# BUILDING STATISTICS

Whitmore Laboratory Renovation

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# General Building Data

Whitmore Laboratory is 88,721 SF building and three stories above grade plus a ground floor. It is occupied by Elberly College of Science in University Park, PA 16802. The building is a mix of teaching and research labs. As the number of students is increasing, the building will be renovated and upgraded to serve 12oo students properly. The project will include upgrade to the mechanical, electrical roofing systems plus replacing the windows and interior doors. Design-Bid-Build delivery method is used in this project. Whitmore Laboratory renovations will be phased into two phases to allow continuous use of the building. Construction started at the end of July 2015 and will finish at the end of July 2016. Project cost is $24.5 M for both phases. Cost breakdown is as following:

a. Demolition – 361,565

b. Abatement – 822,600

c. Masonry Restoration – 370,000

d. Steel – 502,052

e. Roofing – 294,475

f. Windows – 738,759

g. General Trades – 1,851,384

h. Flooring – 311,580

i. Painting – 170,984

j. Lab Casework & Fume Hoods – 2,079,000

k. Lab Equipment – 72,500

l. Fire Protection – 359,040

m. Mechanical & Plumbing – 7,974,500

n. Electrical – 2,050,000

o. Wheelchair Lifts – 118,000

p. Site work – 475,000

q. Self-Perform, Allowances & Buyout Savings – 1,918,055

r. Contingency, Insurance, Staffing & General Conditions, Fee – 4,076,880

There are many trades involved in the project but not listed in table. Main project parties are listed in the table with links to their website.

**Table 1- Main Project Roles**

| Role | Firm | Link |
|---|---|---|
| **Owner** | Penn State OPP | http://www.opp.psu.edu/ |
| **Construction Manger** | Barton Malow | http://www.bartonmalow.com/ |
| **A/E** | Stantec | http://www.stantec.com/ |
| **General Contractor** | J.C. Orr | http://jcorrpa.com/ |
| **Mechanical** | North Central Mechanical | www.northcentralmechanicalservices.com/ |
| **Electrical** | Westmoreland Electrical | http://www.westmorelandelectric.com/ |
| **Site Civil A/E** | Keller Engineer | http://www.keller-engineers.com/ |

# Architecture

Whitmore Laboratory architecture falls under the Federal Style which is influenced by the Roman architecture. Fluently, the building displays in its façade a great combination of classical symmetric design and modern materials. Following the classical style, every floor has a base, shaft, and an entablature. Moreover the proportions of façade, Windows, and doors cooperate to perform an artistic monument that mimics ancient Opera houses and Legislatures. The building stands in the western edge of the university central parking lot as shown below. Regarding the building materials, the building integrates glass, aluminum and steel which signifies the modern aspects such as factories warehouses and the railroads. Besides, the use of steel helps constructing larger and safer structure.

**Figure 1- An Old View of Whitmore Lab**

Courtesy to Stantec

Whitmore Laboratory complies with these codes:

- 2009 Uniform Construction Code – International construction codes
- 2009 International Existing Building Code
- 2009 International Building Code
- 2009 international Fire Code
- 2009 International Energy Conservation Code
- 2009 International Mechanical Code
- 2009 International Plumbing Code
- 2009 ICC/ANSI 117.1
- 2010 NFPA 72-10-National Fire Alarm Code
- 2008 NFPA 72-11 – National Electrical Code
- ASME A17.1 Elevator Code
- 2012 International Building Code, Chapter 11 - Accessibility

## Zoning:

Whitmore laboratory complies with Pennsylvania State University's "University Planned District" that was established to promote the university campuses.

- Maximum Building Height: 90 ft.
- Maximum Allowable Floor Area Ratio: 1.00
- Maximum Allowable Impervious Area: 55%
- Minimum Amount of Open Space Required: 45%

# Building Enclosure

Whitmore Laboratory façade design goes back to the mid-1900s where the façade consist of Roman brick wall, rectangular windows and three doors as the main entrance to the building. Fiberglass is used as insulation for the enclosure. Aesthetically, the façade rises three stories above ground and holds 21 modules. The windows on the second and third floor are slightly larger than those in the first floor. First floor windows are 6'-4 ¼" x 4'-0 7/8" where the windows on the second and third floor are 9'-5" x 7'-7 5/8".

