SRG: Mass Timber Study
Seating Bowls Design

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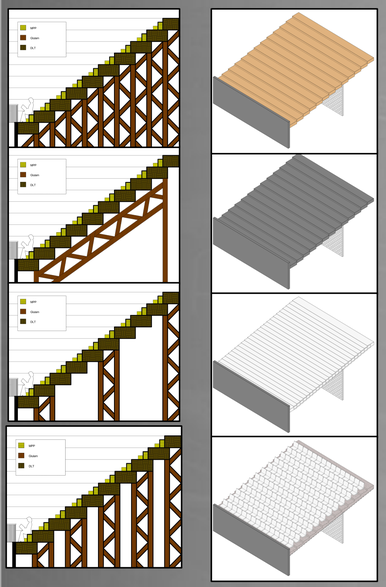
Objectives

Milestone/ Goal:

- Find other ways we can use mass timber (Outside of roof)
  - Structure
  - Integrated Seating Bowl
- Focused on something unique that has not been done Yet
- Find what is available and where they source
- What has been done?
  - Precedents:
    - Hayward Field,Eco Park Stadium, & Telus Stadium at Université Laval

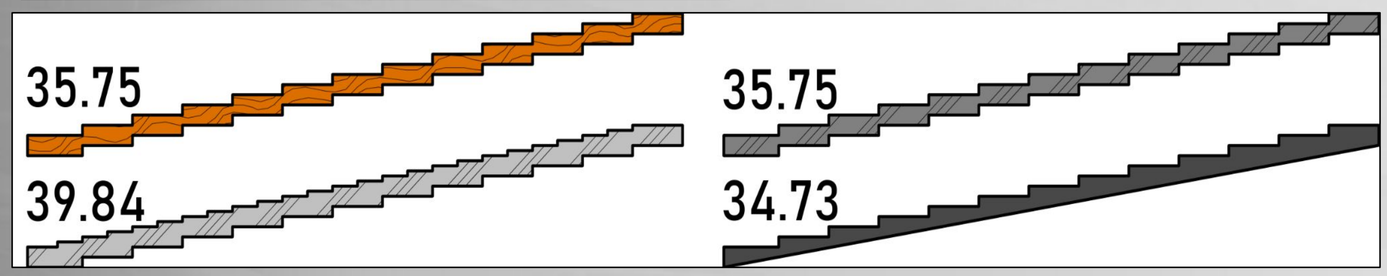
Analysis:
Comparison to precast, cast in place, aluminum

- Strength
- Weight
- Embodied Carbon Analysis
- Cost benefit
- Environmental Damage
- Weatherproofing
- Cost comparison
- Acustis



Research Methodology

We started by researching the different types of timber that is produced and harvested in the oregon, as well as the Pacific Northwest from a number of companies that our partners at SRG provided us with. This would aid in giving us dimensions to use for our calculations. From there, we designed a model in revit to help guide use visually on how these different materials are designed in a seating bowls construction. Concrete would have the smallest cross-section while Aluminum would have the biggest. After establishing the cross-section, we gave each one of the different construction types the same width and length so their surface areas were controlled. Later, we would look into the different values of each material through cost, weight thermal conductivity, waterproofing cost, acoustics and embodied carbon. We took numbers that we found from various articles and pdf's and applied those numbers to each of the 4 construction types. For example, when it came to discovering the embodied carbon of the various construction types, we used the EC3 calculator to generate the amount of embodied carbon per density or per weight. After we obtained the metric either in kilograms of Carbon Dioxide emitted per cubic yard or pounds, we multiplied these numbers by the cubic yardage or weight of the construction types. In the case of the carbon emission calculations, we had different units, but the result of the construction types mathematics still brought us to our intention of uncovering what is the total emission of the construction type. After our midterm, our research had a major shift, for we met emily, who explained to us that there is an extra 10 inches added to mass timber construction to achieve a charr layer thick enough for a proper fire rating. So, we had to change the calculations that we extract from the cross-section of the mass timber construction. We also decided to switch from standard waterproofing for the mass timber to regular traffic coating to experiment with it and its associated cheaper cost. This process was used in the initial revit model, but then we performed this same feat on a section of the Hillsboro stadium design, in an effort to provide SRG with research on how renovating their buildings with mass timber would affect the pre established metric of that already existing building. It also aids in seeing how mass timber design varies from the others in future design proposals.



