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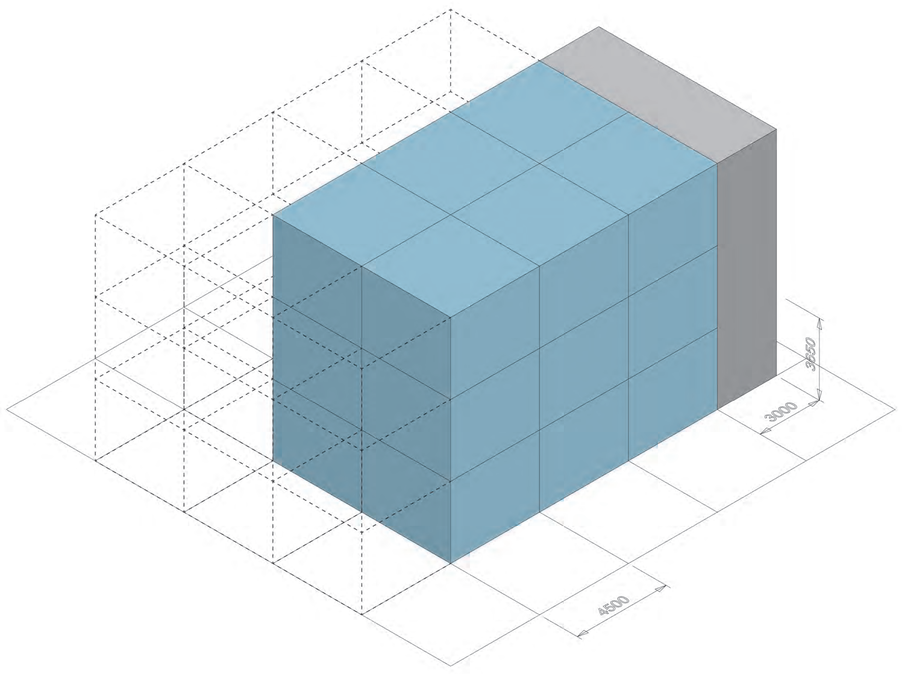
