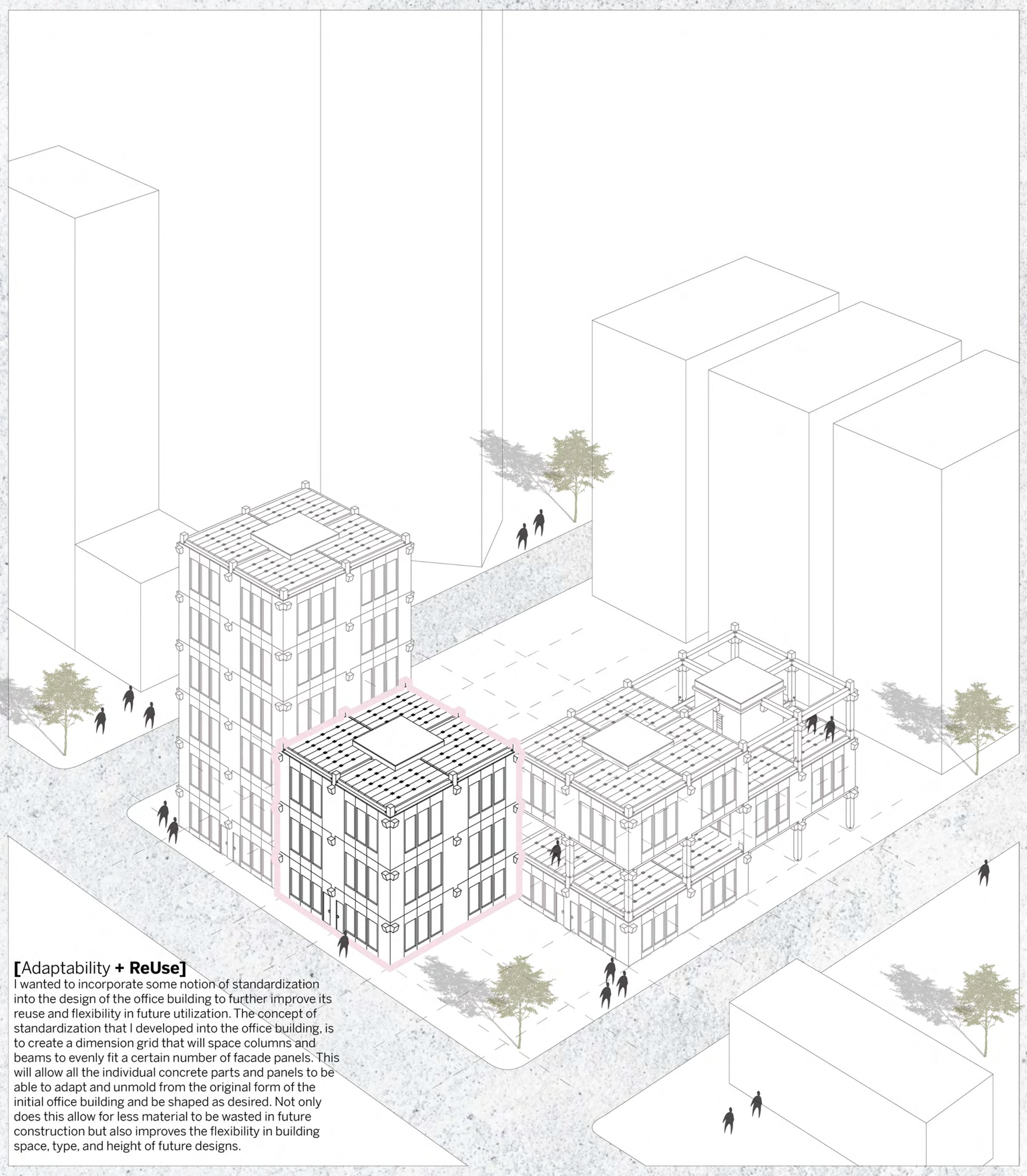
VERSATILE **[CONCRETE]**

REIMAGINE // CONCRETE DESIGN COMPETITION 2021/2022



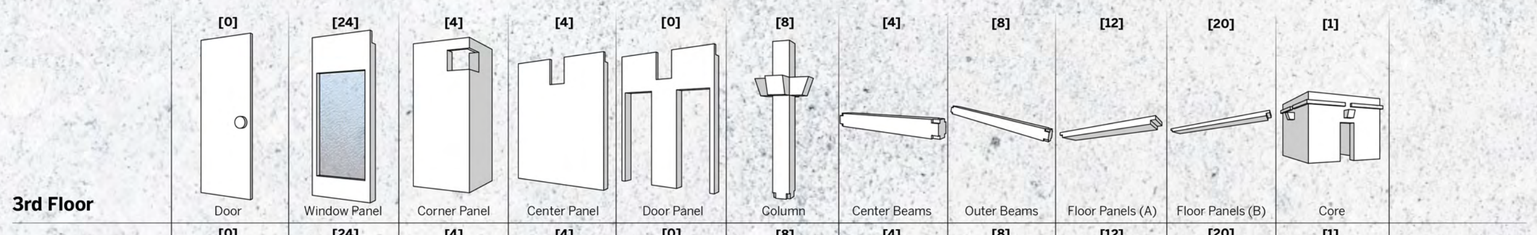
The objective of this design proposal is to reimagine a typical office building that is based on designing for adaptability, disassembly, and reuse. Unlike timber and steel frame construction which connections can easily be reversible and recyclable, concrete buildings are destined to be demolished and end up in landfills. However, by taking the opportunity to exploit the potential of concrete and its properties, allows for an office building to be reimagined into a concrete construction system that promotes its future disassembly and reuse. In order to meet these objectives, the office building in which I propose relies on precast concrete parts, critical connections, and a disassembly plan. The office building's structure consists of a concrete frame that surrounds a concrete core made entirely out of precast parts. Not only does the core promote cross bracing for the structure, but also acts as vertical circulation for the building in terms of fire stairs and an elevator. The façade of the office building is also a precast concrete insulation panel that loads directly onto the beams of the concrete frame. To allow these precast parts to potentially be disassembled relies on reversible metal connections that work in conjunction with each other. All the metal connections are exposed and aren't grouted over, instead the metal connections are galvanized to prevent rust, and are positioned at a level in which the dropped