Emily Roarty
Thesis Proposal

I. Depth 1: Prefabricated Kitchen and Bathroom Manifold

After attending the PACE seminar on Modular construction, prefabrication seemed very applicable in comparison to modular. Due to the repetitive nature of the six story apartment building, prefabrication must be utilized to save on schedule and budget. In order for the prefabrication to be possible, the mechanical subcontractor must be willing to do this type of prefabrication in their shop.

Beyond the general interest in utilizing prefabrication, the first step taken was to see how many units does this manifold situation apply to. After looking at the drawings, there are 52 bathroom manifolds, and 56 kitchen manifolds. That impacts a total of 108 manifolds in a building with 182 units. Clearly this prefabrication makes sense for a numbers prospective.

In addition to checking the math on this depth, it has to make sense architecturally by looking at the floor plans of these manifold. The drawings are in the Appendix A of this document. Clearly by looking at the exact alignment of the utilities like toilet, appliances, sinks, etc. this looks like a feasible depth option. In addition I will continue to develop a chart with the manifold type and unit type to be clear on the type of construction.

After spending some time with the drawings, I would mockup the chase walls utilizing Building Information Modeling (BIM). This will not only help visualize the space, but help estimate the space that the chase wall would take up on a truck. How the chase walls will be installed whether using a lift or duct jack will be determined during this step. BIM lends itself well to this step because Mechanical Contractors already have those tools and are capable of using them. The owner can tangibly see the prefabricated work before it is even built in a shop.

Finally, the cost and schedule savings on the overall project will be estimated. This is the key selling point of prefabrication to the owner. One of the main objectives of the project is to rent out the rooms quickly and save on schedule. It would also be interesting to research if this was at all looked at in design, and why it was never pursued in construction.

The table below outlines the major objectives for this research depth. A schedule will be attached to each objective to be completed.

Floor	Type of Manifold	Quantity (total if multiple floors)
2nd	Bathroom	9
2nd	Kitchen	11
3rd, 4th, 5th	Bathroom	33
3rd, 4th, 5th	Kitchen	36
6th	Bathroom	8
6th	Kitchen	9
Total	Bath	52
Total	Kitchen	56

Steps for Depth 1: Prefabricated Chase Walls
1. Utilize BIM to create a model of these manifolds.
2. Research transportation cost and efficiency.
3. Finally explore the cost and schedule savings on the overall project.

II. Depth 2: Comparison Between Built in Place Wooden and Infinity Metal Frame Structure

The reason behind this depth is to explore the reasons why structural designers choose wood typically for a podium style building. The first step in investigating would be to examine the existing structure in terms of cost. Then look at schedule implications of a wooden structure.

This process will then be repeated for a metal framed structure. Using a program like Timberline along with RS Means, an estimate will be fully developed for the metal frame structure. A schedule will be made on Primavera to show the change in duration for this type of structure.

Detailing out all of the pros and cons of these structural system will help decide which structure to use. All of the floors will be analyzed except the first floor because it is post tensioned concrete.

Overall this depth is straightforward in terms of the comparison. The main reason why I am interested in this depth is the understand the structure more if it is common in most apartment buildings. I would be able to explain that better to someone in the future if they are arguing for a certain structural design.

After Dr. Leicht's recommendation, my last depth would research on Infinity Wall Panels, which are prefabricated metal wall panels. Infinity Wall panels are prefabricated off site to achieve a high quality, installed with a crane, and use a composite floor system. Hotels, apartments, dorms, and senior living are typical buildings that use this type of system.


Images above show Infinity Wall Panel structure.

The type of wall system would help supplement the last Depth 2 in deciding which structure to use, but it takes it a step further using prefabrication. The first step would be to investigate the size of a typical wall panel and how they would efficiently fit on a truck. Also to see if these panels can be made by a local manufacturer. As well as looking at the environmental impact of shipping panels to the jobsite.

I will then analyze their impact on safety, cost, and schedule. I would create a new site logistics plan to lift the metal panels into place on site. As well as seeing if there are financial savings in the process. The owner would like there to be schedule savings, and in this depth a schedule will be made using Primavera to show the impact. Below are images of the wall panel makeup as well as the steps for the Depth analysis.

