Independent Technical Memo – 3D Printed Housing Project

For this report, I will be focusing on is the material choice and the competing factors around this design aspect. There are many factors surrounding this choice that fall into the PERSEID categories, the bulk falling under performance, environmental, and socio-cultural. These factors are in competition because the 3 major material choices favor different categories. Concrete is the best performing material in terms of throughput and in terms of regulations already in place, but it is not as environmentally friendly or as appealing to consumers. The material is cheap to purchase but expensive to transport because its short usable life and rapid transportation requirements [1]. A resin-based material is more environmentally friendly and more aesthetically appealing (socio-cultural) but is also costly [2] and has sub-optimal throughput because of the resin 3D printing procedure, which is longer and complex compared to conventional printing [3]. Third, a naturally occurring material is most likely the most renewable (environmental) but is likely the least aesthetically appealing (socio-cultural). In addition, regulations are not yet "set in stone" concerning 3D printed natural materials [4] (like a clay-based material), which would make regulations approval difficult and lengthy. Finally, the possibility that the natural material might need heavy refinement could possibly cause it to be less environmentally conscious than concrete.

Observing the pros and cons of each material, a clear winner cannot be chosen. Aside from performance, none of the materials come out ahead in a certain category (concrete wins in the performance aspect). Resin presents an opposite to concrete, excelling in every aspect that concrete does not, while naturally based or clay-based presents a reasonable middle ground in each category. This rendered the decision-making process difficult and caused many arguments concerning what is most important to the project.

To address these concerns, my group employed a decision matrix. By weighting the different aspects of the project by their importance, we were able to decide which material was the best choice. We discussed and agreed that the original goal of the project was to make housing that is more affordable and appealing to the average Canadian. Having said this, we weighted factors such as cost, aesthetic appeal, construction time, structural integrity, and other factors that would make the house more appealing higher. Then, we weighted environmental concerns as lower than the former since it was a secondary goal for the project to be more

sustainable. Finally, any other outstanding factors we could think of were weighted accordingly. Through this process we narrowed down our options and found that concrete was the most important in terms of the goal of the project. Resin was a close second, it is more environmentally friendly, but its cost and sacrifice of printing throughput impeded its appeal to the average Canadian because of the price increases it would cause.

Through this process, I have learned that the best way to decide when presented a multitude of candidates is through a thorough evaluation of their contribution to the main goal of a project. A decision matrix is an excellent tool to achieve this, and I think it should be used more often. Personal bias would be removed from things like selecting a candidate for a job opening or deciding what platform to use for app development. I've learned that as a group with individual wants and needs, we tend to stray from the true goal of our project after long hours working towards it. A reminder of our main goal helped set us straight and allowed us to criticize our own perspectives and biases. Above all, I have learned that it is important to look internally at your actions and opinions and to make sure you are considering the opinions of others. Getting a second, third, fourth opinion on your ideas only serves to refine them more and open your mind to new horizons.

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