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EGR 353

Dr. Wunderlich

4/24/24

Elizabethtown Engineering Graduate Program Facilities

Elizabethtown College owns an unoccupied, open plot of land on the eastern side of campus. This land offers many opportunities for academic and cultural expansion for the college. Our design is to make this unused land a new staple for the college campus. We want to create a graduate engineering program, a new food hall and a beautiful Japanese garden to build on the college's academic and community connections. Our design of these buildings will focus on sustainability by using the environment around it as a tool and guide. This essay will describe the design process of the new engineering buildings. Our design goal is to meet LEED's platinum certification level. To reach this certification goal, there was a huge emphasis on the building's orientation, passive and active heating and cooling, solar energy, air quality, HVAC techniques and the overall well-being of the building's occupants. With these priorities our design provides the college with a LEED platinum certified design. The project will bring lasting and self-sustaining facilities that will surely enhance campus amenities for students and the surrounding community.

There will be two new engineering buildings that will only hold graduate level classes. They will consist of two large rectangular buildings, 40 meters by 55 meters, connected on the second story by a bridge. Each building will promote an optimal learning environment that provides students with hands on learning opportunities. There will be a large fabrication lab such as the one in Esbenshade, but it will provide a space that will give students an opportunity to

work on larger projects. These could consist of material strength testing, mechanical projects with cars and other bigger scale projects. This area will be overlooked by a glass window which leads to office spaces for the professors. This will allow professors to see how their students are doing and watch projects slowly take shape. There will also be small classrooms that will engage students in discussions during class. This will allow for there to be a better connection between professors and students. A large library will also be available for use for studying, homework and design work. There will be a large collection of books on mathematics, tips for design and engineering standards. Within this space, there will be computers for hard to run softwares and study rooms. This design promotes a highly active learning environment that will push students to excel in their academic endeavors. These aspects also aid LEED's neighborhood connections, innovation and design process checklist.

To optimize the buildings' performance, we had to first come up with an efficient orientation for all the amenities it was designed to have. With our goal to make the building as self-sustainable as possible, there will be monocrystalline solar panels placed on the southern side of the building. This is the most optimum position for them and there will be no trees or buildings blocking the sun. This will lead to the maximum amount of energy absorbed and will help provide a ton of energy for the school. To lengthen the time to replace the roof on the building, there will be a pyramid shaped roof. This will provide the least amount of upward force on the roof when there is wind blowing on the building. With this change, there is a significant reduction in roofing damage during storms which will make the buildings last much longer. To also help during storms there will be counter flashing placed all around the corners and creases of the walls and roof. This will provide the building with protection from small leaks and mold growth. The roof and walls will also be painted lighter colors such as blue and white. This will allow the heat to be reflected off the building, which will cool it down significantly in the

warmer months. These approaches are a great foundation for a sustainable building which helps build points on LEED's green infrastructure section.

Our design also provides the buildings with multiple different passive heating and cooling opportunities which will continue to grow points for LEED's green infrastructure section. Many bushes and trees will be planted on all sides of the building. This will not only provide an ascetically pleasing parameter but also protect the building from wind and the hot summer sun. These plants will also help with maintaining the wetlands area that is around the building. By soaking up the wet land around the building, there will be natural drainage. Also, during the winter, the leaves will fall leaving there to spaces for the sun's heat to be absorbed. This also points to the benefit of having two buildings next to each other. They offer shade and storm protection, along with insulation for each other which will help maintain temperature levels easier. Having calculated placed double pane windows will also help with passive heating and cooling. The majority of windows will be placed on the southern side of the building to allow the sun to heat the inside during the winter. Above the southern and western windows, there will be overhangs built. This will help block the high, hot sun in the summer and cool down the building. It will still allow the lower winter sun to provide heat to the building. There will also be blinds and thermal insulated curtains that drape over the windows. These will be closed at night to help regulate the buildings temperature and allow there to be less heat and cold loss. Additionally, there will be expanding insulation foam used all around the building. This will allow the insulation to fill all the nooks and cracks by keeping a tight seal. There will be emphasis on insulating the roof and floor because a lot of heat is lost from there. With these passive techniques, our building will be highly efficient in all the types of weather Pennsylvania has.

