Deliverable F

Prototype 1

GNG 1103

Group 20

Abstract

This document contains the feedback from clients after the third client meeting, the 2D floor plan and 3D model of the second building concept, as well as the results for the prototyping test plans for the second concept.

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1. Objective

Develop your first prototype and devise a test plan for your second. Get customer feedback to improve your prototype.

Instructions:

1. Clearly outline the feedback received from your client on the group concept or detailed design. Specify how the feedback will be used to inform future design choices and improve the solution.
2. Develop a prototype which will be used to achieve the objectives your team has set out in the plan created in the last deliverable (i.e. you need to answer the "why", "what" and "when" of prototyping).
    1. Remember: a prototype is not normal work on your project, it is something that has a smaller, targeted objective with specific tests and measurabledi results.
3. A simple analysis of critical components or systems should also be included, based on your current knowledge of engineering science or other knowledge.
4. Carefully document your prototyping test plan, analysis and your results (including detailed images of your prototype).
5. You must gather feedback and comments on your ideas and prototype from potential clients/users that you have sought out and identified on your own.
6. If applicable, update your target specifications, detailed design and BOM after tests are completed and analyzed.
7. Finally, teams will outline a prototyping test plan based on the template provided in "Lecture 11 – Prototyping Test Plan" to prepare to build the second prototype in the next deliverable.
    1. Typical objectives include: communicating and getting feedback for ideas, verifying feasibility, analysing critical subsystems or system integration or reducing risk and uncertainty.
    2. You must also define a stopping criteria which will allow you to end the test once you are satisfied that you have achieved your testing objectives.
    3. Be very clear about what you are trying to measure and define an acceptable fidelity based on the objectives of your prototype.
    See https://en.wiki.makerepo.com/wiki/Professional_development/Design_thinking/Design_for_manufacturing.

Since this will be your team's first prototype, you should focus on creating a basic proof of concept which should be made using materials and components that cost very little (e.g. things found around the house, scraps, etc.). Get creative in order to improve your results.

It is strongly recommended that you start early, as prototyping takes a significant amount of time.

2. Client feedback after third meeting

- Clients were satisfied with the boardroom design
- Clients liked the lab design but needed a larger garage door entrance.
- Dryer rooms requires more storage space

- Don't need a drying room.
- Bigger bathrooms or less stalls worried not enough leg room.
- Loading bay should be attached to the Lab.
- Storage room to be closer to lab.
- If possible, add more office spaces.
- Like the design
- Like that there is a walk-in freezer
- Like the additional storage room
- Like that an estimated cost was shared

From the feedback, the second concept was iterated with a removed drying room and reconfiguration of rooms in the left wing, with the storage and loading bay now attached to the lab. Right wing has two more offices. Washroom was slightly extended in size.

3. Our plans for the prototyping test

1. Loads withstand able by subsections of the building. Subsections will be defined by homogeneous structure, where it can be generalized more easily into a single expression.
2. Occupant capacity.
3. Wheelchair accessibility.
4. Fire emergency evacuation and controlling of fire.
5. Accessibility of building in high snow accumulation.

Tests that could be omitted:

3. Wheelchair accessibility
   Our building is one story and is planned to use wheelchair ramps on all external doors. All hallways are at least 1.1 meter wide, and bends leave extra space. Public and single washrooms have wheelchair accessible stalls. Wheelchairs are generally 1.07m L X 0.66m W. Could iterate hallways to be extra 0.2 meters wider.

For test 1:

Mathematical focused prototype.

WHY-

The test is to determine the expected weight at worst case scenario. The purpose of which is to estimate the weight that must be withstand able by the roof.

WHAT-

The estimated weight of frozen snow at 30 cm thick, heaviest estimate, is 3 kilograms per square meter. If there were to be people on top of the roof, maximum weight estimate can be increased to 80 kilograms per square meter. Leaving a 50% precaution, the roof must withstand 120 kg/m^2 or 24.6 pounds per square foot. If assuming the angle of the roof to be 30 degrees, the applied force experienced by the roof would be 1019.5 N/m^2.

Pressure withstand able by roof = weight of roof per m^2 X 9.81 m/s^2 X cos(30 degrees) + 1019.5 N/m^2

Pressure withstand able by roof = weight of roof per m^2 X 8.50 m/s^2 + 1019.5 N/m^2

For test 2:

Analytical comprehensive prototype

WHY-

The test is to determine the maximum capacity of each room before it would be considered crowded. The purpose is to understand the room capacities and iterate if needed.

WHAT-

Lab: ~12

Male washroom: 7

Female washroom: 6

Kitchen: ~5

Board room: ~12

Office: 12

Workspace: 4

Lobby: ~15

For test 4:

Analytical comprehensive prototype

WHY-

The test is to determine the fire escape routes and whether they are feasible. The purpose is to develop a fire escape plan.