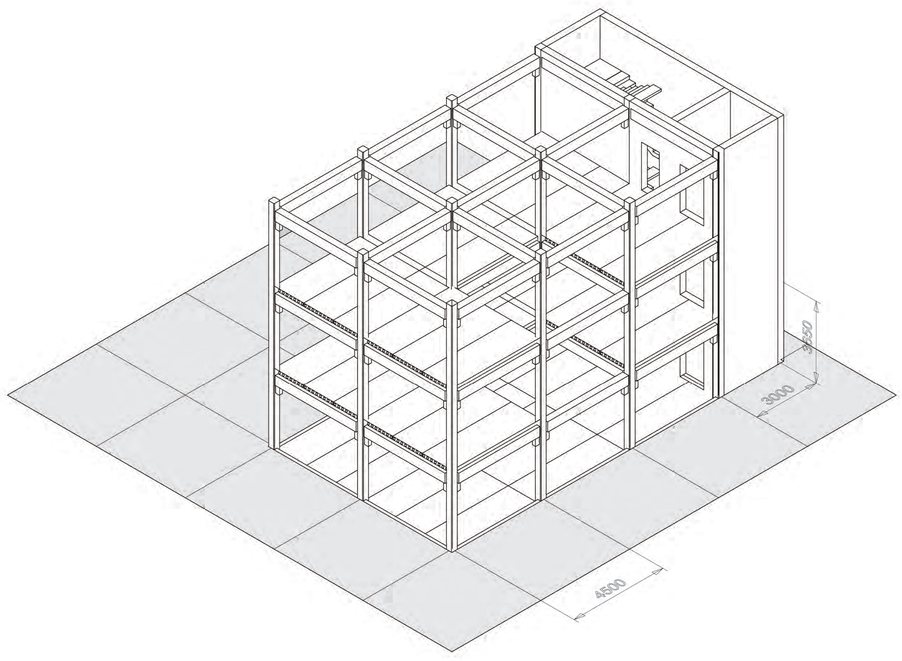
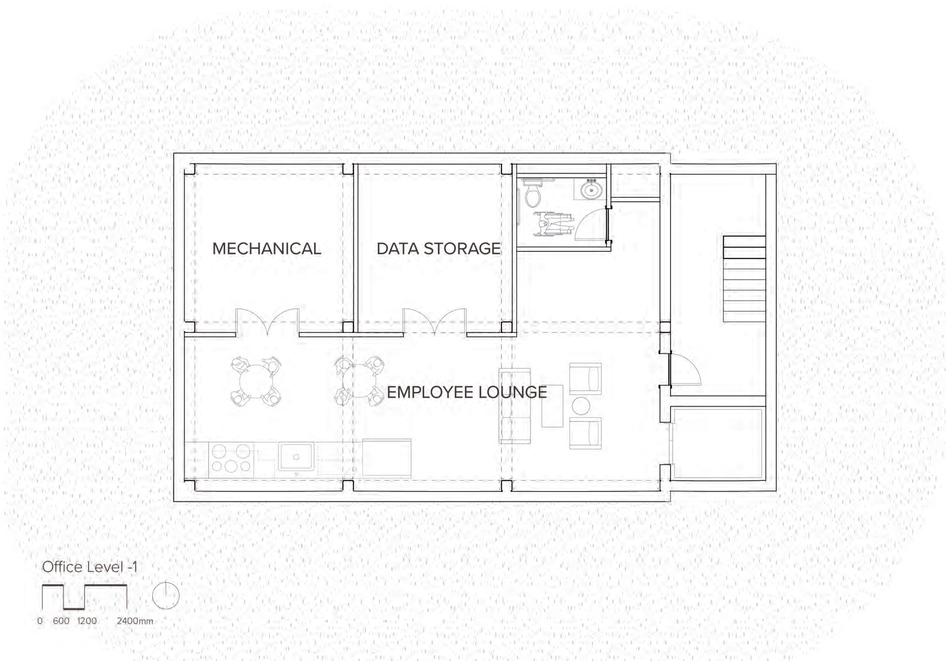
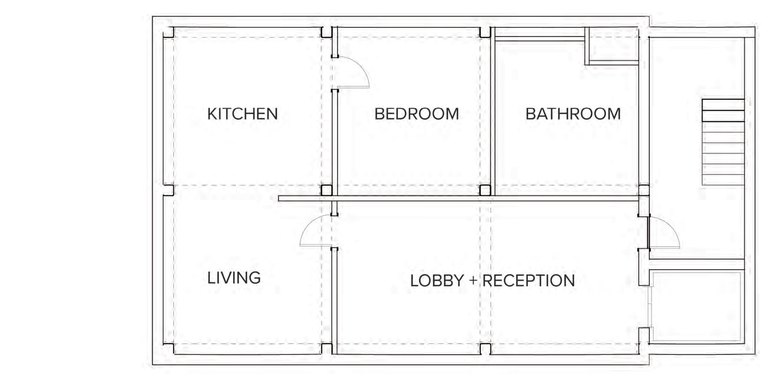