There is also a large emphasis on air quality and HVAC systems. First off, there will be airlocks at every entrance into the building. This will not only help keep the temperature inside of the building more stable but also provide protection against pollutants that could come from the outside. To help the air quality in the building we will have 5-6 air exchanges per hour. With this high amount of airflow, viruses such as Influenza and Covid will be less likely to spread inside. This can be a huge selling point and can provide a healthy environment to learn. There are multiple design implementations we will be adding to reach these exchanges. We will have a very open floor plan which will allow air to move freely around the building. Additionally, there will be many windows that can be automatically opened to help produce natural airflow. These windows can be set on a timer and be opened for a few minutes at a time every hour to help bring fresh air into the building. These controls can be programed by engineers and will operate on their own. However, there is a control panel that will provide people with the option to control it themselves. This system will be significantly helpful within the fabrication lab. The windows in the lab are high up and would be a hassle to operate. With a system that can operate on its own, the air quality will be much better. This is especially helpful when wood and metal chippings are floating in the air after cuts are made. Investing in having HEPA filters scattered around the buildings air vents will also significantly help the air quality. These high-quality filters help block small dust particles, pollutants, viruses and bacteria. With these filters, there will be a decrease in illnesses and health risks for all visitors in the building. They will also be much more sustainable as they won't need to be changed out very often (US EPA, 2019). These focuses will provide the building with many options to help with the air quality in the building.

This leads us to our next focus which is on the buildings comfort level for the professors and students. Having an inviting atmosphere inside the buildings can significantly increase productivity. Our design goal is to follow Fitwell's three-star certification which also connects

with some of LEED's platinum certification requirements. Fitwell's three-star certification is the highest level of their health promotional qualifications. At this level, the building will provide occupants with, "an excellent level of health promotion" (Richey, n.d.). To reach this level, there are multiple design ideas. To uplift energy in areas without sunlight, music will be incorporated to create a better atmosphere. This will be key on the east side of the building because it will predominantly receive sunlight in the morning and as the day goes on, it will be darker than the rest of the building. There will also be a mix of lighting options. Having a variety of ambient light, task light, and accent light, utilizing LED lighting technology will provide a more appealing environment. The library and computer lab will be illuminated with a combination of natural and artificial light to enhance productivity and comfort. Lighting will also drive the northern side of the building to hold most of the classrooms. This is because the northern sun, in Pennsylvania, provides rooms with a well-lit environment but also doesn't have any glare from the sun. This will allow natural light to bleed in and drive students to be more awake and listen more while in class. To also help students while in class, there will be multiple designs to help keep the classroom quiet and not interrupted by nearby roadways or work being done in the fabrication lab. There will be soundproof insulation that fills the walls around the classroom. On top of that, the room will have noise reduction sound panels. This design will allow the teacher to be fully heard even if there are students who have restricted hearing (Acoustic Panels for Soundproofing Your Classroom | NetWell, 2017). The airlock system on all the doors will also allow for help against pressure change within the building. Having a two-door entrance allows there to be a less of a sudden pressure change for people walking in the building. This will benefit everyone that walks in and make the atmosphere much more natural. Also, our design with automated windows will help the buildings' experience. People can work much better and be more attentive with air flow coming from the outside. In the Fitwell certification, there is also

a big emphasis on promoting physical activity. In our design we want to add an area for people to have a space to be active. There will be some treadmills and yoga mats that look out of a large window. Also, with our open-concept floor design, there will be more of an incentive to walk around and be active. With all these additions to the buildings, it will surely help foster a competitive learning environment allowing students to excel academically.

