10	5x6 ft.	2,500 lbs.	300 ft./min.	40-70 ft.

[10] Early simple generators during the first half of the 18th century relied on permanent magnets to create their magnetic field. In 1866 Werner von Siemens and Johann Halske manufactured a dynamo in which the magnets were replaced by much more powerful electromagnets. The electricity passing through the electromagnets was called the "exciter" current. By 1878 alternating-current generators had been developed independently by Gramme and Fontaine in France and Siemens in Germany. These improvements enabled the generation of sufficient electrical energy to run powerful traction motors. The use of excitation voltage allowed close control of output voltage. By regulating the excitation voltage the strength of the electromagnets would change and this in turn would vary output voltage.

[11] E.J. Bell, "Electrical Traction and Station Construction," in History of Engineering Construction and Equipment of the Pennsylvania Railroad Company's New York Terminal and Approaches, edited by William Couper (New York: Isaac H. Blanchard, 1912), p.72.

Dumb Waiters	2	4x3 ft.	400 lbs.	200 ft./min.	54 ft.
Dumb Waiters	4	2x2 ft.	100 lbs.	200 ft./min.	37 ft.
Escalator	1	4 ft. wide		85 ft./min.	25 ft.

Power for hydraulic baggage and passenger elevators was furnished by three steam-driven hydraulic pumps in the New York Terminal Service Plant. Two of the pumps were rated at capacities of 1,500 gallons per minute (gpm) while the smaller yielded 500 gpm. Pressure in the hydraulic system was 300 pounds per square inch (psi). Current for the electric elevators was taken from the general traction power service at the main switchboard connection. A transformer reduced the 11,000 volt traction power to 420 volts to supply a motor generator set. The motor generator produced 650 volt direct current for the elevator motors.

The shafts for electric elevators were provided with air cushion wells about ten feet deep. If the cables on an elevator failed, the car would plunge into the well where a cushion of air would stop it from crashing to the bottom of the shaft. The system was tested by dropping a fully loaded elevator car 70 feet into the air cushion well. It was "*brought to a stop without spilling water or breaking an egg in the car.*"[12]

Lighting Power

Power cables entered sub-switchboards located at the main sections of the station. From these switchboards power was further distributed to local boards in the smaller sections or in individual rooms. Room switches in public rooms controlled the lights. All lighting in the larger public rooms was supplied with current from duplicate sets of feeders, one set of which was connected to an emergency bus in the Service Plant. During a power failure half the lights would be supplied from the emergency system. A total of 21,000 lighting fixtures were supplied with power.[13] The Service Plant also provided power to light nearby portions of the tunnels under the Hudson (North) and East Rivers. Power and monitoring services for the station and tunnel fire detection and alarm system were also accommodated at the New York Terminal Service Plant.

Heating and Ventilating System

> *The heating and ventilating of the station building offered a challenge to the mechanical engineer because of the sheer volume of space to be heated and the diversity of enclosures within it. Heat had to be supplied not only to the head house proper, which embraced 342,000 square feet of area and 10,280,000 cubic feet of volume, but also to the power plant for station utilities, the service buildings of the station yard, and the cars parked on the yard tracks.*[14]

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[12] Ibid., p.60, 69.
[13] Ibid., p. 64.
[14] Condit, p.302.

A forced draft heating system was selected as being most cost effective and capable way to fulfill the heating requirements. Heat was supplied from a hot water system with the hot water heated by exhaust steam from the Service Plant. Steam from the boilers in the Service Plant was passed through the engines and turbines used to power generators, air compressors, pumps and fans. Exhaust steam was passed through heat exchangers to heat water circulating through the radiators in the station. Motor-driven centrifugal pumps circulated this water throughout a closed-pipe system, into and through nine heating chambers in the building. From here the water returned to the circulating tanks and was used again. Live steam could be injected into the system when, on extremely cold days, it might be necessary to augment the heat obtainable from exhaust steam. Fans delivered fresh air to the heating stacks from intakes on the roof. The heated air was forced through metal ducts into the various rooms in the station. Warm air was admitted near the floor line and drawn out at or near the ceilings. The heating stacks were located where they occupied less valuable space, and the ducts were concealed in the room ceilings. The temperature of the air throughout the station building was changed by manipulation of the steam valves on the hot water heaters in the New York Terminal Service Plant.