ceiling and raised floor would cover them from the space used by the occupants. This allows for the precast concrete parts to easily be disassembled and allows the concrete absorb much more carbon dioxide from the atmosphere than it would if it was grouted over.

[Adaptability **+ ReUse]**

I wanted to incorporate some notion of standardization into the design of the office building to further improve its reuse and flexibility in future utilization. The concept of standardization that I developed into the office building, is to create a dimension grid that will space columns and beams to evenly fit a certain number of facade panels. This will allow all the individual concrete parts and panels to be able to adapt and unmold from the original form of the initial office building and be shaped as desired. Not only does this allow for less material to be wasted in future construction but also improves the flexibility in building space, type, and height of future designs.

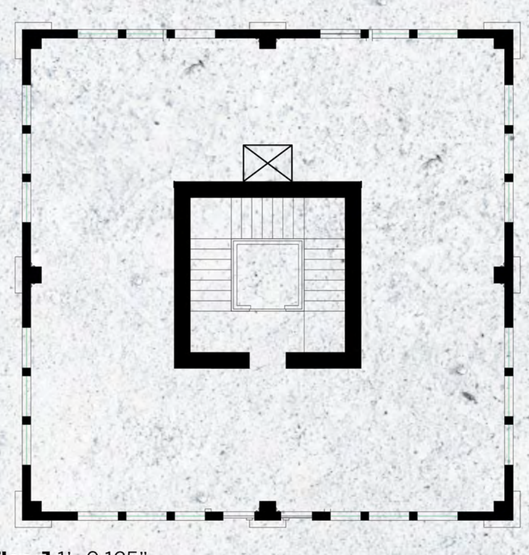
[Material **Bank]**

In order to further aid the objective of designing for disassembly and reuse in this office building I've created a spreadsheet of the precast concrete elements that are able to be reused or recycled in the future. This material bank allows for the concrete elements to be itemized and allows the type and quantity of the precast parts to be labeled. This will not only detail the quantity of concrete in the building, but also give insight of the different types of concrete elements that can be recovered and reused when the building gets disassembled.