Outside of the building, we have designed a vibrant Japanese-style garden. The garden will be next to the pond that is already in the nearby woods. Within the garden, there will be many stones that form a pathway around the water. There will also be a bridge that goes over a part of the pond. The vegetation will be mostly cherry blossom and maples trees with bamboo and moss lining the ground. This will be a beautiful touch aesthetically and will provide a soothing place for students and faculty to utilize. There will be benches and tables for students to sit, eat and do work on. This will also drive the local community and the college to be more connected. There will be many neighboring residents that will visit the college and take the time to connect with the beautiful garden.

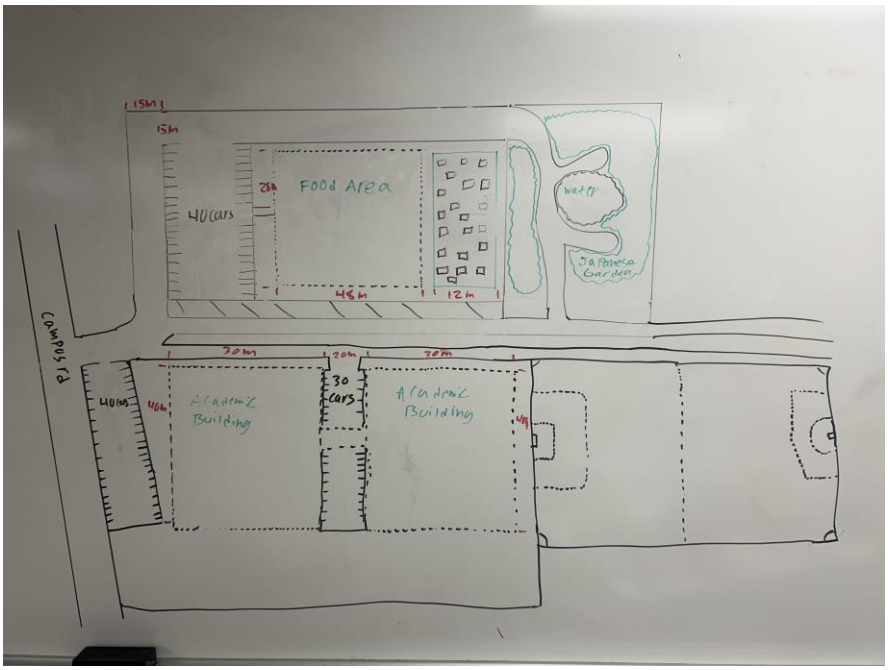
In conclusion, our design of these academic buildings will provide the campus with new sustainable and self-operating buildings that will foster academic growth and success. While following LEED’s platinum level certification, we created buildings centered on utilizing the surrounding environment to create a great product. We deeply designed the building's orientation, passive and active heating and cooling, solar energy, air quality, HVAC techniques and the overall well-being of the building's occupants. With these efforts, we have created something that can be a staple for the college campus and grow the community and college more closely connected.

Works cited

Acoustic Panels for Soundproofing Your Classroom | NetWell. (2017, April 21). https://www.controlnoise.com/treatment/classroom/

Richey, D. (n.d.). *Fitwel* |. Fitwel. Retrieved April 28, 2024, from https://www.newcomb-boyd.com/energy/fitwel/

US EPA. (2019, February 19). *What is a HEPA filter?* Www.epa.gov. https://www.epa.gov/indoor-air-quality-iaq/what-hepa-filter



Detailed Drawing

LEED v4 for Neighborhood Development Plan
Project Checklist

Project Name: Elizabethtown Engineering Graduate Program Facilities
Date: 3/18/2024

Yes	?	No	Smart Location & Linkage		28
Y			Prereq	Smart Location	Required
Y			Prereq	Imperiled Species and Ecological Communities	Required
Y			Prereq	Wetland and Water Body Conservation	Required
Y			Prereq	Agricultural Land Conservation	Required
Y			Prereq	Floodplain Avoidance	Required
8			Credit	Preferred Locations	10
2			Credit	Brownfield Remediation	2
2			Credit	Access to Quality Transit	7
2			Credit	Bicycle Facilities	2
3			Credit	Housing and Jobs Proximity	3
1			Credit	Steep Slope Protection	1
1			Credit	Site Design for Habitat or Wetland and Water Body Conservation	1
0			Credit	Restoration of Habitat or Wetlands and Water Bodies	1
0			Credit	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	1