Exterior windows are being replaced with double glazed aluminum windows with frame of 3 ¾" deep. They have condensation-Resistance Factor (CRF) of 45 and no water leakage tolerance. In addition, the glazing will be 9.00 mm tinted glass rated for 90 mph wind (figure 2).

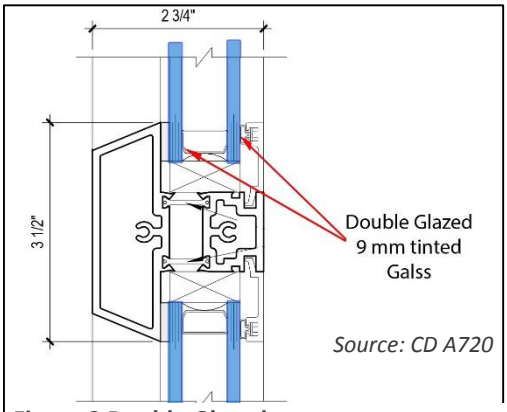

Figure 2 Double Glazed

Roofing is low-slope roof and comprises several layers as shown on figure 3. Starting from the bottom, the concrete layer provides flat structural support to the layers above. Vapor barrier prevent any moisture from passing to the building. Polisocyanurate tapered insulation provides thermal and acoustical insulation. 1/2"' fiberboard covers the insulation and provides a flat solid surface for the layers above. Base ply with the other plies above it work as a water proof system.

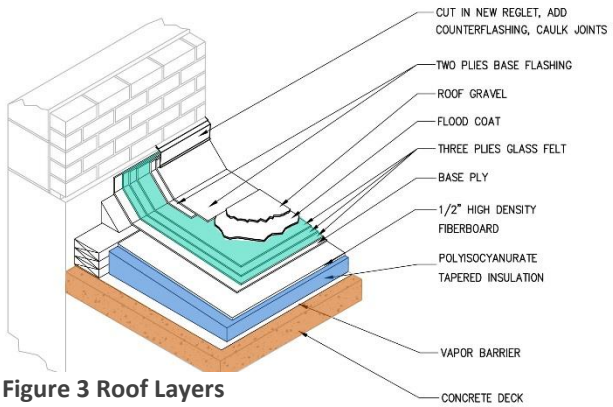

Figure 3 Roof Layers

**Sustainability Features**

Since the building was constructed in the mid-1900s and the current project targets mainly mechanical, electrical and roofing systems, Whitmore Lab will not pursue any LEED Level. However, the roof and equipment upgrade will enhance the power-consumption efficiency. Any use of A/C welders or electrical heater is prohibited during construction to avoid heavy electricity consumption.

# Primary Engineering Systems

## 1- Construction

Whitmore Renovation delivery method is Design-Bid-Build. The Design phase started in May 2012 by Stantec and finished in November 2014. Barton Malow (CM) was awarded this project in Fall 2012. Cost estimate was submitted to OPP in July 2013 by Barton Malow. The Construction is phased into two phases; phase one is renovating the west half of the building while phase two is renovating the east half. Construction started from the roof proceeding downwards except for the basement which is renovated first because it houses the mechanical room and the two electrical rooms. A change order was submitted during construction adding the roofing system replacement to the scope. Phase one is expected to finish on December 21, 2015. Phase two starts right away and is expected to finish on August 19, 2016.

Since the renovation is taking place in a three-story building, no cranes are used. However telescopic basket is utilized to reach certain areas where masonry restoration is required. Inside the building, there will be a forklift and hydraulic lift to move and install the fume hoods.

## 2- Structural System

Structural system is designed for a 90 MPH wind, 1.15 seismic importance factor and seismic class B. Type of steel is cold formed metal framing. Foundation is spread footings supporting reinforced concrete columns in the basement. The basement is reinforced concrete columns supporting concrete 12’x12” beams that carry a flat slab. For the first, second and third floor, the structural System is a steel frame with metal decking and concrete slab. Infill steel beams are spaced 10 ft away while the steel beams are spaced in different spans ranging from 12’-14’. The roof is supported by 24” steel joist spanning 42’.