The total volume of heated areas in Penn Station was 10.28 million cubic feet. Under maximum conditions the system heated two million pounds of water per hour at 200°F. with a return temperature of 160°F. The fans had a capacity of 37 million cubic feet per hour of air raised from 0°F. to 130° F. This required approximately 77 million BTU's. Using a separate fan system, air pressure in toilet rooms and kitchens was maintained slightly below that of adjoining rooms to prevent odors from escaping out of these areas.

Water

> *A sufficient and certain supply of water for all station purposes is a very necessary requirement for a large terminal station. As the water supply from the nearest city mains was subject to frequent fluctuation in pressure and to occasional interruption, it was found desirable to establish a central system of water distribution in the Service Station.*[15]

Water was obtained from two private 12-inch mains under 31st Street, connected to independent city mains at Seventh and Ninth Avenues. Water for general use in kitchens and drinking fountains was metered, filtered and cooled at the New York Terminal Service Plant and distributed through piping systems to the station. Water used for lavatories and kitchen sinks was a mixture of fresh water and water flushed from the cooling jackets of compressors and from refrigeration machines. About two-thirds of the station toilets were below the levels of city sewers. Ejector pumps using compressed air at 25 to 30 psi operated automatically to

[15] Westinghouse, p.18.

lift and discharge wastewater 40 to 70 feet to the level of the sewers above.[16] Ejector pumps were also used to discharge drainage water from the tunnels.

Compressed Air

Compressed air was provided for operating switches and signals, brake-testing in the yard, pumping in the tunnels, and for the sewage ejectors and the air cleaning machines. Two steam-driven air compressors were installed for this purpose. The machines were cross-compound, two-stage Corliss valve compressors manufactured by Nordberg, each having a capacity of 2,000 cubic feet of air per minute.

A pneumatic internal communication and package express system was installed to convey messages and ticket stock between the buildings throughout the yard and the offices in the station building. The system operated on air pressure between two to four psi. It was supplied with reduced air pressure obtained from the compressors in the New York Terminal Service Plant.[17]

Traction and Signal Control

The traction power system control board is located on the top floor of the east side of the New York Terminal Service Plant. From this control board, traction power is controlled on Amtrak's Northeast Corridor from south of New Brunswick, New Jersey to the Shell Interlocking at New Rochelle, New York. Although not the largest in the world, the Penn Station interlocking and signaling system "*was regarded by its designers and manufacturers as the most complex.*"[18]

Refrigeration

The refrigerating apparatus for the cooling of storage boxes for the kitchens and restaurants, and drinking water for the entire Terminal Station was located in the engine room and consisted of two 40-ton ammonia compressors and three motor-driven centrifugal brine pumps. These circulated cooled brine through an underground pipe system to 40 cold storage rooms in the station. Water for the station's 41 drinking fountains was also cooled at the New York Terminal Service Plant and sent through its own pipe system to the station at a capacity of 750 gallons per hour. The drinking water cooling system had a capacity of 750 gallons per hour.

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[16] Bell, p.68.
[17] Ibid., p.62.
[18] Condit, p303.

Power Control Center

The top level of the New York Terminal Service Plant still houses a fully-operating illuminated track model board which shows the position of breakers and switches and the status of electrical equipment in the station, tunnels and as far east as Sunnyside Yard on Long Island. The board is comprised of transite or steel panels painted with a graphic representation of the railroad's electrical system corresponding to the track and catenary layout. Indicating lights, located on the schematic diagram of the trackage, correspond to the actual locations of the breakers and switches that they symbolize. The back of each panel forms a base for the pilot and indicating lights, cabling, relays, bells, buzzers and other operating components.

The railroad used standard telephone relays, indicating pilot light bulbs and conventional, readily available components on the board. Telephone components had a proven record of reliability and were mass-produced to high quality standards by the Western Electric Company. The designers expected that they would be available as repair parts for the foreseeable future.

The operators monitor traction power status in the area covered by the board. Telephones and radio links allow communication concerning power with interlocking tower operators, maintenance crews and dispatchers.

Existing Conditions

The New York Terminal Service Plant has been inadequately maintained and repaired over the last four decades and many areas evidence significant and dangerous signs of deterioration. Throughout the 1960s and 70s, maintenance and repairs to the New York Terminal Service Plant were repeatedly and increasingly deferred, creating numerous structural problems in and around the building. The roof has been leaking for years and is considered hazardous to walk on. The two smoke stacks at the southwest corner of the building are rapidly deteriorating and are in an extremely dangerous condition. The coal storage and boiler rooms in the western half of the building are considered hazardous because of the general deterioration of equipment, structure and flooring. The presence of large piles of asbestos from earlier demolition work is another hazard. The granite facade on 31st Street evidences significant water infiltration, which has caused rusting of the encased steel columns at the corners, and the resultant rust jacking has cracked the stone veneer in several locations, further accelerating deterioration.

