Project Deliverable E

Project Plan and Cost Estimate

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November 3, 2023

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1. Introduction

The AOPFN and Neya Wabu Guardian program has tasked our team to design a facility to serve both as an office space and as a space for the community. From the information obtained after the initial client meeting, our team created the following problem statement:

“The AOPFN and Neya Waban Guardian Program need a multi-use indoor and outdoor facility designed for community projects, office space, and harvesting and storing plants for medicinal use, that is reflective of their cultural values. “

From this problem statement, we developed a design criteria that can be used to measure our design’s ability to solve the client’s problem. After much research, brainstorming, and meetings, the first conceptual design was developed and presented to the second client meeting.

Our client greatly enjoyed our design and felt that we met the majority of their needs from the conceptual stage alone. They specified the need for more office spaces and a collaborative workspace.

This document will present our final design concept. It will also list all the required materials and equipment needed to create prototypes, and to create a final design. Furthermore, this document will outline an overview of prototypes and tests that will be held to ensure the completion of our solution.

2. Detailed Design

The building was calculated to have an area of approximately 5125 ft^2 and a height of 12 ft.

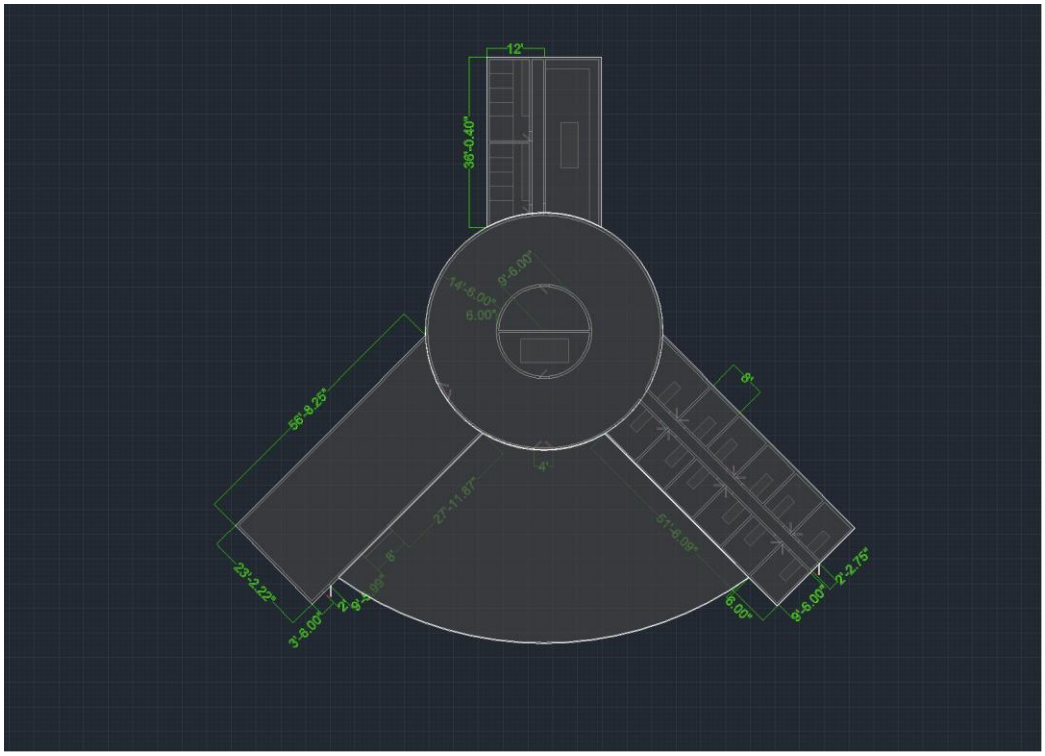

Figure 1. Top view of the detailed design

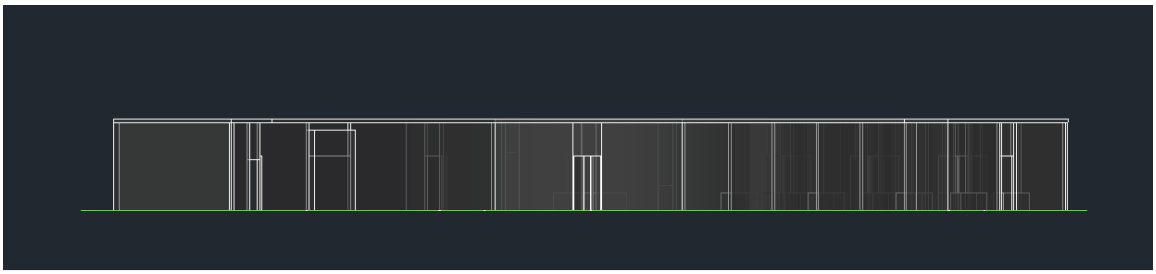

Figure 2. Front view of the detailed design

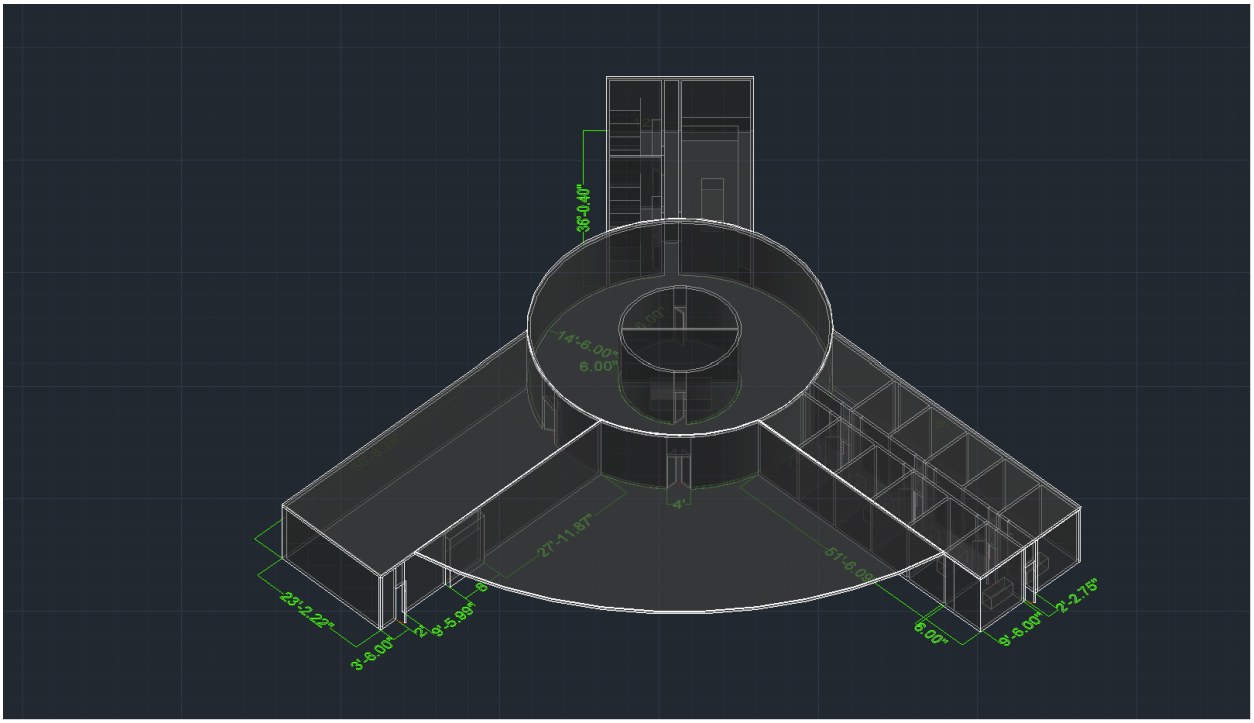

Figure 3. 45° view from the front of the detailed design

3. Project Risks

One main risk for our prototype is sizing and detentions. As a team, we have never designed a building and were not given specific dimensions for the. It is possible that we have not accounted for certain aspects such as parking angles. This could also lead to problems with door spacing and windows. If these proportions are not precise and functional, all the details that follow these prototypes will be displaced and will affect the entire design process. Consequently, the building will not be fit to be constructed, defeating the purpose of our design.