WHAT-

Refer to image below.

For test 5:

Comprehensive analytical prototype

WHY-

The test is to determine the considerations and minimal height of components to function in highest snow accumulation. The purpose of which is to determine the feasibility of components and understand the special considerations.

WHAT-

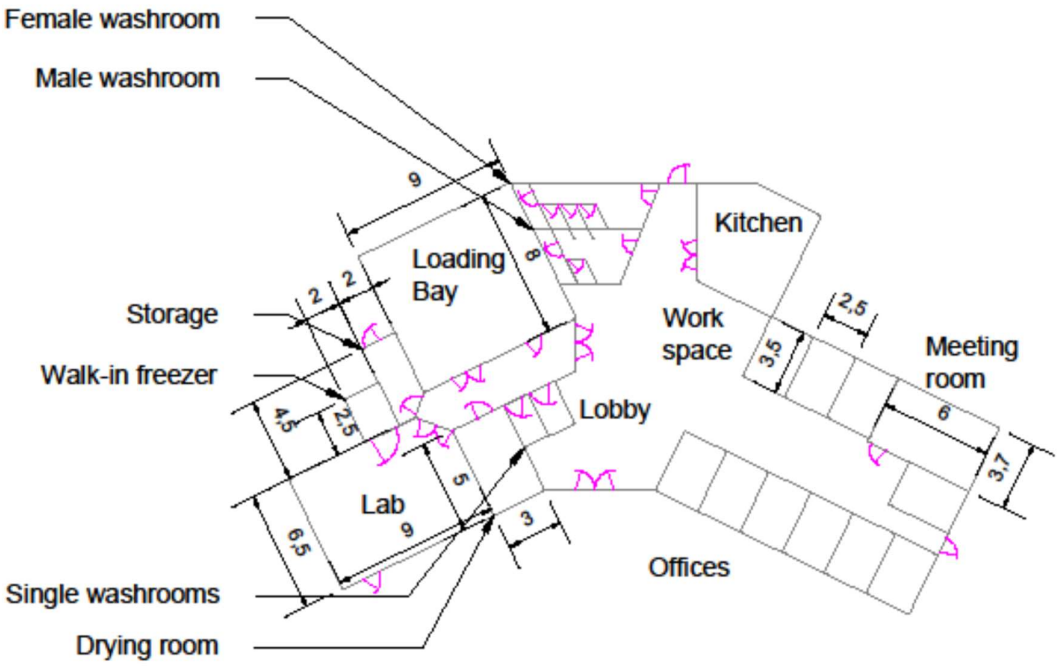
Estimated max height of snow is 400 cm (highest record in Ontario was 464 cm in 1886).

Building cannot be reached by walking or driving at such heights, so building should be accessible as normal in 0.5 meters of snow, 50 cm, functional in waist deep snow, which is 1 meter, 100 cm, and would not shut down in 4 meters of snow, 400 cm, in case of trapped individuals.

We do not have the necessary details and knowledge, i.e., location of vents, to create a detailed analysis.

Main and emergency exits should be fitted with a canopy, the size and height of which can be determined by more experienced engineers. Same with positioning of ventilation systems.

4. First Prototype



WHEN-

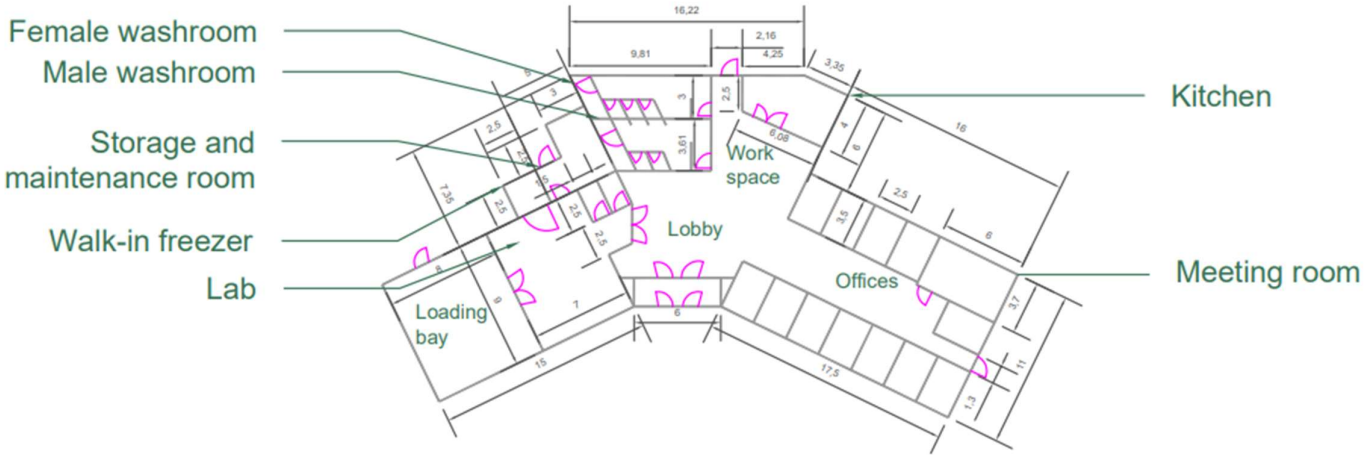
Being the first prototype, the finished model should be finished in about 3 weeks. The basics have been taken care of and now we adjust our already optimal design to incorporate the client's feedback.