Abstract

The study for concrete and reuse was to examine the potential of precast concrete building materials to allow for more efficient construction, greater potential for adaptation and expansion, and for the design for disassembly. The project consists of a 3 story office building with a basement that is roughly 150 square meters per floor that can also be converted into a multi-tenant office or residential units. The precast concrete construction allows for larger structural pieces to be shipped to the site and craned into place which allows for a speedier site assembly. The design of the structural grid and componentized structural assemblies also aids in the ability for the design to have extra bays or floors added to the building during the design phase or post-construction. Next, the spatial planning is roughly configured to allow for the entire building to be operated by a single tenant, one tenant per floor, or residential units divided by floor. Lastly, the project focuses the research on how the finished building can be disassembled entirely or just stripped to the bones in the most efficient and environmentally friendly way possible. The research paper will dive into each of these aspects through the mock-up design, but with on how the proposed design accomplished the goals of adaptability and disassembly. The project will be described in this paper through architectural representations of the proposed office building and it's disassembly as well as through detailed explanations of the drawings.

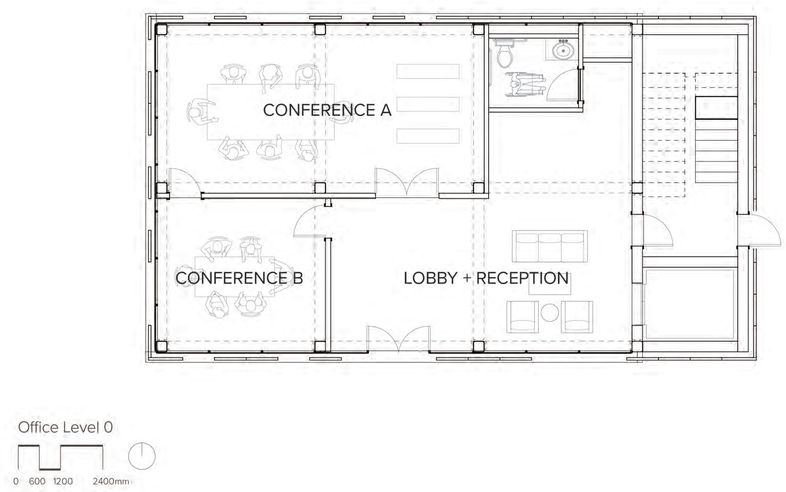


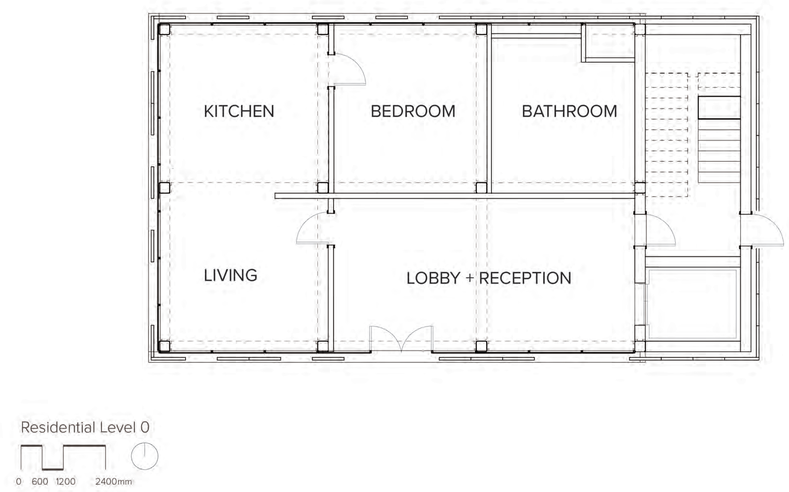


Introduction

Through the course of the semester, concrete and disassembly was researched at great extent. Through the course lectures, the class was taught about basic cement and concrete production, variations of aggregates and concrete strengths, cement carbon emittance and recarbonization, precast forming techniques, sandwich panels, precast site assembly, and demolition techniques. After being taught the fundamentals of how architecture uses concrete, the task was developed to rethink how concrete is used in design.

Simply put, how can architects at the forefront of the design process change how concrete is used to limit the environmental impact that has. The research focuses on this fundamental question by researching a design that can allow for the end of life of concrete to be extended through reuse and disassembly.