4. Contingency Plans

Following our prototype, if the results demonstrate wrong dimensions, we will need to alter the placement of the key components. We will need to find the right configuration and use further testing to ensure this problem is resolved before moving forward with the project. However, to avoid dedicating too much time to this potential issue, the new plans for this particular problem should be brief and forgo other details that aren't related to general measurements.

5. Project Cost Estimate

Using the square foot estimator on RSmeans, we obtained a cost estimate of $1,048,268.69, or about $1,050,000. This was done using dimensions estimated from the detailed design, and average values for architectural and contractor fees.

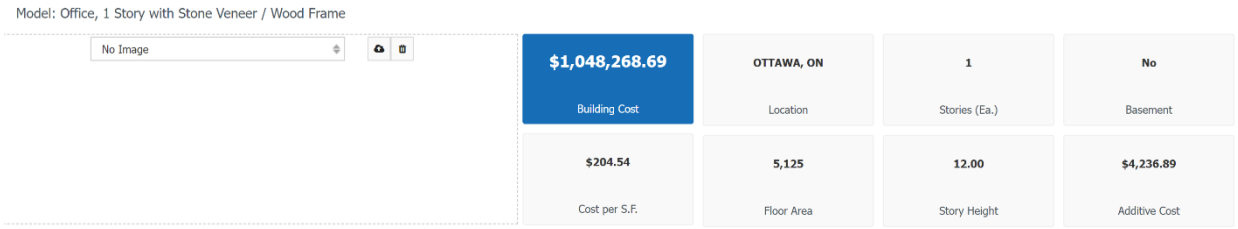

Figure 4. Screenshot of calculated building cost using RSmeans

6. Prototype Test Plan

The prototype plan includes 4 tests on 4 different prototypes to verify the main components of our design. Each test will provide feedback on design and placement that potentially needs to be altered. This first prototype plan highlights general concerns so that we can establish the main components before seeking detailed plans.

Test ID	Test Objective	Description of Prototype used and of basic test Methode	Description of Results to be Recorded and how these results will be used	Estimated Test duration and planned start date
1	Verifying the culture design incorporated in the building by getting personal feedback.	Focused Prototype: Online drawing and designing what the building will look like from the outside. Testing will include personal feedback from users.	The results should include the answers to the following questions: Does this include enough cultural significance? Are the selected shapes accurate for the cultural aspect?	November 6th, 2023
2	Test functionality of outdoor space (i.e. use for cultural events and parking lot. Test if the location of the garage door is plausible for truck accessibility)	Focused and Physical Prototype: Tangible model of the outdoor space connected to the lab. Visually evaluate the space and use model of cars and humans to scale and verify its ability to use the area.	The results should include the answer to the following questions: Is the space large enough? Is the garage placed correctly or does it need to be moved to a better angle? Does the garage door obstruct the other uses of the space?	November 4th, 2023
3	Test general safety of the building	Comprehensive Prototype: Detailed virtual representation of the building. Compare the digital model to safety codes for one story office buildings.	The test will be successful if the building follows the regulations like those of the safety hazard section of office-safety-general.pdf (ccohs.ca). Such a building is equipped with fire escapes, has enough doors and windows,	November 5th, 2023

			and has enough space for safe movement between rooms.	
4	Test security of building	Analytical Prototype Online model of security cameras and outside shape. Calculation of the area of vision of the cameras compared to where they are placed on the model.	The test results should include the total area of visibility of the cameras to make sure the surroundings of the building are covered, especially the lab, and whether there are any blind spots.	November 5th, 2023
5	Test for sustainability and energy efficiency	Focused Analytical Prototype Online model of the building A calculation of the energy emitted by and energy supplied to the building using software	The test results to be recorded include the emitted energy (transmission, infiltration, ventilation, wastewater, cooling) and supplied energy (energy recovery ventilation, energy recovery heat pump, solar energy through windows, heat supply, electricity use, latent energy, human heat gain, process energy room). These can then be compared to the requirements to a green building certification, such as LEED.	November 5th, 2023