The following description of extant elements and their general condition was compiled during a site visit in July 1994 and a detailed site inspection during May 1995. The building is physically divided into two distinct facilities on its lower levels: the power distribution side on the east, and the power generation side on the west. Although these floor levels are

interconnected with occasional doors, the two sides are most easily examined separately. For this reason the following description is divided into east and west sides.

East Side:

Level 1--The lowest level contains two rows of brick splice boxes for relays on the floor above. Below this floor level a linear pit runs under the relays and contains horizontal cable runs from the relays. Many of the relays are still in active use. Key ways for earlier cables with divisions to prevent arcing are still intact, but are no longer in use. The building structure on this side is in generally good condition.

Level 2--Two rows of relays, one for 60-cycle and one for 25-cycle, are located on Level 2, arranged directly over the splice boxes below. Each relay is mounted in a masonry box and stands about seven feet high. Many relays are original equipment and are in active use.

Level 3--This level includes a fan room with large squirrel-cage fans driven by vintage Westinghouse motors. Some of this equipment is still in use. Bus ducts arranged over the relays at Level 2 below feed panel boards on Level 4 above. A large wall opening provides an overview of Level 2 on the adjacent west side.

Level 4--Level 4 is about four feet above 31st Street and is the entrance level to the building. The space contains original panel boards for AC and DC systems (soapstone boards painted black[19]) with original meters, switches, breakers and other equipment. The space also contains two new Caterpillar emergency generators with an 11,000 gallon diesel fuel tank. Except for the front bay of the building, this level is double-height and contains two large manually-operated rolling cranes to move generator equipment. Several unused generators still occupy a portion of the space.

Level 5--Level 5 on the east side is a simple, one-bay mezzanine to Level 4 with original window openings to the double-height space beyond. It contains offices, locker rooms and restroom facilities which match original plans. Finishes include original paint and oak woodwork including window trim, picture mold and baseboards. The original bathroom layout remains intact including slate partitions, although many fixtures have been replaced. Original stair construction, railings and other details are well preserved.

Levels 6 and 7--Levels 6 and 7 contain miscellaneous office storage and training areas.

Level 8--An illuminated track model board which shows the operating position of breakers, switches and the status of electrical equipment in the station, tunnels and as far east as Sunnyside Yard on Long Island is located on Level 8 of the New York Terminal Service Plant.

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[19] Turn-of -the-century electrical engineers called soapstone "marble," and used it for mounting high-voltage electrical components.

West Side:

Basement--The lowest level on the west side is primarily a ruin. Steam lines are fed from floors above and enter the tunnel system which extends to the north running under the platform tracks of Penn Station. The space is full of moisture with significant rusting of the structural steel and the floor is extensively littered with asbestos and other debris.

Level 1--Level 1 was originally the location for steam-powered equipment which provided power and chilled and hot water for Penn Station. Portions of a large steam-powered compressor, the chiller unit and two turbine generators remain in their original locations.

Level 4--Level 4 on the west side was the main boiler room for the New York Terminal Service Plant. The space rises two levels. Two rows of boiler housings with masonry side walls still remain in the space and portions of boiler piping are still in place in some housings. Above each of the boiler rows are steel exhaust manifolds that connect to the stacks above. The space exhibits major structural decay, water penetration and debris.

Level 5--Level 5 on the west side is a partial floor located over the boilers. The space is full of debris with significant water penetration and structural decay. The bottom of the coal bunker is visible directly above.

Level 6--The west side of Level 6 is the lower half of the coal bunker.

Level 7--The bottom of a central light well is at this level, with window openings which are boarded up. The west side of Level 7 is the upper half of the coal bunker.

Level 8--The west side of Level 8 is gallery space over the coal bunker. The space contains standing water and exhibits substantial structural deterioration and decay. The roof structure above provides the only structural support for exhaust stacks, and indicates significant rust and distress. The bases of the smoke stacks are built over framed openings in the steel and concrete roof structural system. The breach from the boilers directs the boiler exhaust up to the stacks.

Roof Level:

The roof shows signs of significant deterioration. Plant material is growing from roof seams and at the low points near the parapets. There are large areas of standing water from blocked roof drains. There has been a recent roof slab failure caused by walking on the roof and a temporary walkway has been built to confine roof access. The current roof material is a sheet membrane with an aluminum foil outer lining. The parapet is brick with a terra cotta coping.