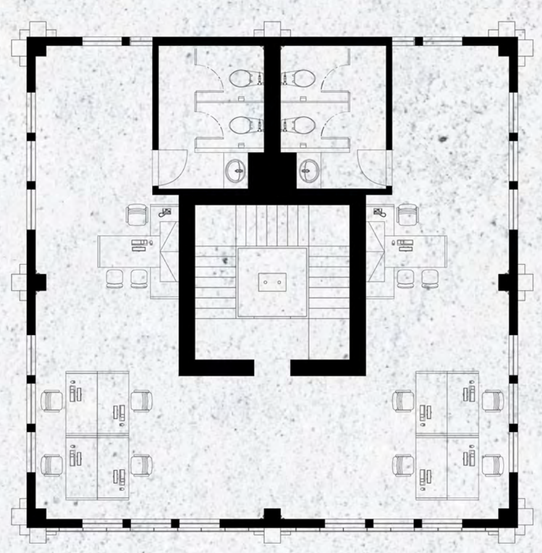


	Door	Window Panel	Corner Panel	Center Panel	Door Panel	Column	Center Beams	Outer Beams	Floor Panels (A)	Floor Panels (B)	Core
3rd Floor	[0]	[24]	[4]	[4]	[0]	[8]	[4]	[8]	[12]	[20]	[1]
2nd Floor	[0]	[24]	[4]	[4]	[0]	[8]	[4]	[8]	[12]	[20]	[1]
1st Floor	[2]	[24]	[4]	[3]	[1]	[8]	[4]	[8]	[12]	[20]	[1]
[Total]	**[2]**	**[72]**	**[12]**	**[11]**	**[1]**	**[24]**	**[12]**	**[24]**	**[36]**	**[60]**	**[3]**

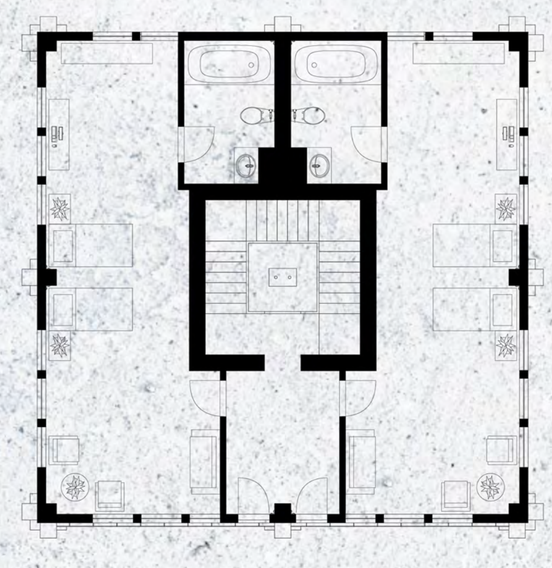
[Plans]



[Ground **Floor]** 1'=0.125"



[First **Floor]** 1'=0.125"
Office layout



[Second **Floor]** 1'=0.125"
2 Tenant Residential layout

[Disassembly **Plan**]