Yes	?	No	Neighborhood Pattern & Design		41
Y			Prereq	Walkable Streets	Required
Y			Prereq	Compact Development	Required
Y			Prereq	Connected and Open Community	Required
9			Credit	Walkable Streets	9
6			Credit	Compact Development	6
3			Credit	Mixed-Use Neighborhoods	4
6			Credit	Housing Types and Affordability	7
1			Credit	Reduced Parking Footprint	1
2			Credit	Connected and Open Community	2
0			Credit	Transit Facilities	1
1			Credit	Transportation Demand Management	2
1			Credit	Access to Civic & Public Space	1
1			Credit	Access to Recreation Facilities	1
1			Credit	Visitability and Universal Design	1
2			Credit	Community Outreach and Involvement	2
1			Credit	Local Food Production	1
1			Credit	Tree-Lined and Shaded Streetscapes	2
1			Credit	Neighborhood Schools	1

Yes	?	No	Green Infrastructure & Buildings		31
Y			Prereq	Certified Green Building	Required
Y			Prereq	Minimum Building Energy Performance	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Construction Activity Pollution Prevention	Required
3			Credit	Certified Green Buildings	5
2			Credit	Optimize Building Energy Performance	2
1			Credit	Indoor Water Use Reduction	1
1			Credit	Outdoor Water Use Reduction	2
0			Credit	Building Reuse	1
1			Credit	Historic Resource Preservation and Adaptive Reuse	2
0			Credit	Minimized Site Disturbance	1
4			Credit	Rainwater Management	4
0			Credit	Heat Island Reduction	1
1			Credit	Solar Orientation	1
1			Credit	Renewable Energy Production	3
1			Credit	District Heating and Cooling	2
1			Credit	Infrastructure Energy Efficiency	1
2			Credit	Wastewater Management	2
0			Credit	Recycled and Reused Infrastructure	1
1			Credit	Solid Waste Management	1
0			Credit	Light Pollution Reduction	1

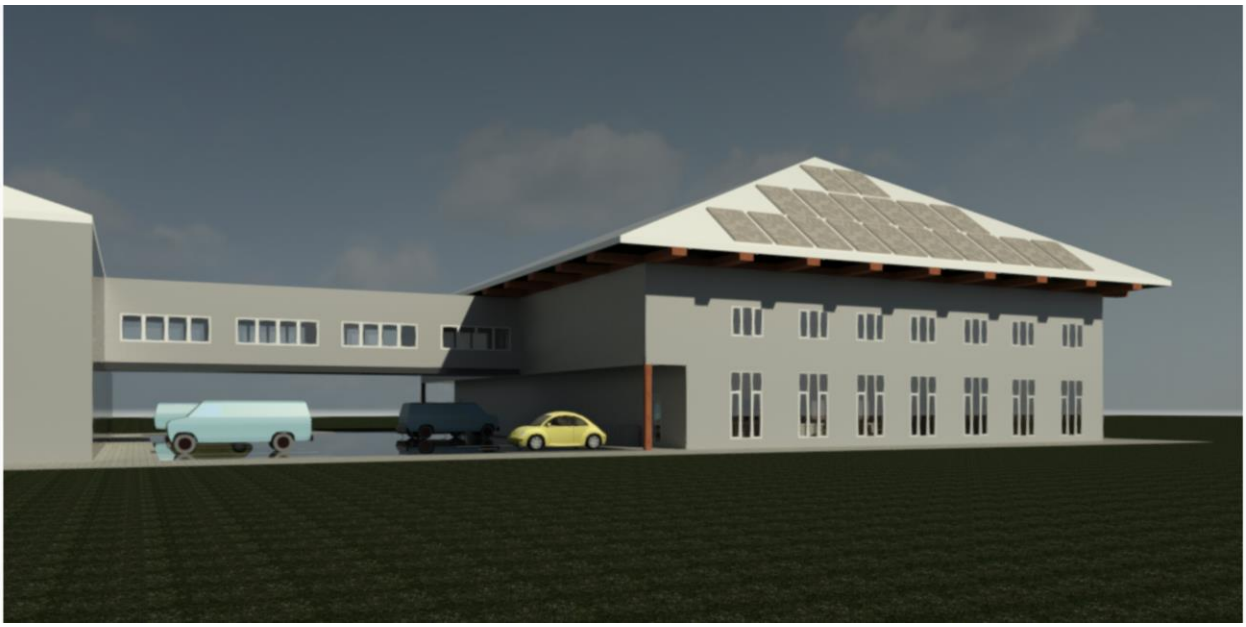
Yes	?	No	Innovation & Design Process		6
2			Credit	Innovation	5
0			Credit	LEED® Accredited Professional	1