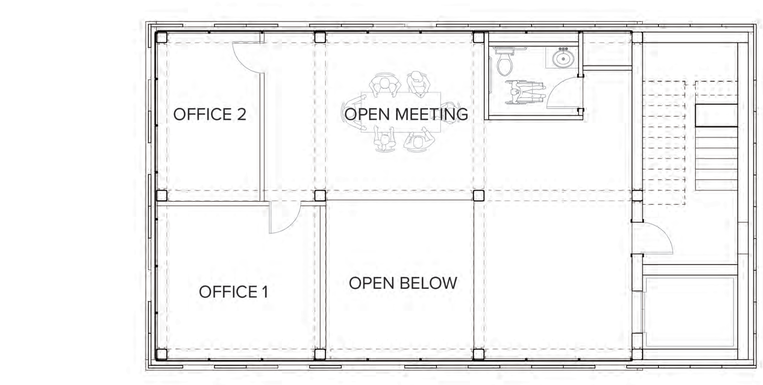


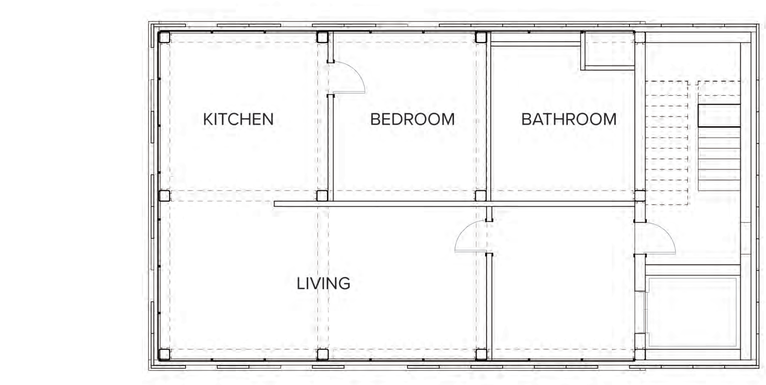


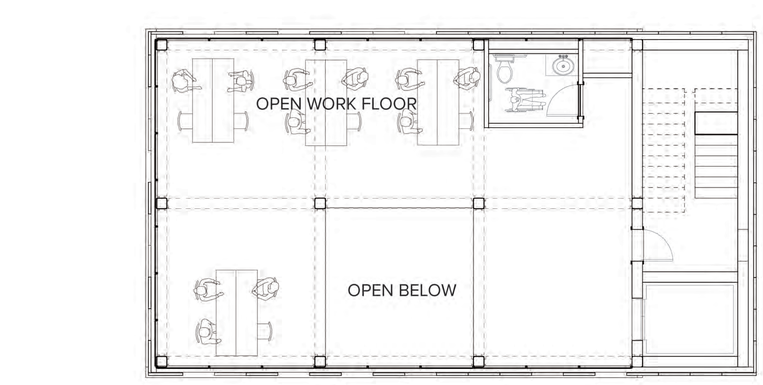
DfA/DR Design

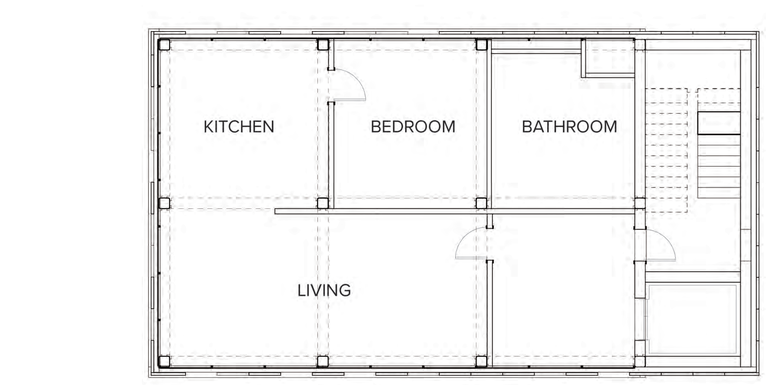
The office block was designed for adaptability and disassembly. The design started by creating a 4.5 meter structural grid that every structural and most other components would be able to adhere to. The strict grid allows for less variations in precast pieces to help with the production as well as simplify the inventory during disassembly. The design starts with a cast in situ basement, stair core, and base columns. From there precast columns, beams, floor framing, and stairs create the skeleton.

The structural grid allows for an easier expansion of the buildings footprint, additional floors, or optional openings within the floor plates. The entire building is wrapped in a curtain wall for thermal and weather protection with precast shading panels on the exterior. The interior is mostly exposed except for the floating floor panels to create a seamless transition on the ground. The basic materials and construction methods were chosen for the potential for the structure to be converted to a multi-tenant office or residential units.