To be given to contractor to allow for effecient disassembly

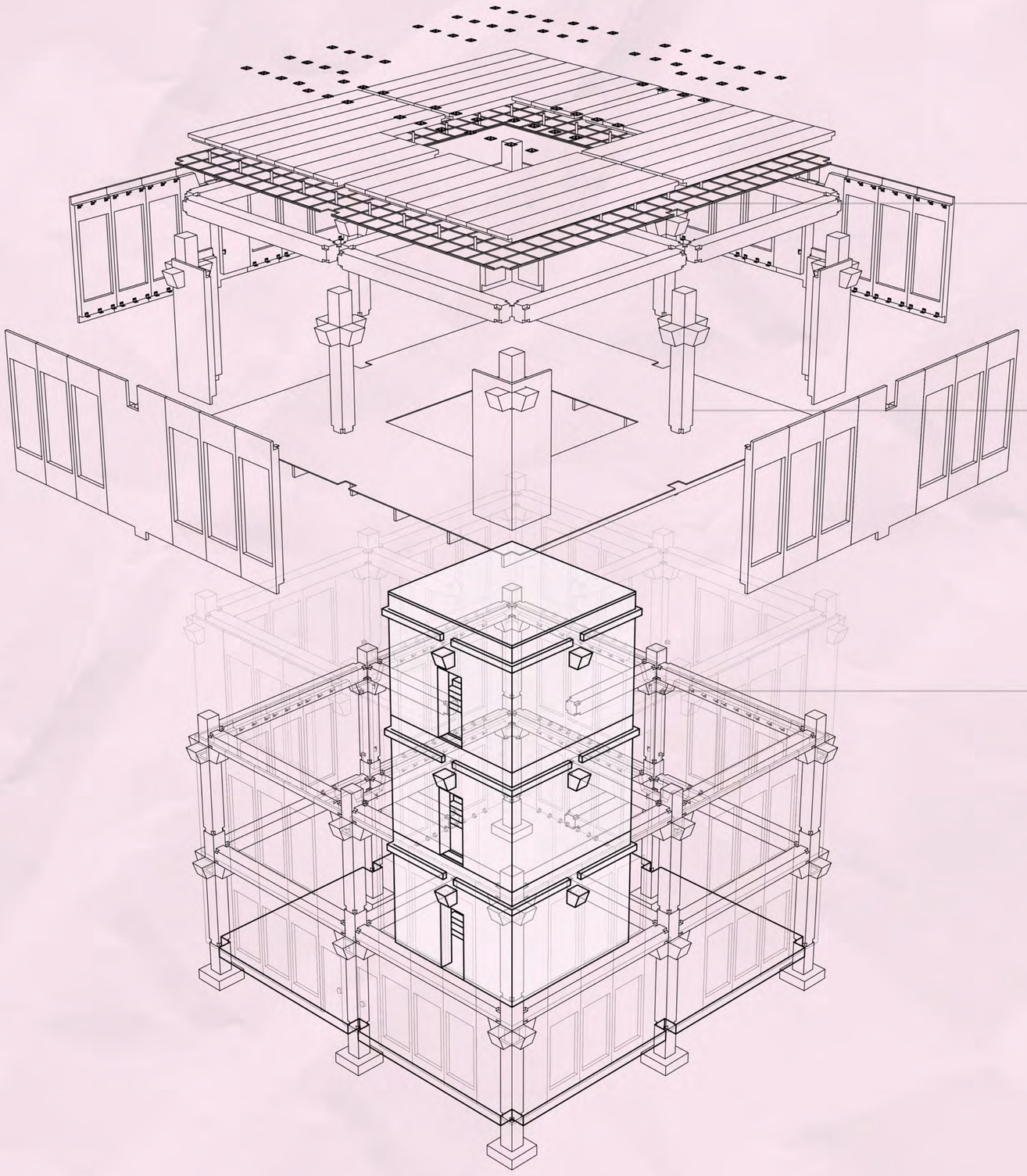
[1] The first step to disassemble the building is to strip the interior components that aren't structural to give access to the exposed metal connections. This includes removing all non-load bearing walls, raised floor, dropped ceiling, and any duct work. These stripped interior components can be separated into material categories such as wood, steel, and others to allow for a more efficient recycling process. At the end of this step all of the buildings metal connections should be exposed and will prepare the building to be strategically disassembled.