Present Operation and Use

Throughout its history, the New York Terminal Service Plant provided electric power, steam, water and other utilities to Penn Station. While much of the original equipment has been dismantled or abandoned, some of the original power distribution equipment is still in use and a significant portion of the interior remains intact. Nearly all of the Service Plant's original power generation equipment has been abandoned in place and replaced by ConEd electric service. Much of the original and 1927 upgraded power distribution and control equipment remains in regular service.

In conjunction with the Northeast Corridor Improvement Project, Amtrak plans to remove all outdated power distribution equipment, as well as abandoned power generating equipment in the four basement levels of the Service Plant. In place of this equipment, Amtrak proposes to install new power distribution control equipment, switching equipment and track-level ventilation systems. In several areas entire floor levels will be removed and re-configured. The present roof is proposed to be lowered to help conceal three new cooling towers planned to be installed behind the present walls which will then become parapets. New traction and house power equipment as well as mechanical systems distribution for the entire proposed Farley/Penn Station Complex would be installed within the space of the present four sub-basements. The floors above the present grade level would be re-configured for administrative, training and shop spaces. The building will be made handicapped accessible. A loading dock will be constructed at the rear of the present parking lot to the east of the building. Restoration work is anticipated on the street facade.

PART III SOURCES OF INFORMATION

A. Original Drawings

Westinghouse Church Kerr & Company, "*P., N.Y. & L.I.R.R. New York Terminal Service Plant,*" original elevations and floor plans, 1906-1909. Originals on file at the National Railroad Passenger Corporation (Amtrak) Office, Document Control Department, File Drawer 28, 30th Street Station, Philadelphia, Pennsylvania.

B. Early Views

Builder's Photographs from McKim Mead & White Office, showing Pennsylvania Station and New York Terminal Service Plant under construction, 1908-10. Originals in the collection of Avery Architectural Library, Columbia University, New York, NY.

C. Bibliography

1. Primary and Unpublished Sources:

Couper, William, ed. History of the Engineering Construction and Equipment of the Pennsylvania Railroad Company's New York Terminal and Approaches. New York: Isaac H. Blanchard Co., 1912. Reprinted in Penn Station: Its Tunnels and Side Rodders by Frederick Westing. Seattle: Superior Publishing, 1978.

Gibbs, George. "The New York Tunnel Extension of the Pennsylvania Railroad," Papers and Discussions of the American Society of Civil Engineers 37, no. 5 (May 1911): 636-791.

The New York Passenger Terminal of the Pennsylvania Railroad. New York: Westinghouse Church Kerr & Company, 1908.

"The Pennsylvania Railroad Improvements About New York," Architects' and Builders' Magazine 11, no. 7 (July 1910): 379-410.

Vogel, Robert M., Curator Emeritus, National Museum of American History. "Some Comments on the Prospects for Preservation of Historic Machinery and Equipment Remaining in the Penn Station Service (Power-Plant) Building, NYC," Letter to McGinley Hart & Associates following site visit, May 1995.

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2. Secondary and Published Sources:

Condit, Carl. The Port of New York: A History of the Rail and Terminal System from the Beginnings to Pennsylvania Station. Chicago: University of Chicago Press, 1980.

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Diehl, Lorraine B. The Late, Great Pennsylvania Station. New York: American Heritage Press, 1985.

Dixon, A.E. "The Planning And Construction of Power Stations," Engineering Magazine 31 and 32 (August 1906–March 1907), 722-27, 909-34, 58-86, 227-47, 370-90, 551-71, 749-68, 860-73.

McKim Mead & White. A Monograph of the Works of McKim Mead & White 1879-1915, single-volume reprint of four-volume set, originally published in 1915. New York: Benjamin Blom, Inc., 1973; reprinted by Arno Press, 1977.

Meyer, Henry C., Jr. Steam Power Plants: Their Design and Construction, third edition. New York: McGraw-Hill Book Company, 1912.

Middleton, William D. When the Steam Railroads Electrified. Milwaukee: Kalmbach Publishing, 1974.

Stilgoe, John R. Metropolitan Corridor: Railroads and the American Scene. New Haven: Yale University Press, 1983.

D. Other Sources Investigated:

All known and likely sources have been investigated, including:

McKim Mead & White Archive, New York Historical Society Architectural Drawing Collection, New York, NY. (This is the most extensive McKim Mead & White drawing archive in the country, containing nearly all extant drawings of the firm's work--two tubes of drawings are listed on the 1953/1962 inventory, but Service Plant drawings are missing since being transferred to NYHS. Photo archive not accessible due to fire damage, Spring 1995.)