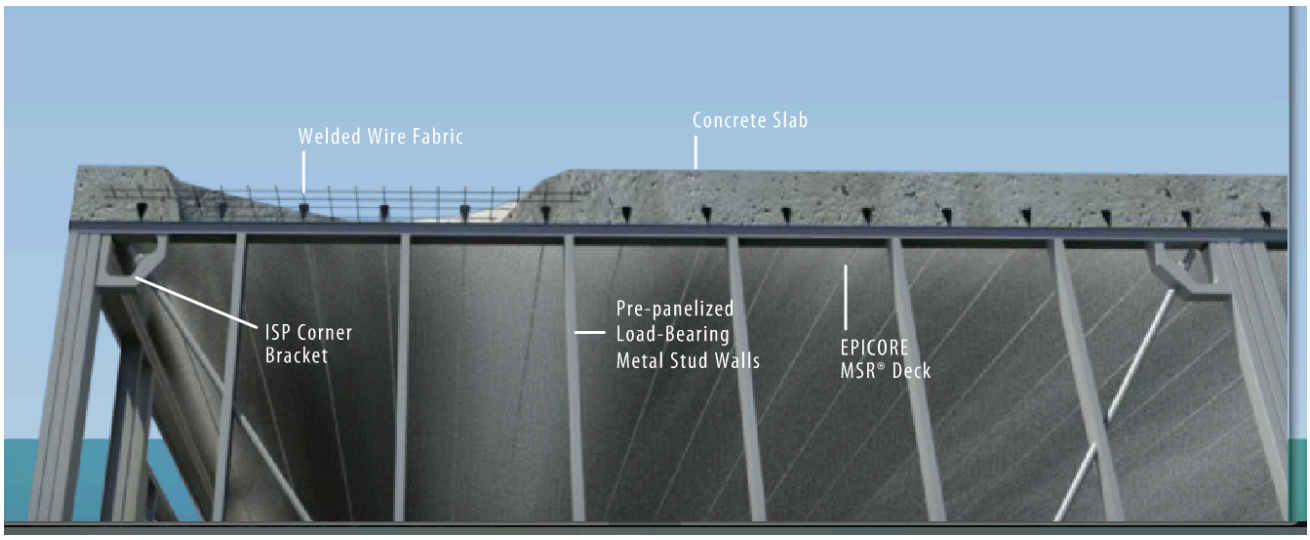
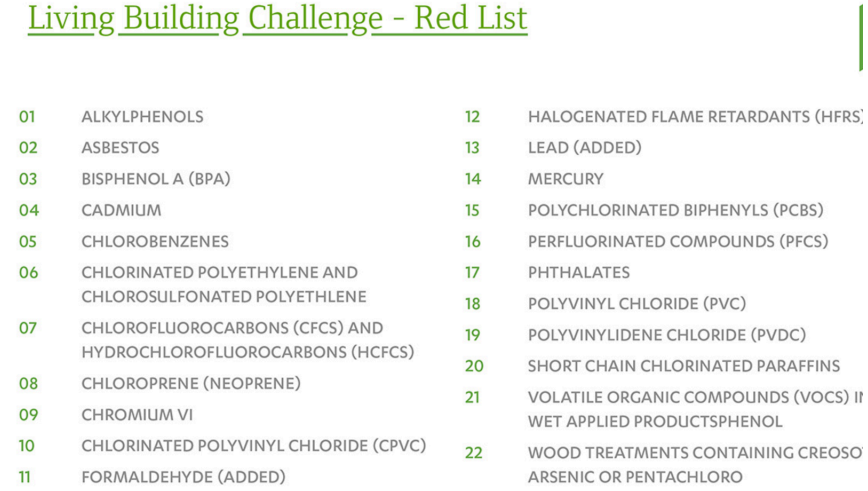


Image above shows the structural makeup of an infinity structure.

Steps for Depth 2: Structural Change from Wooden to Metal
1. Estimate the Cost of Wooden Structure.
2. Estimate the Schedule impacts of the existing structure.
3. Estimate the Cost of a metal Structure including the weight of panels and installation costs.
4. Estimate the Schedule impacts of a metal structure
5. Detail the benefits and drawbacks of each structural system. 6. Create a specific safety and site logistics plan for the wall panels.
7. Recommend a particular system.