## 3- Mechanical System

The building is air conditioned by 8 Air Handler Unites each has capacity of 15000 CFM with a cooling tower. Mechanical equipment are located in the third floor and to be removed in this project. The new mechanical room is in the basement. The new AHUs will be tied to the campus central chiller that operates at 42 F during the summer and 48 F during the winter. A heat exchanger will be installed in the basement that transfers heat between the campus loop and

the building loop. Fume hoods are expected to have a significant effect in the air balance, and HVAC system may be adjusted after installing to ensure minimal air imbalance. In the labs, supply air is 100% outside air. Exhausted air from the fume hoods and the HVAC system will pass through a heat recovery system in the roof to minimize energy consumption. Hallways are always kept wit 10% higher pressure to insure the air moves into the labs but not the opposite.

## 4- Lighting/Electrical System

The building is fully fed from campus grid and power is transformed from 1247 KV to 480 V by one transformer located outside the building. The main switchgear will be replaced to satisfy the new building loads. All the conduits will be replaced with new EMT and flexible metal. Two electrical rooms are located in the basement and conduits branching out through building in EMT conduits. All conduits run in the plenum.

All light fixture are recessed troffer LED except for the few existing fixtures. Efficacy of the light fixtures ranges from 91-81 lumen/W. Light control is dim for all rooms except the storage and the mechanical room.

# Additional Engineering and Engineering Support Systems

## Fire Protection

Fire protection system is automatic wet-pipe sprinklers and standpipe. The system is fed from a 6” pipe coming from Muller building. All pipes are installed with seismic resistant to avoid any structural load being transferred to the pipes. Sprinkler heads are selected based on the room use and layout; and there are different types of sprinkler heads in the building: FlexHead, Concealed pendant, Horizontal sidewall, and Dry sidewall. In addition, fire extinguishers will be placed and labeled in cabinets in different locations in the building. Doors will be protected by powder paint with two coats. Existing beams will be cleaned and painted in areas where fire protection has vanished.

## Transportation

Whitmore Laboratory has an entrance in all four sides of the building. The main entrance is located in the west side. Two stairs wells in the building, one in the north side and the other in the south side. One elevator located towards the south side conveys to four floors. The building also has a wheelchair lift in the first floor that transports to and from the elevated floor in the first floor.

## Telecommunication

Whitmore Laboratory is covered by Penn State wireless network (psu). Offices in the third floor are provided with telephones for the department faculty and staff.

## Lab Casework and Fume hoods

Coordination must be established with the mechanical, electrical and plumbing subcontractors, before installing the casework or fume hoods. Pipe unistruts are installed before screwing the racks of the casework on the floor.

Fume hoods will be assembled in the factory to the greatest possible extents but not greater than 35" x 79" to fit into a door opening. All accessories associated with the fume hood are pre-mounted in factory. Other services such as: wiring, plumbing and in-fume ducting are completed in the shop prior to delivery. All fume hoods are fed by a #12 AWG 3-wire, 20-amp, 120V and connected to junction box in the plenum just to the right of each fume hood.

The racks of the casework provide the structural support to the casework. First, the aluminum racks are screwed to the floor and then cabinets and drawers are fitted in and secured in place. Next, the counter tops are placed and screwed from below to be attached to the racks. After that, the sinks are installed and supported by a hanging aluminum channel (figure 5). When all the parts of the casework are fixed, the services (power, plumbing and ducting) are connected to the building services. Besides, wall mounted cabinets are above the countertop and to the defined height. Finally, Epoxy is applied to the specified areas and left to dry.

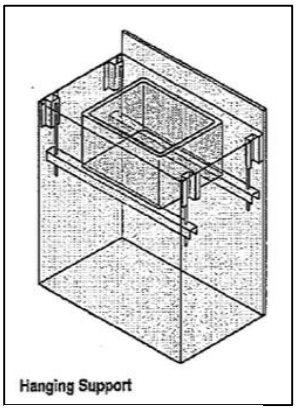


**Figure 4- Aluminum Channel supporting the Sink**