

Mueller Laboratory Renovation

Technical Report #1

By

Mark Jackson

Construction Management Option

9/19/14

Executive Summary

The Mueller Laboratory building on the Penn State University Park campus was built in 1963. Fifteen years after its construction that it was given its current title, in honor of Erwin W. Mueller, a Penn State faculty member from 1952-1977. Dr. Mueller was the first person to experimentally observe atoms, and developed several high precision microscopes to study them.

Even though the Mueller building shared its name with such a brilliant scientist, the building itself was rather low-tech. In the 51 years since it was built the laboratory has not undergone a significant renovation. Notably, in 2001 Penn State professor of ecology Christopher Uhl led a team of grad students in exposing the shortcomings of the Mueller building. The team released an extensive document, titled "The Mueller Report" detailing inefficiencies in the building.

Finally, in 2014, Penn State chose to begin the renovation of the Mueller building. Robert Bloom, Facilities Project Manager for Penn State's Office of Physical Plant was chosen as project leader. Priorities included full renovation of labs on four of the building's seven floors, overhauling the laboratory exhaust system, replacing the outdated mechanical and electrical systems, and installing a new fire sprinkler system. Overall 75,482 square feet of the building will be renovated. Although much of the building's interior will be gutted, the building's facade will not change extensively during the renovation. This means that matching surrounding buildings and the entire Penn State campus was not a concern, since the only outwardly visible addition to the building will be two brick-wrapped HVAC ducts. Stantec, which has a State College office, was chosen to do the design drawings.

Penn State collected bids for the project in fall of 2013. Barton Malow was selected as the CM firm, with a team led by Scott Mull. Starting in May of 2014, the renovation is schedule to be completed in August of 2015, in time for the start of the fall semester. By its completion roughly 18 million dollars will have been spent on the renovation.

Many pieces of the building's renovation will make it more sustainable. An overhauled HVAC system will both be more efficient. Connecting to campus chilled water will benefit from the economy of scale, saving energy. And improved electrical distribution will minimize loses.

Client Information

The client of the Mueller Laboratory renovation is Penn State University. Much of the mechanical and electrical systems are original to the building, and near the end of their service life or close to overloaded. The building also lacks a fire suppression system, and asbestos tile remains in many rooms. Replacing the aging mechanical and electrical systems will better serve the labs and be more energy efficient. And installing a fire sprinkler system and removing the asbestos tile will create a safer working environment of the building's occupants.

There are several complications to the renovation. Firstly, the building is to remain partially occupied during the renovation. Also, the building is in an area of heavy pedestrian traffic. And furthermore, Penn State wants the renovation to interrupt a minimum number of school years. As such many special considerations have to be taken when planning and performing the building's renovation.

Project Delivery

Penn State is by no means an inexperienced owner. Penn State's Office of the Physical Plant (OPP) Facilities Project Manager Robert Bloom was chosen as Project Leader. He and a team from OPP released the findings of the inspection of Mueller Lab to three companies for bids on the renovation design. Stantec won the bid, and when the design was complete Penn State opened the renovation for bids, eventually selecting Barton Malow. Barton Malow acts as a CM at risk, not performing any work themselves.

Project Schedule

The author has yet to receive the actual project schedule for the renovation. It is known that the project began in May of 2014 and is scheduled to be completed before the beginning of the fall 2015 semester. Due to the project being a renovation, and somewhat of a unique one, estimating the construction schedule is difficult. It can be assumed that replacing the HVAC and electrical systems would be the highest priority, and necessary to complete before control systems and panels/breaker boxes

could be installed. However, air handlers and electrical switchgear take months to build, and as such would need to be ordered far in advance of the start date of construction. Also, shutting off power and chilled water to the building would need to occur when it is unoccupied and there are no ongoing experiments in the labs. This could potentially occur during summer when campus is less populated, or perhaps during a holiday break. Another complication is that of the asbestos flooring. Safe removal of asbestos requires the area to be sealed off and all workers to wear proper protective suits and breathing apparatus. This means that the asbestos removal must occur after (or well before) other trades, such as the electrical and mechanical workers, are done with their tasks.

Thus, due to the building being partially occupied and the renovation requiring the shutoff of several essential services, the schedule of construction cannot easily be estimated. It will be interesting to see how Barton Malow worked around the difficulties of renovating Mueller Laboratory.

Cost Evaluation Summary

The author is still waiting to receive cost data on the renovation. However, Penn State performed several estimates in conjunction with their investigation of the building. The cost breakdown is as follows:

System Code	System Description	Subtotal
AC	ACCESSIBILITY	131,952
EL	ELECTRICAL	2,607,870
ES	EXTERIOR	559,637
FS	FIRE/LIFE SAFETY	952,138
HV	HVAC	5,977,210
IS	INTERIOR/FINISH SYS.	2,738,700
PL	PLUMBING	1,898,492
SI	SITE	6,621
VT	VERT. TRANSPORTATION	316,062
TOTALS		\$15,188,682

The total cost of \$15,188,682 does not include design costs, fees, insurance, etc. Since details of the exact electrical, HVAC, and plumbing systems being chosen is still unknown, it is difficult to perform a cost estimate. However, the author found an interesting correspondence. The cost of new construction of a college laboratory,

according to RS Means 2014, is \$206.70 per square foot. The Mueller Lab renovation will comprise 75,482 square feet. Thus, if constructing a new lab the size of the Mueller renovation, the cost would be \$15,602,130. This is within 3% of the estimated cost reported by Penn State. It is surprising that overhauling the electrical, HVAC, and plumbing systems, as well as renovating the interior and exterior finishes, costs as much as constructing a whole new structure of equal size.