Yes	?	No	Regional Priority Credits		4
1			Credit	Regional Priority Credit: Region Defined	1
1			Credit	Regional Priority Credit: Region Defined	1
1			Credit	Regional Priority Credit: Region Defined	1
1			Credit	Regional Priority Credit: Region Defined	1

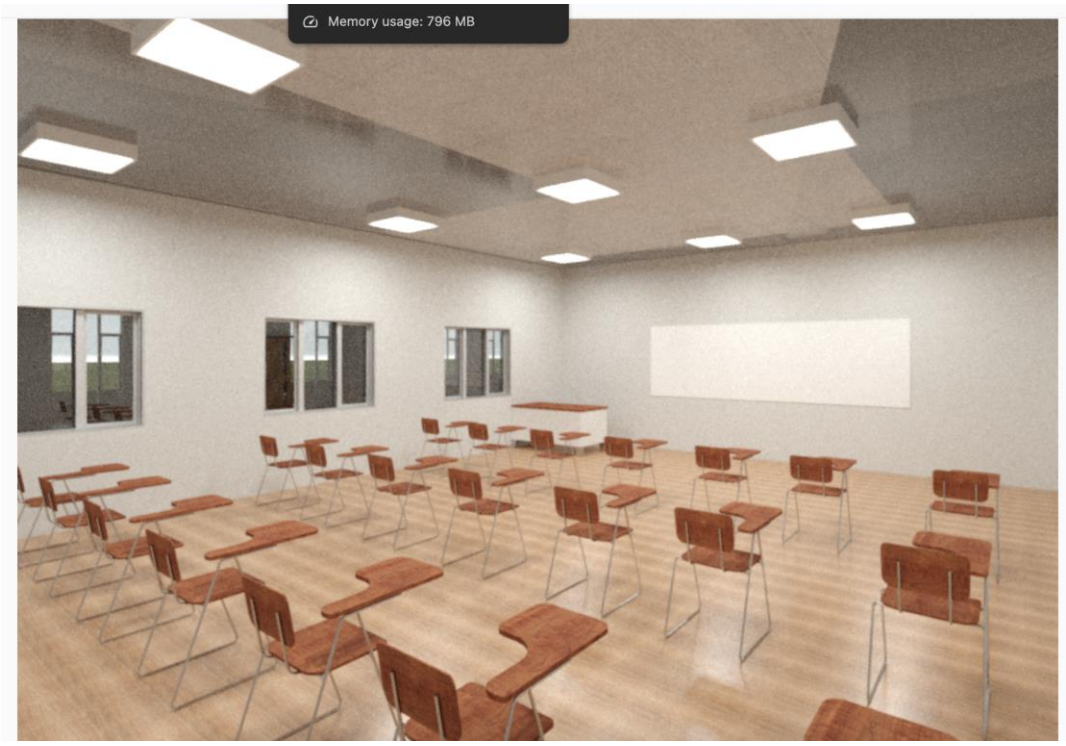
82	0	0	**PROJECT TOTALS (Certification estimates)**	110

