UNIVERSITY OF PENNSYLVANIA NEURAL AND BEHAVIORAL SCIENCES BUILDING

415 University Ave, Philadelphia, PA 19104

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Building Statistics Part II
10.25.13

PRIMARY ENGINEERING SYSTEMS

CONSTRUCTION

P. Anges is the construction manager responsible for the construction of the NBS Building to begin in January 2014 and finish around March 2016. The project is bid as guaranteed maximum price (GMP) for an estimated $49,300,000. The project delivery method is design-bid-build.

Construction trailers are currently planned to be placed to the East of the existing Leidy building. A construction entrance to the lower level of the NBS Building is planned to the South of the NBS Building along University Avenue. More construction and loading entrances are planned towards the West of the Leidy and NBS Building. The biggest anticipated construction issue is the limited construction space on UPenn's campus and the safe demolition of the existing Kaplan Wing and multi-story brick building (where the new NBS Building will stand).

Courtesy of SmithGroupJJR | Looking North-East from University Avenue

ELECTRICAL

As designed, the existing electrical system utilizes a building voltage of 480/277V and provides high redundancy. Power is supplied at medium voltage (13.2 kV) through UPenn's campus distribution. A 15kV (18,000 AIC) main switchgear located in the penthouse receives this power at the building service entrance. The switchgear has a normally open 1200A tie for extra redundancy. Each side of the switchgear has a 1200A draw-out circuit breaker.

Power is then delivered to a double-ended substation. A 1500AA/2000FA kVA dry-type transformer steps the primary 13.2 kV voltage down to 480Y/277V, 3PH, 4W secondary power to service the substation. Buses for Substations 1A and 1B are sized as 480/277V, 3200A, 65,000 AIC units. For added redundancy, a 2500A tie is located between Substations 1A and 1B. The substations have various-sized fixed molded-case breakers that service equipment and lighting.

Substation 1A services the fire pump, a mechanical distribution panel, legally required loads, and optional standby loads. Substation 1B services the fire pump, life safety loads, and bus duct. Several lighting and mechanical loads are powered through emergency panels. The central copper 600A, 35,000 AIC bus duct passes vertically through the NBS Building and provides power for lighting loads through remotely operated circuit breaker panelboards. On every floor, a step-down transformer connected to the bus supplies power to panelboards for receptacles and small equipment loads.

A 500kW diesel generator located on the roof of the NBS building provides emergency power for a 480Y/277V 800A switchboard, the central load bank, and 25 HP fire pump (ATS-FP2). This switchboard distributes power to various distribution panels and panelboards. Emergency power is supplied to ATS-LS (life safety), ATS-LR (legally required), and ATS-OS (optional standby).

The NBS Building utilizes a combination of panelboards with main lugs only or main circuit breakers. Thermal-magnetic circuit molded-case breakers have an inverse time-current element for low-level overloads and an instantaneous magnetic trip element for short circuits. All panelboards have copper buses and are to be rated with NEMA 1 enclosures unless otherwise noted.

LIGHTING

The overall lighting scheme for the NBS Building is minimal, effective, and complementary of the architecture. Linear fixtures are integrated well into the architecture and interiors. Lighting, thus, visually reinforces modernity and a stylish

aesthetic; the solution emphasizes the concept of organic growth and neural connections.

The building is lit primarily by LED and linear fluorescent fixtures. Several direct/indirect fluorescent fixtures illuminate classrooms and laboratories while the lecture hall is lit almost entirely by direct LED fixtures. Public spaces utilize LED downlights and other integrated fixtures; LED and fluorescent fixtures are used in cove, wall-washing, and grazing applications. Exterior lighting is realized by a University of Pennsylvania standard direct Type V LED pole-mounted fixture. All lighting is on a 277V system. A large portion of the lighting is specified as emergency lighting at the discretion of the owner.

Lighting is controlled using a variety of control system protocols. Offices and classrooms have typical wall switches and use occupancy sensors for manual-on/automatic-off operation. Many spaces implement simple 0-10V dimming while others—such as the lecture hall—require ELV dimming; Creston Master Controls are used in large spaces for easy scene control and use with A/V equipment. Photocells (dual zone daylight sensors) are installed in public spaces to maximize energy savings when daylight is available. Corridor, façade, and decorative lighting are on time-control schemes that turn off at sunset and on at sunrise.