Building Systems Summary

There are five main components of the renovation: new mechanical systems, new electrical systems, new interior finishes, building enveloped maintenance, and improved accessibility and safety.

The primary component of the renovation is a complete overhaul of the mechanical systems. The HVAC system will be almost completely replaced, from air handlers, to ductwork, to control systems. The new system will include VAV and constant volume air distribution. Additionally the building will be connected to campus-supplied chilled water, with connections run to each of the labs. Also, many components of the building's plumbing system need replacement. The domestic hot water converter and its associated piping are reaching the end of their service life. Laboratory waste drains are original to the building and leak in spots. And even the bathroom fixtures and piping are aging and worn. As such, much of the plumbing system will be replaced during the renovation.

Another large component of the renovation will be the replacement of the building's electrical system. The switchgear and transformers of the building are all original to the building. Also, the panel and breaker boxes that supply the labs are at near capacity. Furthermore, many of the lighting fixtures in the building run on old, inefficient ballasts, at 120 volts. And finally, the emergency power feeders to the building have proved to be inadequate during power outages. Because of the shortcomings of the entire electrical system, virtually all of it will be replaced in the renovation.

Interior finishes makes up the third most costly component of the renovation. Carpet, floor tiles, and seamless laboratory floors are to be installed. Though normally

a simple procedure, the flooring being replaced is suspected to contain asbestos. Removal of this asbestos properly will incur significant cost. In addition to floor, select interior doors and hardware and laboratory furniture are to be replaced.

Another piece of the renovation is maintenance of the building envelope. The warranty on the building's roof system expired in 2004, and will thus be replaced. Also, some of the mortar joints of the brick exterior are failing, and so selective repointing of the bricks will be done during the renovation.

Last, but not least, are accessibility and safety improvements. The building has no sprinkler system. The stairway guardrails, fire alarms, and exits signs no longer comply with current codes and standards. There are not enough laboratory eyewash stations, and many of those present are of poor quality. Also, both elevators in the building are original to the building, and lack fire extinguishers or emergency phones. Braille labeling is positioned incorrectly. All of these problems will be corrected in the renovation.

Staffing

The author is still waiting for info on the staffing of the renovation. It is known that Scott Mull is the Project Manager, and that Jeremy Duckott is in charge of Document Distribution. Further information on the project staffing should be available soon.

Questions Asked

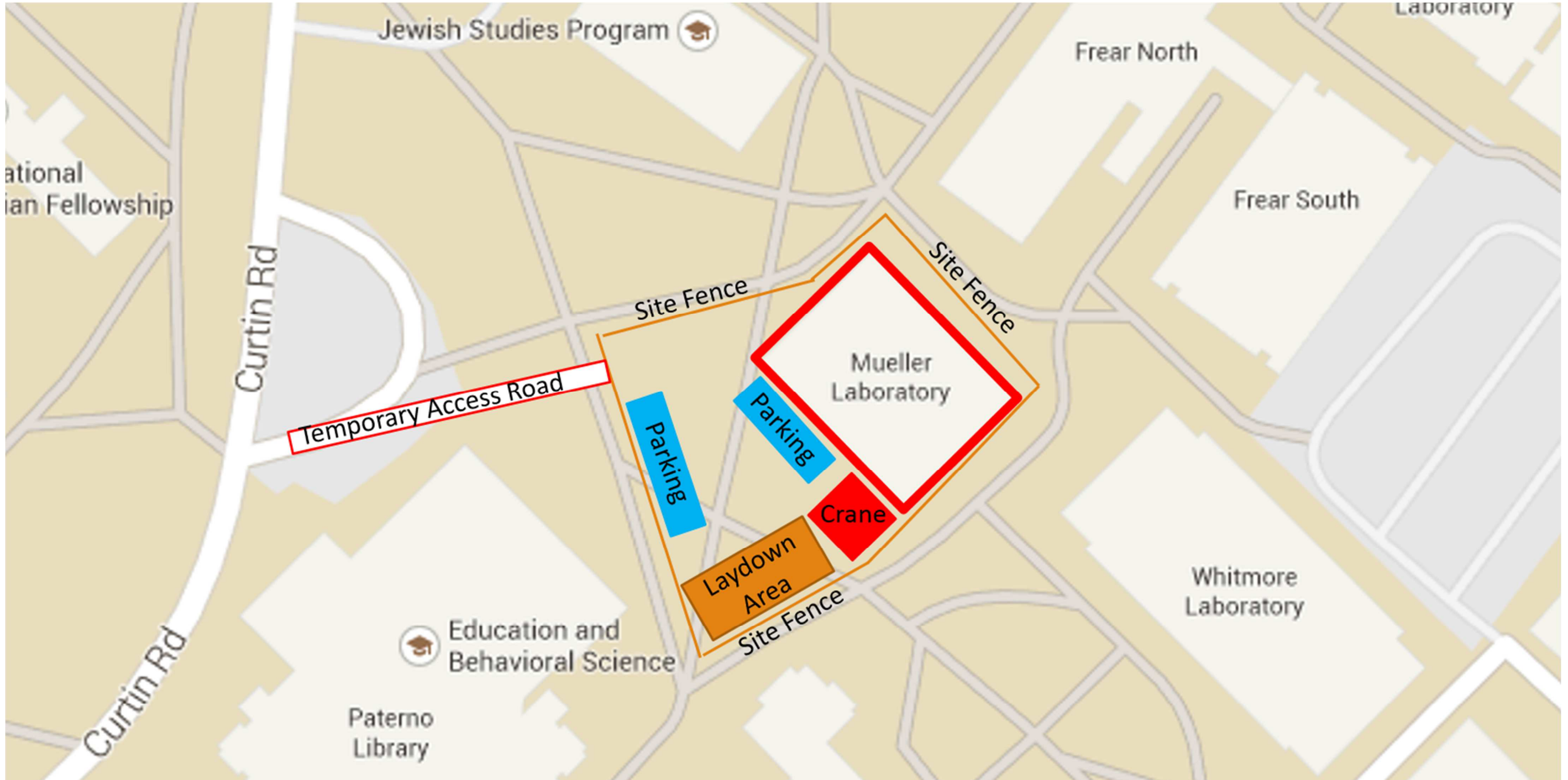
Q1: What changes could be made to the scope or schedule to ensure the project finishes on time?