Main testing plan:
Finding a design that works for harsh snow conditions also putting the attractiveness of the roof in mind.

Crowd control of building.

Efficient and optimal fire escape route(properly spaced fire exits)

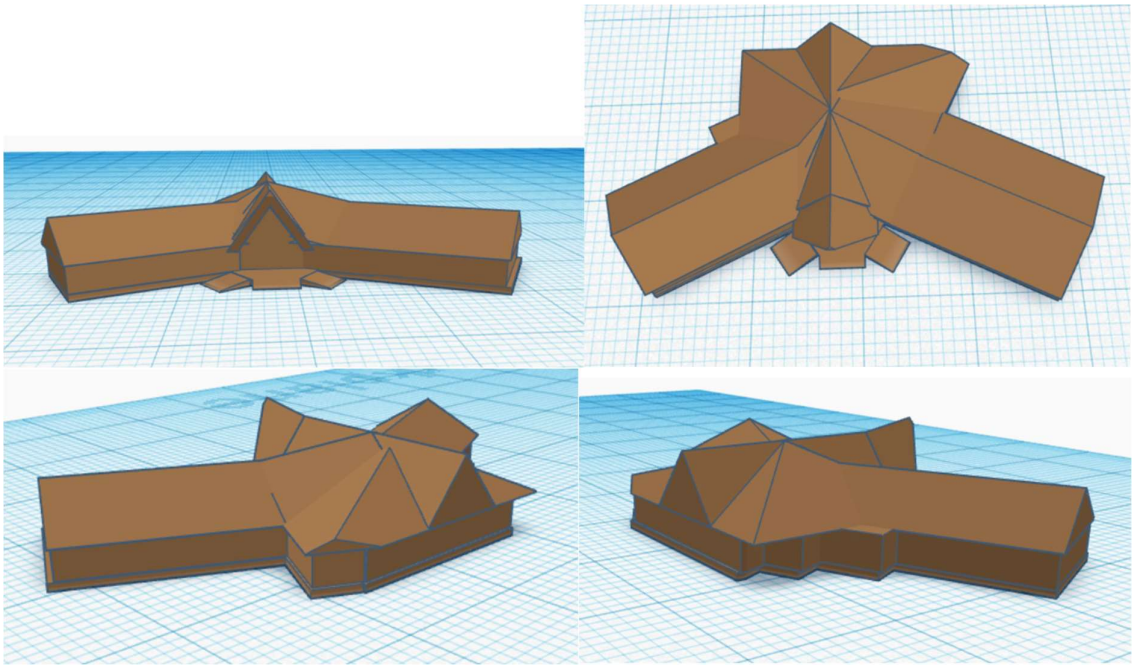
5. Concept 2, iterated from concept 1, floor plan



6. Fire escape plan

The building code regulations states that emergency exits/egresses should be no more than 15 m travel distance from any point in public space. Our prototype's floor plan meets this criterion.

7. 3D model



For the final concept design, an alternative roof design will be presented, with changes in the design made to reflect the form of a butterfly. This is primarily an aesthetic change and will not cause any difference in floor plan or functionality. It will offer an alternative that leans more deeply into the indigenous inspirations for the design rooted in that of the importance of the butterfly in indigenous culture. (*re orient to talk about it from testing perspective). The roof would maintain the standard 30-degree incline and would offer more internal volume for similar surface area, as well as a more ergonomic construction from simpler geometric shapes. (?)

Materials used for constructions and its purpose goes as follows: concrete foundation, steel framing, internal walls will be drywall/wood.

OR

Concrete walls and foundation with wood for framing with insulation in between, dry walls and wood on the internal layer.

Since we did not have time for a feedback, Deliverable G, second prototype, will be treated as a different design for concept 2, with the same prototyping test plan.

8. Link to Wrike

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=eKi49xEumMVGMfGOHLVOWihMHIx1T9KW%7CIE2DSNZVHA2DELSTGIYA