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80+ points

LEED Checklist

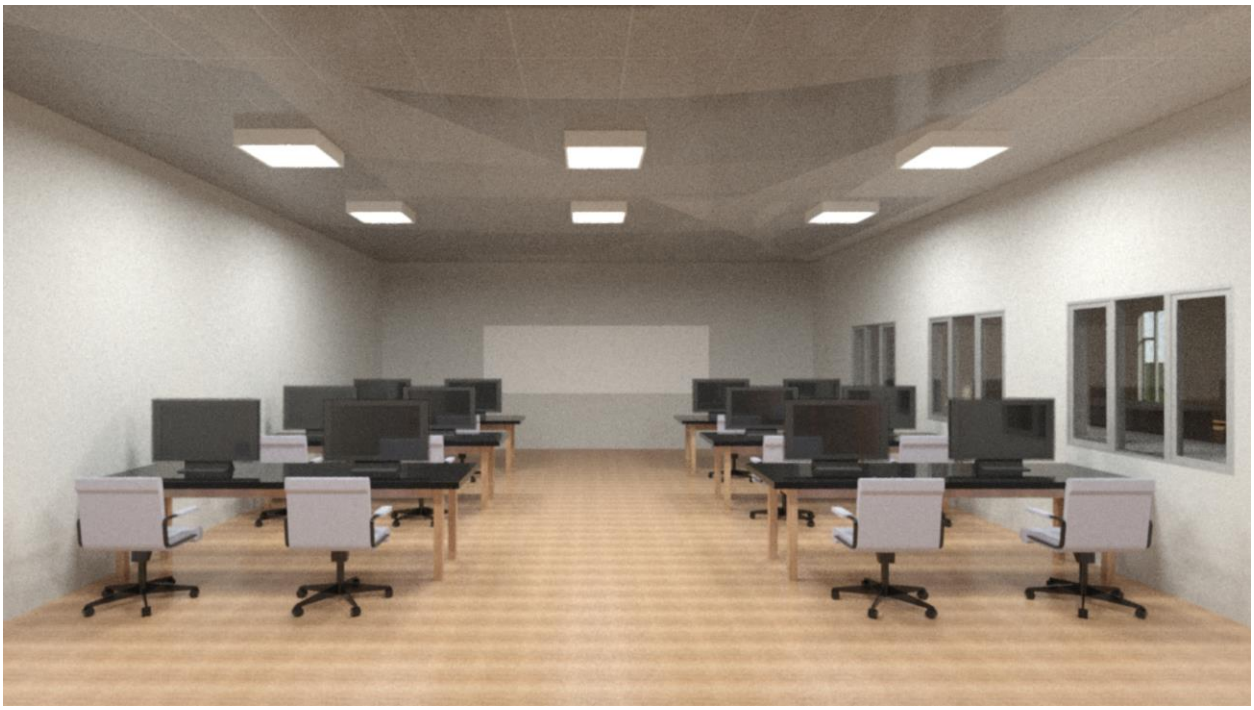


Building South View



Classroom One

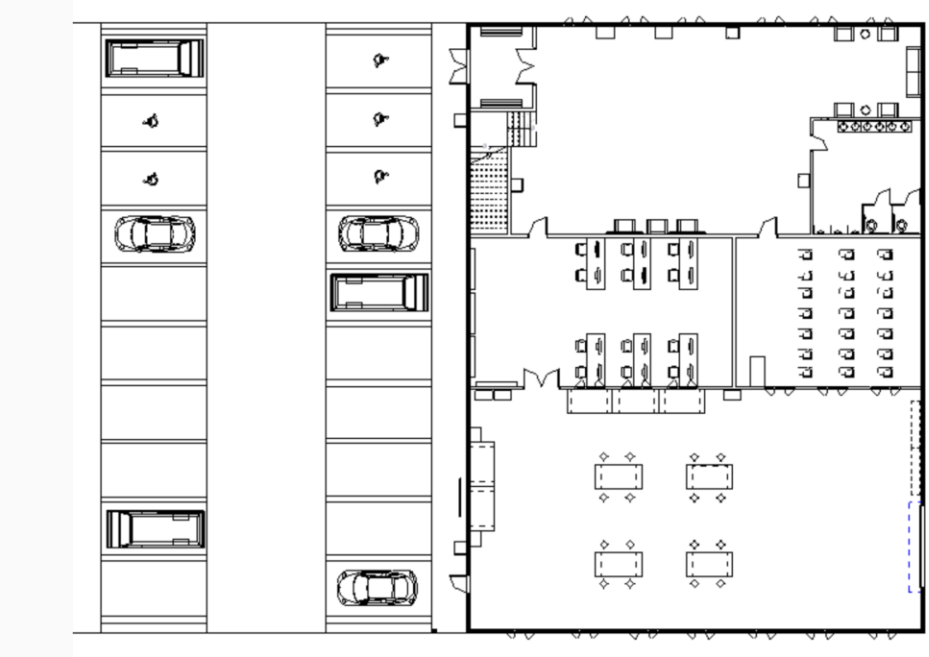
Classroom Two