[2] The next step in the disassembly process is the removal of facade panels. The connections of the facade panels are designed in a way to allow for any panel to be removed without being dependent on other panels. This allows for the panels to be removed at any order the demolition contractor prefers and to start on any level. This way the building can be more flexible in terms of swapping out façade panels in the building's lifetime. After step one all the bolts that tie back the panels to the building should be exposed and allows for workers to detach the connection and remove the panels.

[3] Now that the facade panels are removed from the concrete frame the next component to be removed are the floor panels. Starting with the top floor the metal connections that tie the floor panels together should be exposed after removing the raised floor and allows workers to remove these connections. Now that the floor panels aren't connected together, they can be craned down and removed from the structure.

[4] After the floor panels are removed, the beams and columns that surround the concrete central core are next. Starting with the topmost floor the workers should unfasten the metal bolts that attach column to column, and column to beam. After the bolts are disconnected the columns and beams can be removed from the structure.

[5] The only component that should be left standing on the topmost floor should be the central core. This should be either removed whole, or by removing the three individual staircase components to light¬en the load of the concrete volume. The concrete volume is interlocked with the volume underneath it is using a tongue and groove connection which facilitates no metal disconnections. The individual staircases are attached via metal connections and can be accessed prior to removal of the concrete volume. Now steps three through five should be repeated until the whole structure is removed.



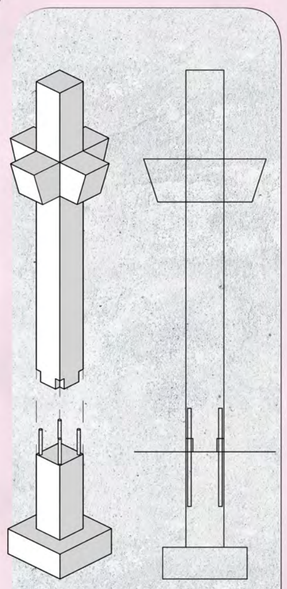
[Raised Floor/ Dropped Ceilling] The incorporation of a raised and dropped floor allows for the critical connections that attach the individual precast concrete parts to continue to be exposed for dissasembly, but still remain hidden from occupants using the space. This not only allows the concrete parts to remain bare and absorb as much carbon dioxide from the atmosphere as possible, but also allows duct work to travel through the space. By allowing the duct work to travel in between the raised floor and dropped ceiling allows for further flexibility in the program of the building.

[Frame Connections] The exterior frame that surrounds the core of the building is designed in a way to allow for disassembly, but also adaptability. The precast columns are designed to connect to other columns, foundation, and beams using column shoes and anchor bolts that are incorporated into the cast. This allows for a reversible connection between the parts. However, the columns are designed to be oversized to allow for a maximum of 6 other columns to be loaded above and allow beams to be connected on all 4 sides. This may seem like a waste in material to oversize the columns to hold the maximum possible load even when not needed, but this aids in its reuse and adaptability in the future. By allowing all the columns to support a standardized load allows for a more universal use and less specific parts to be made.

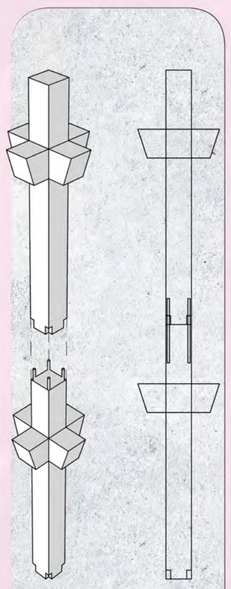
[Core] The core acts as the heart of the building where all the other precast parts begin to connect to. The central core not only acts as cross bracing for the frame structure, but also acts as vertical circulation. The core consists of a precast shell in which the fire stairs attach to. The shell and staircases are casted separately and can be connected on or off site, which allows for a more flexible transportation option. Each shell is one story tall and consists of three staircases that wrap around the interior to reach to upper floors. The cores attach to each other using an interlocking connection of a tongue and groove system.