As mentioned in the table, the prototypes will include a 3D detailed model of the building signaling doors, windows and other general safety requirements, a tangible model of the outdoor space, an online model of the security camera placement with a determination of their range of view, an online drawing of the exterior for culture symbolism as well as a checklist for sustainability. Once these prototypes are tested and altered, we will specify our test to other concerns such as circulation of the building, sun path diagrams and more detailed functional test of the sustainable elements.

7. List of Equipment

In the table below, we have outlined the software and equipment needed to create our final product.

Item Name	Description	Type	Prototype #	Source
Rhinoceros 3D	To create a 3D model of our detailed design	Software	2	https://www.rhino3d.com/
AutoCAD	To draw a detailed design of the outside and inside of the building	Software	1	https://web.autocad.com/
Ultimaker 3	To make a model of the outdoor space and car models for outdoor space	Equipment	2	MakerLab
PLA	Filament fed to the Ultimaker 3 to create the 3D model	Equipment	2	Makerstore
OnShape	To design the models to be printed.	Software	3 and 4	https://www.onshape.com/en/
BIM Energy	To measure the energy emitted by the building, and to measure the energy needed to be supplied to the building	Software	1 and 3	https://bimenergy.com/
Adobe Illustrator	To create a sun path diagram and a circulation diagram	Software	1, 2, 3	https://www.adobe.com/ca/products/illustrator.html

8. Bill of Materials

In the table below, we have outlined the required materials and costs for creating our final product.

Item Name	Description	Units of Measure	Quantity	Unit Cost	Extended Cost	Link
Rhinoceros 3D	3D computer graphics and CAD software to develop a 3D version of the design	Free subscription trial of 90 days (about 3 months)	1	0	0	https://www.rhino3d.com/
AutoCAD	Design software for detailed designs of floor layouts, building overview	Included as a member of the uOttawa community	1	0	0	https://www.autodesk.com/ca-en/products/autocad/overview
Ultimaker 3	3D printer for production of physical prototypes	Included as a member of the uOttawa community	1	0	0	Makerspace
PLA	Filament to be used to create our 3D model using the Ultimaker 3	Available in the Makerstore	1	$40.00	$40.00	Makerstore
3D printing	Base price of 3D printing inside the Makerspace	Unit	-	$10.00 + $0.2/g	$10.00 + $0.2/g	Makerspace
Onshape	3D design software to produce the 3D designs for printing	Included as a member of the uOttawa community	1	0	0	https://www.onshape.com/en/
BIM Energy	Building energy analysis software for	Free license available for Students	1	0	0	https://bimenergy.com/

	the calculation and simulation of energy					
Adobe Illustrator	Vector graphics editor and design program	Free subscription trial of 7 days OR $25.99 per month	1	0	0	https://www.adobe.com/ca/products/illustrator.html
Total product cost (without taxes or shipping)					$50.00 + $0.2/g	
Total product cost (including taxes and shipping)					$50.00 + $0.2/g	

9. Conclusion

As presented above, we have a general design which will be tested using multiple prototypes for this stage of the design process. The results should address the risk factors and ensure our plan is on the right track to further the detail in our design. We will be verifying the dimensions, cultural aspect, sustainability, safety, and security of the building plan. These prototypes, as well as the final design, will have a fairly low total cost since most "materials" used are software. This will allow us to create more prototypes to continue testing our building project. This document also includes a cost estimate of the project if it were to be executed, however this cost may change as we alter our designs following the prototyping process.

Wrike snapshot:

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=Cd8nKHOD0aFnUIjrbQDxn7A5jIzKQJBY%7CIE2DSNZVHA2DELSTGIYA