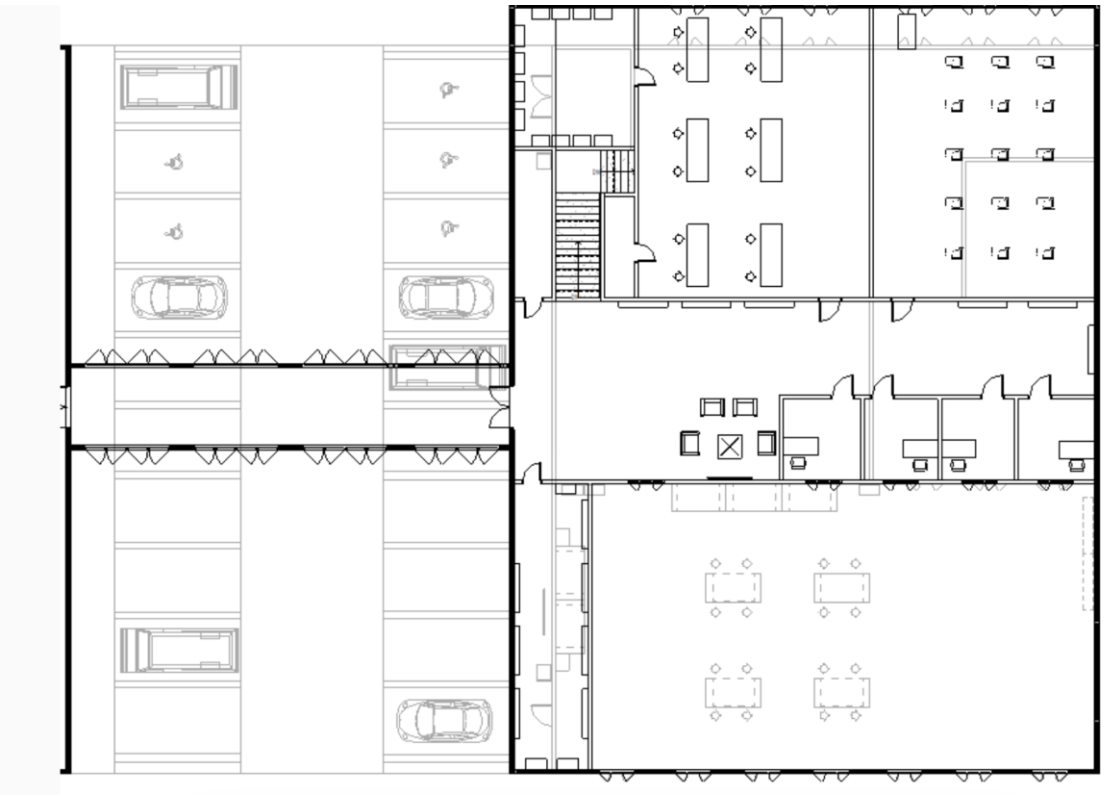
Computer Lab

Fabracation Lab

Bathroom



Floor One Layout



Floor Two Layout

Main Entrance

Material Testing Classroom

Professor Office

Professor Offices and Lounge Area

South View