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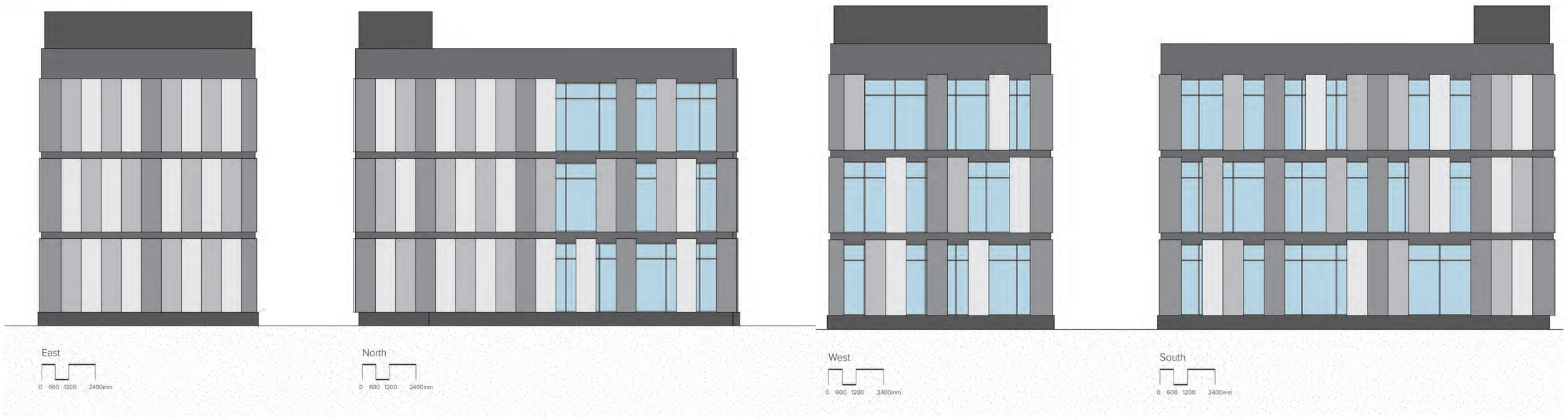
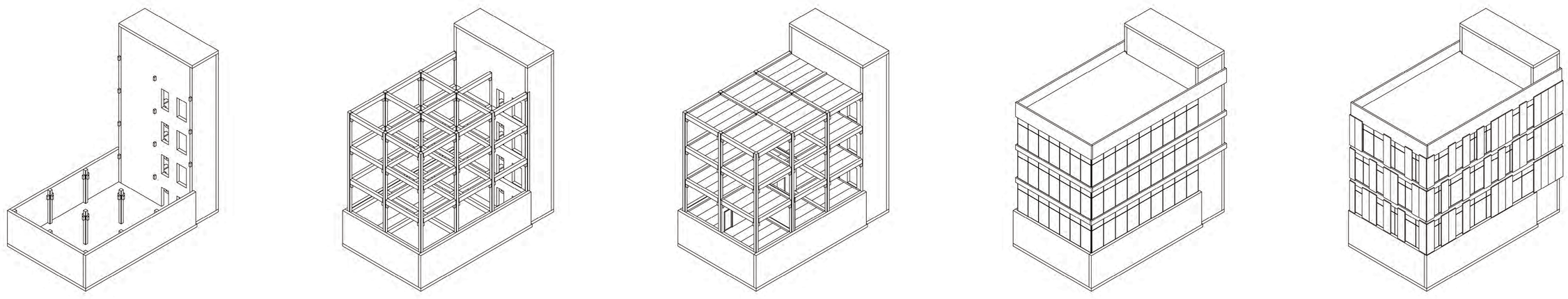




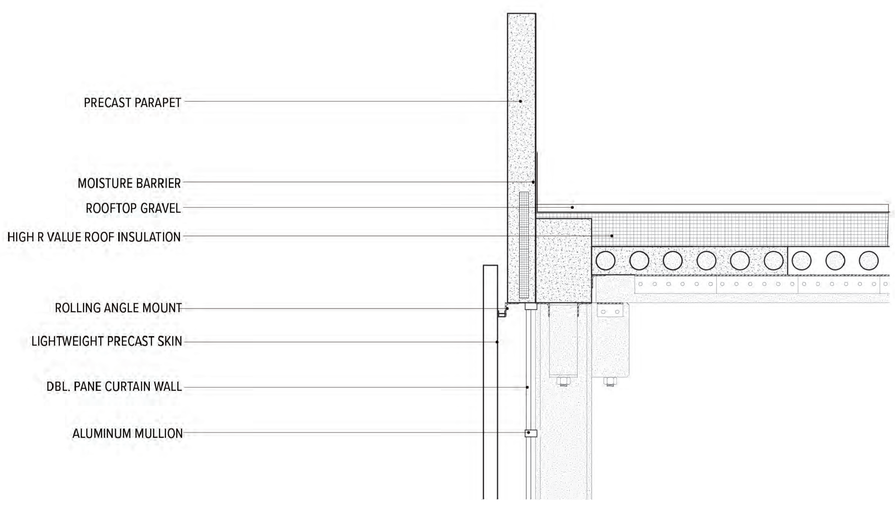
Stage 01 : Add Site Cast Components
Foundation, Basement Walls,
Column Piers, Egress Core, and
Corbels Cast into Egress Wall.