III. Depth 3: Using Environmentally Healthy Materials

During recent discussion with Dr. Riley, I learned about the Red List. Certain materials that are unheathly for people and the environment. A summary of the Red List is below:



When speaking with the Project Engineer, one of the main goals of the owner was to have high end finishes. It would be a key selling point to have high end materials that did not include materials from the Red List. Considering the contractor has completed the Living Building Challenge in Pittsburgh, the contractor would potentially have buy in and experience in this area.

Pairing this topic with my research topic, I could recommend healthier finishes to the owner that do not contain harmful substances. I would start by collecting submittal data on the flooring, cabinets, doors, and other finishes. After procuring a list of the finishes, I can explore if they contain materials on the Red List. Finally I will suggest an alternative material.

Steps to Depth 3: Red List Finishes
1. Identify a list of major finishes, and procure product data.
2. Identify if the material is on the red list.
3. Recommend Alternative finishes not on the Red List.

IV. Research Topic 1: Sustainable 5th Floor

In conjunction with Eshan, I hope to explore the materials used for high end finishes that are sustainable for the 5th floor of the Foundry at 41st. A program that uses the geometry of the architectural drawings helps to choose the most sustainable materials for the residential building. I would do research on how the program works and the limitations of the program.

This building was once an old Foundry and is supposed to transform a neighborhood, I was surprised that LEED was not pursued on this project.

The overall problem of the research statement is how can sustainable materials be more easily used on construction site. An objective of the research would be to analyze sustainable materials for the local area, and to create a demand for a sustainable living space. It would be interesting to survey or interview the owner and ask why LEED was not a priority on the project.

After coming up with a bill of materials, I would have to calculate the impact on rent for the tenants, and do research on the percent of people willing to pay more to live in a green space. I would look up research that would support my findings which I would ask for from Dr. Riley and Eshan. This would be my first choice in research topics.

V. Research Topic 2: Financing and Structuring for LEED on Project

Working with Masha, I would work to explore how the Project could implement LEED, and how to get key stake holders on board. I would use surveys, create an implementation, and financing plan. I would do some research on which LEED certification the owner would want to achieve. I would write out feasible steps to achieving that particular certification.

The overall research problem is that the owner and developer did not have the objective to create a sustainable living space, and to figure out what was the major driver in this decision. Did cost of implementing LEED prevent them from implementing it? Or overall man hours involved in tracking the materials prevent it from happening? I would work with the graduate student to refine this particular research topic.

VI. Breadth 1: Mechanical

In conjunction with Depth 1, the Prefabricated Kitchen and Bathroom walls, I would do a breadth on Mechanical systems of the building. I would want to explore the efficiency of the system, and explore why the existing system was used. To achieve this I would begin by analyzing the current system, and understand the reasoning why it was chosen in comparison to alternatives. I will see how easy it would be to implement a prefabricated part into that particular mechanical system.

VII. Breadth 2: Structural

Depth 2, the Comparison between a Wooden and Metal Structure, would lend itself well to a structural breadth. I would work with structural Professors like Professor Hannagan to explore podium structures. I will take into account the regional area for Pittsburgh, and what works best in that part of the country. Both of my breath options lend themselves well to the matching depths.

Appendix: A Kitchen and Bathroom Manifolds.