Q2: Are there any sustainability components of the design?

A1: Improvements to interior finishes could be omitted from the project scope.

A2: The new HVAC and electrical systems will be more energy efficient. Using campus chilled water will save energy also.

Site Plan



Mueller Laboratory Renovation

BY

MARK JACKSON

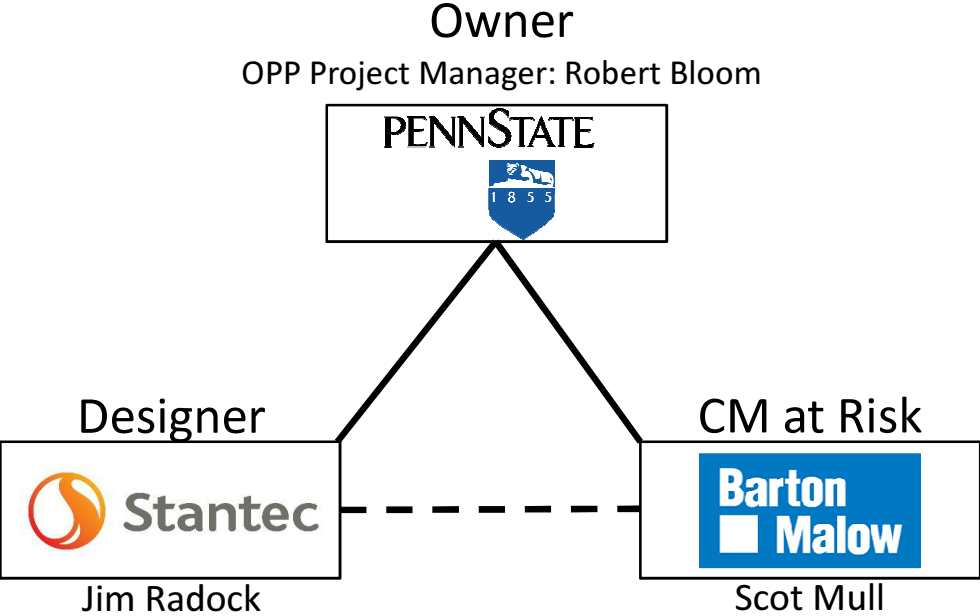


Client Information

- Penn State University
- Renovation Details:
 - Replace outdated HVAC, electrical systems
 - Maintain building envelope
 - Renovate interior finishes
 - Fire safety, accessibility, elevators
- Building to remain partially occupied
- High pedestrian traffic area around building
- Minimal interruption to school years



Project Delivery



Project Cost Evaluation

- Square footage: 75,482ft²
- Cost/SF for College Laboratory, new construction: \$206.70
(from RS Means 2014)
- Cost estimate: \$15,602,130
- New construction cost comparable to renovated cost

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Building Systems Summary

- Electrical distribution system
- Building envelope
 - Replace roof
 - Repoint bricks
- Fire safety-sprinkler system
- HVAC system-air handlers and ducts
- Interior finishes-paint, hardware
- Plumbing-campus chilled water
- Elevator



Existing Conditions/Site Plan



Staffing

Barton Malow

- Scott Mull, project manager
- Jeremy Duckott, Document Distributions

Waiting on futher staffing details

Questions asked

What changes could be made to the scope or schedule to ensure the project finishes on time?

Are there any sustainability components of the design?