Timeline

- Week 1: Assigned to SRG Project
- Week 2: First MEeting with SRG
- Week 3: Preliminary wood Research
- Week 4: Bring/Speak Strategies
- Week 5: Midterm
- Week 6: COst Calculations X Cost Comparison
- Week 7: Embodied Carbon X Acoustics
- Week 6: Weather X Fire Proofing
- Week 9: Vibrations X Environment
- Week 10: Pull it All together

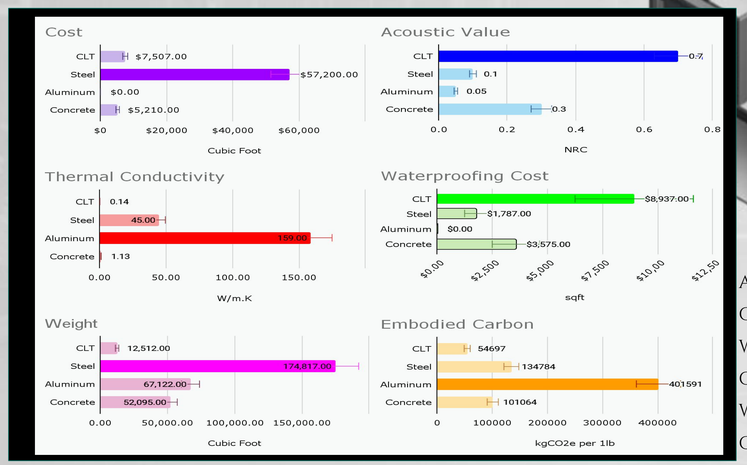
Communication

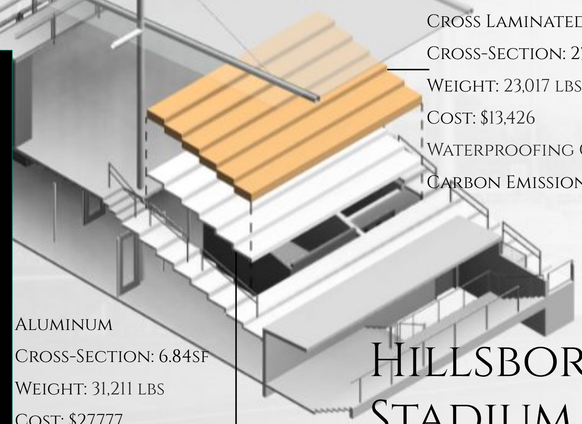
Trust

SRG Timeline:

Conception/ Planning	Schematic Design / Design Development	Construction Admin.
Start the conversation Research and talk about different ways to use mass timber	**Understand the material** Figure out how the systems come together	**Theory to Function** Watching all the systems come together

Findings





Cross Laminated Timber
Cross-Section: 23.68sf
Weight: 23,017 lbs
Cost: $13,426
Waterproofing Cost: $3,604
Carbon Emissions: 3,623 kgCO2e

Aluminum
Cross-Section: 6.84sf
Weight: 31,211 lbs
Cost: $27,777
Waterproofing Cost: $0
Carbon Emissions: 18,7266 kgCO2e

Hillsboro Stadium Calculation

Reflection

In conclusion we found that mass timber can be used in different facets of a stadium, like in the seating bowl. However, there are many factors that have to be considered including weather and fire proofing, combustibility of the material and occupancy levels, ect. These factors increase the size and decrease spacing of the columns which increases the weight and cost of the material. Moreover, we now understand that the use of other materials may be necessary in the structure to reduce the use of overbearing timber members. In regards to the result of the Hillsboro Stadium design, we found that the mass timber was not only lighter than the previously installed aluminum, but we also found the CLT to be cheaper, and have nearly only a sixth of the carbon emissions as aluminum. Since aluminum doesn't need to be waterproof, mass timber was more expensive to waterproof with the traffic coating, but it was still a cheaper construction overall.