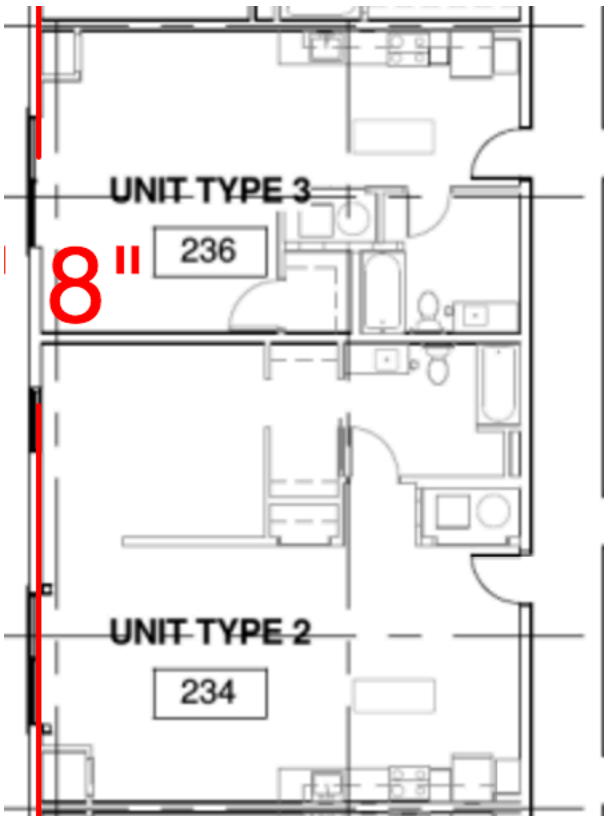


Image 1: Common Manifold Unit Type 2 to Unit Type 3

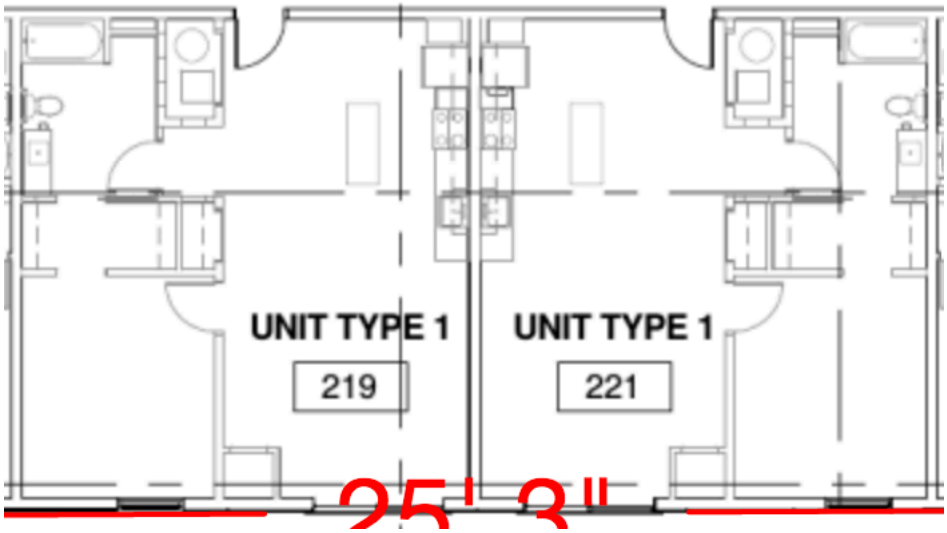


Image 2: Common Manifold Unit Type 1 to Unit Type 1

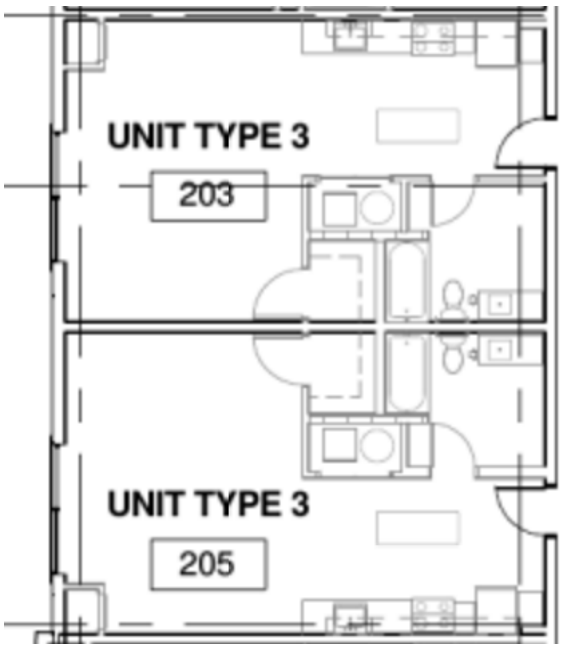


Image 3: Common Manifold Type Unit 3 to Unit 3

Appendix B: Life Edited Links

1) http://lifeedited.com/about/video/
2) http://lifeedited.com/graham-hill-on-ted/