Westinghouse Electric & Manufacturing Company Archives, Pittsburgh, PA. (This archive contains no documents pertaining to New York Terminal Service Plant.)

E. Supplemental Material:

Location Map. [Source: U.S.G.S. Quadrangle, Central Park, New York, 1967/81.]

Site Plan. [Modified from: Allee King Rosen & Fleming, Inc., "Neighborhood Character," study completed for Penn Station Associates as part of 1995 Environmental Assessment for proposed alterations to General Post Office/James A. Farley Building.]

Historic Site Plan, 1916, showing Service Plant in relation to Pennsylvania Station. [Source: G.W. Bromley, Atlas of the Borough of Manhattan, City of New York, 1916, Plate 59.]

Current Site Plan, 1995, showing Madison Square Garden on former site of Pennsylvania Station. [Modified from: Allee King Rosen & Fleming, Inc., "Neighborhood Character," study completed for Penn Station Associates as part of 1995 Environmental Assessment for proposed alterations to General Post Office/James A. Farley Building.]

Builder's Photographs from McKim Mead & White Office, showing Pennsylvania Station and New York Terminal Service Plant under construction, 1908-10. [Originals in the collection of Avery Architectural Library, Columbia University, New York, NY.]

Westinghouse Church Kerr & Company, *"P., N.Y. & L.I.R.R. New York Terminal Service Plant,"* original elevations and floor plans, 1906-1909. [Originals on file at the National Railroad Passenger Corporation (Amtrak) Office, Document Control Department, FileDrawer 28, 30th Street Station, Philadelphia, Pennsylvania.]

Equipment Layout Section and Plans, 1911. Published in George Gibbs, "The New York Tunnel Extension of the Pennsylvania Railroad," Papers and Discussions of the American Society of Civil Engineers 37, no. 5 (May 1911).

PART IV PROJECT INFORMATION

This documentation was initiated in accordance with a Memorandum of Agreement between the Federal Railroad Administration, the National Railroad Passenger Corporation (Amtrak) and the New York State Historic Preservation Office as a mitigation measure prior to interior alterations as part of the Northeast Corridor Improvement Project. This documentation was prepared between June and October, 1995 by:

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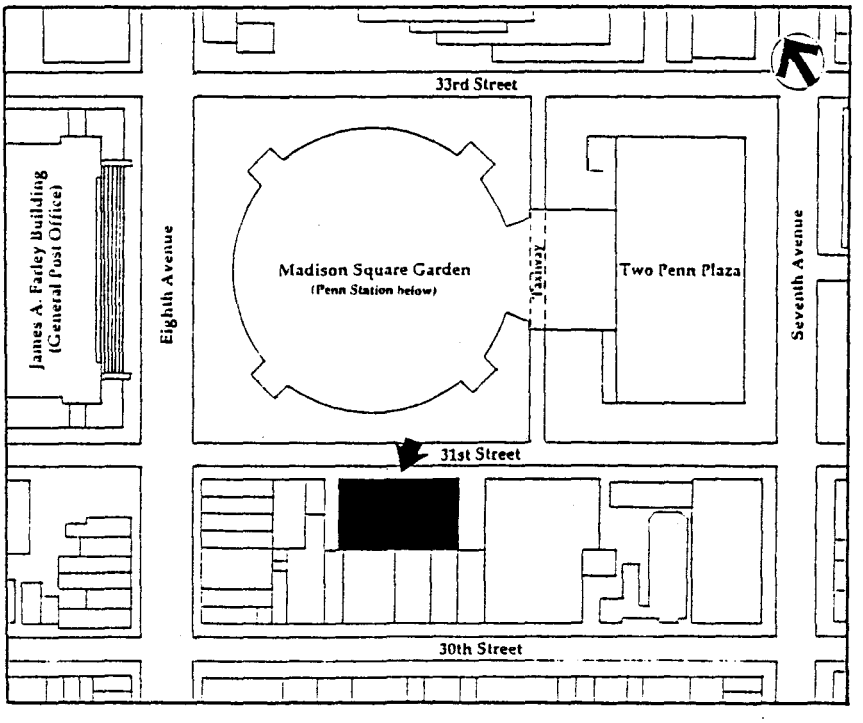
Below: Current Site Plan, 1994, showing Madison Square Garden on former site of Pennsylvania Station.