Stage 02 : Add Primary Structure Components
3 Story Precast Columns
Type 1: Corbels on 2 Sides (2)
Type 2: Corbels on 3 Sides (5)
Type 3: Corbels on 4 Sides (2)
Precast Beams (60)

Stage 03 : Add Structural Framing
PreCast Hollow Core Floor Panels (88)

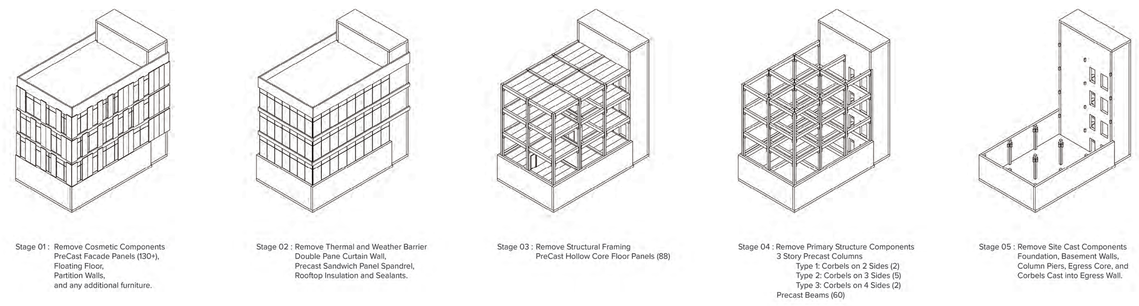
Stage 04 : Add Thermal and Weather Barrier
Double Pane Curtain Wall,
Precast Sandwich Panel Spandrel,
Rooftop Insulation and Sealants.

Stage 05 : Add Cosmetic Components
PreCast Facade Panels (130+),
Floating Floor,
Partition Walls.



Roof Detail

0 600 1200 2400mm



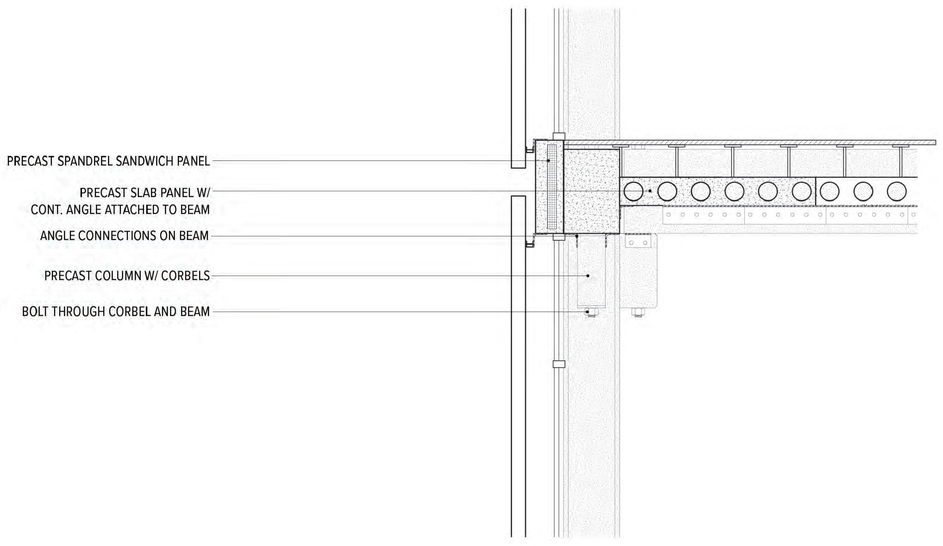
Stage 01 : Remove Cosmetic Components
PreCast Facade Panels (130+),
Floating Floor,
Partition Walls,
and any additional furniture.

Stage 02 : Remove Thermal and Weather Barrier
Double Pane Curtain Wall,
Precast Sandwich Panel Spandrel,
Rooftop Insulation and Sealants.

Stage 03 : Remove Structural Framing
PreCast Hollow Core Floor Panels (88)