MECHANICAL

Four air handling units (in penthouse) service the NBS Building. Conditioned air is delivered to the interior using two air handling units: AHU-1 and AHU-2 each supply 32,000 CFM and are fitted with heating and cooling coils. Air through these units is delivered to offices and public corridors fitted with volume control boxes (VCBs). AHU-1 is specified with a 78.2% efficient energy recovery wheel. AHU-3 (12,000 CFM) is a dedicated outdoor air system (DOAS) with a heat recovery wheel to service laboratory spaces. AHU-4 is a CHW/HHW modular system that services the mechanical equipment room. Fin-tube perimeter heating is typical along building façade.

Building heating is supplied by UPenn's campus steam system through a steam pressure reducing station; the corresponding heat pumps are used in a 30% glycol pre-heat piping system with AHU-1/2/3. Cooling is supplied by UPenn's campus chilled water serving AHU-1/2/3/4 and one fan cooling unit per floor. The mechanical system is controlled with a Building Automation System (BMS).

STRUCTURAL

A composite beam system—structural steel with composite decking—is used throughout the building (ground to penthouse floors). The typical floor construction is 3.25" thick 3000 psi reinforced lightweight concrete on 3" deep galvanized metal deck (gage 20) supported by steel wide-flange beams. Steel grid spacing is approximately 15' x 20' across the floors. Beams as large as W30 x 116 are used to support the lecture hall ceiling which supports exterior paving above. Steel beams range between W12 x 14 and W21 x 131 for the ground floor and floors above. The penthouse roof (green roof) slopes ¼" per foot and is supported by steel beams are large as W21 x 144.

As a result of the lower level being well below the water table, a 3' 4000 psi reinforced normal weight concrete mat with #8 gage rebar spaced at 6" serves as the foundation. Moment frames in the North-South direction and braced frames in the East-West direction resist lateral forces.

ADDITIONAL ENGINEERING SYSTEMS

FIRE PROTECTION

This project is built as type 1B construction. Primary structural framing, interior bearing walls, and exterior bearing walls are built for two hour fire-ratings. Floor construction and secondary members are also rated for two hours while the roof and its secondary members are rated for one hour. The maximum travel distance for common paths of egress is 100'. Dead ends have a maximum travel distance of 50'.

The NBS building is fully sprinkled. Smoke detectors are in all transition spaces, electrical rooms, and telecom rooms. Every room has at least one strobe; main corridors implement strobes with speakers. Heat detectors are located in the lower mechanical room and penthouse. A remote fire alarm annunciator plate is located in the ground floor lobby.

Wet stand-pipes in the stairwell supply water to the sprinklers. One 25 HP (500 gpm) fire pump on the lower level supplies pressured water through 6" sprinkler lines near the bottom of the building. Towards to the upper floors, the pipe reduces to 4" in diameter. An integral part of the fire pump's control system, a jockey pump maintains pressure in the fire protection piping system.

TRANSPORTATION

Vertical circulation is realized with two central elevators and two stairwells. One stairwell is centrally located near the elevators. The second stairwell is located to the west end of the building along the southern façade. Both stairwells extend from the lower floor up to the penthouse. There is an intermediate stairwell along the southern façade that connects the ground and lower levels. Both elevators extend vertically from the lower floor up the fourth floor. Only one elevator can access the penthouse.

Access to the northern Leidy Building is accomplished by a connection tunnel on the ground, second, and third floors. An underground tunnel connects the NBS Building to the southern Lynch Building.

TELECOMMUNICATIONS

Stacked telecom rooms are located to the north of each floor plan. Seventy-eight square feet on each floor is dedicated to these rooms. Telecom racks are connected to the existing Lynch and Leidy Buildings—telecommunication lines enter the building on the lower level; lines then travel through risers up the floors. From these telecom rooms, data is distributed throughout the building.

Phone and data is available in every room. Wall phone outlets are dispersed throughout the building, located on walls and floors. Several Wireless Access Points (WAP) are located in the lecture hall, several larger classrooms, and labs.

SECURITY/ACCESS CONTROL

The NBS Building introduces access control using card swipe technology and keypads to restrict entry into the building. Major doors have monitoring hardware, request for exit sensors, and audible horns to monitor the flow of traffic in and out of the building. Several closed-circuit television (CCTV) cameras with swiveling capabilities strategically monitor building entrances and public corridors on the ground floor. There is a security guard located in the southern lobby of the ground floor.

AUDIO/VISUAL

A/V equipment includes projector screens in educational spaces, televisions located in classrooms and main lobby (three 46" LED TV's in lobby), and speakers throughout the building. The lecture hall includes fourteen ceiling speakers, two wall-mounted loud speakers, a projector, and HD video camera in the back. Team study rooms are outfitted with wall-mounted web video cameras and ceiling-mounted microphones.

CATV cable runs throughout the building for use with several media displays.