[Connection **Details**]

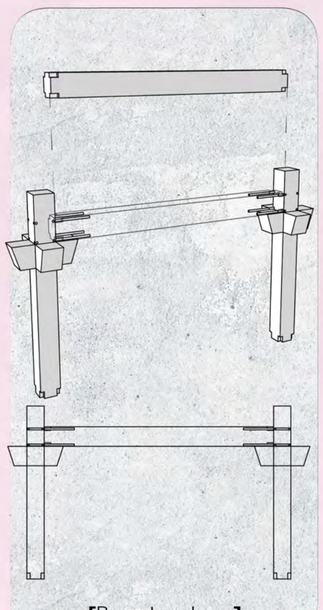
[Frame]



[Column to Foundation]

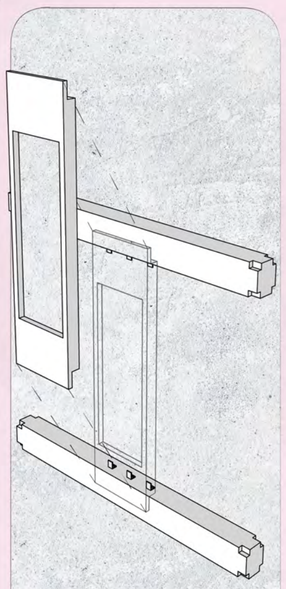


[Column to column]

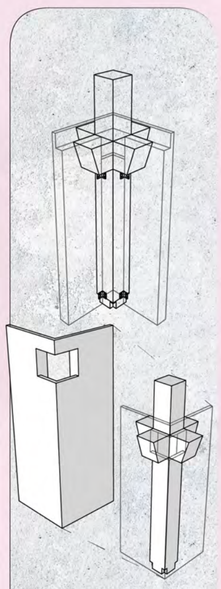


[Beam to column]

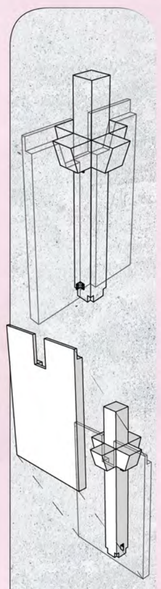
[Facade Panel]



[Glass Panel]

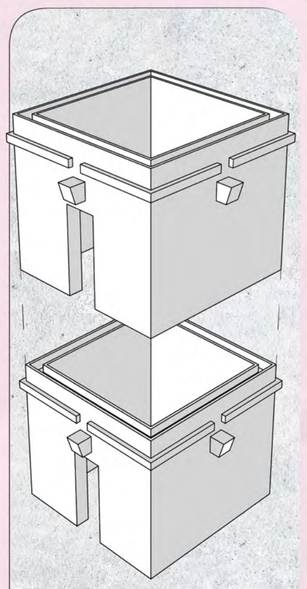


[CornerPanel]



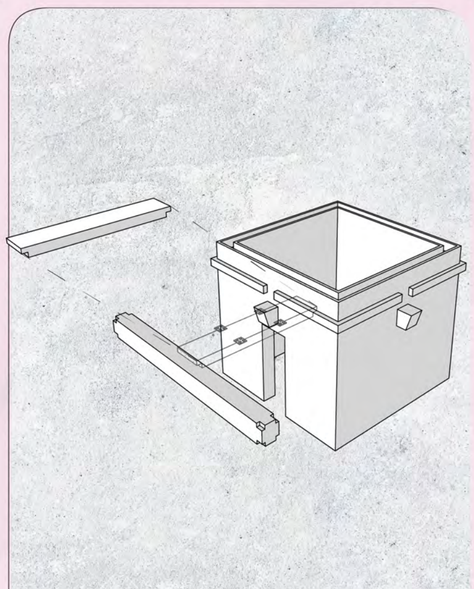
[CenterPanel]

[Core]



[Core on Core]

[Floor Slab]



[Floor Slab on Core]