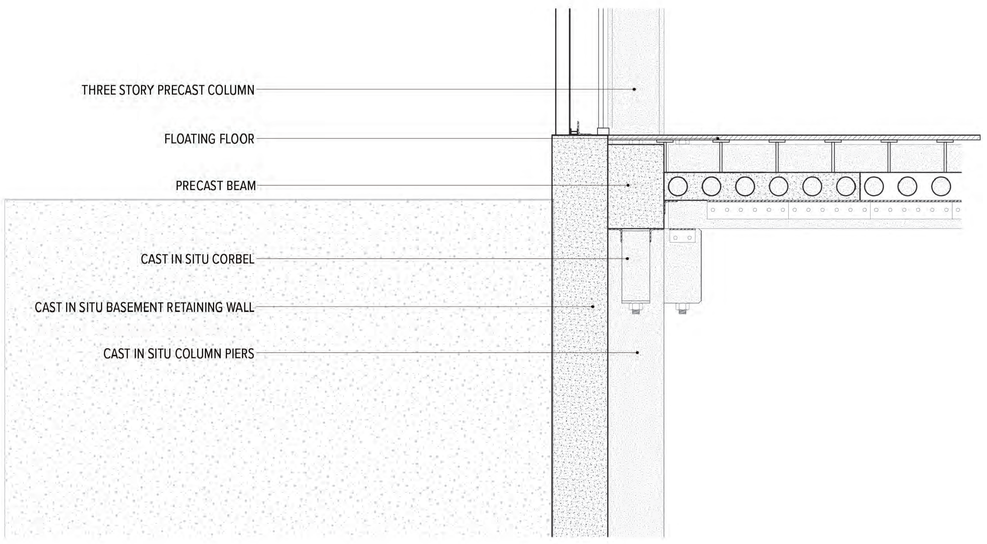
Stage 04 : Remove Primary Structure Components
3 Story Precast Columns
Type 1: Corbels on 2 Sides (2)
Type 2: Corbels on 3 Sides (5)
Type 3: Corbels on 4 Sides (2)
Precast Beams (60)

Stage 05 : Remove Site Cast Components
Foundation, Basement Walls,
Column Piers, Egress Core, and
Corbels Cast into Egress Wall.



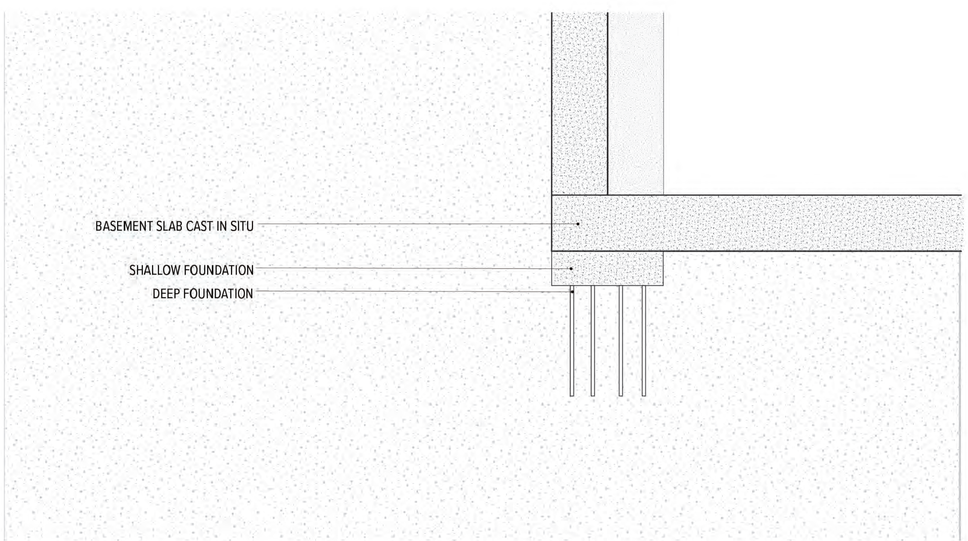
Upper Floor Detail

0 600 1200 2400mm



Ground Floor Detail

0 600 1200 2400mm



Foundation Detail

0 600 1200 2400mm

DfA/DR Disassembly Plan

The basic assembly and disassembly can be accomplished through the detailed wall section and axonometric diagrams for builders to understand the process of efficiently taking the building down. Being since most demolition experts already understand the basics, the diagrams are just used to provide a simple order of operations and inventory for the experts to have on hand when the time comes. Some highlights from the drawings are that there are 3 types of columns, with corbels on 2 sides, 3 sides or four sides. All the floor panels are identical in size and fit within the space between beams with the floating floor going over the beam for cover. In the section it is also shown how the floor panels are mounted through steel angles, how the façade panels are mounted on angles, and other connection details.

Conclusion

In the end the proposed design focused on perfecting how the structure could be reused or expanded on without sending the precast columns and beams into a landfill. From there, most of the challenges were associated with the thermal bridging and weather barrier so the design opted for a curtain wall for efficiency and potential for disassembly instead of other precast panels. The design is overall intended to extend the end of life of either the building as a whole or the pieces of the building.

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