Wholistic Nihilism:

An Architecture of Parts

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Death of the Detail

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"Nothing more or less than the construction of the surface without a seam, the wall without a joint, something a stone wall, even after it was covered with plaster, was unable to give......Does it not fulfill completely this noticeable desire to create jointless and seamless surfaces."

-H.P. Berlage 1906

Abstract

Architecture has reciprocated within the past century with H. P. Berlage declaring the death of the detail in 1906 and Greg Lynn taking the same position in 2006. This rebirth in modern architectural theory begs the re-examination of architecture as a relationship of parts and mereological assemblages. Through this contemporary discourse fixated on digital tools and emerging fabrication processes this research will challenge the ontology of the architectural detail and the joint.

Modernism fundamentally relies on extreme continuity, and through this, the joint has been removed from architecture to give a visual reading of the whole. The irony is that modernsim focuses on the reading of the whole so much that the joint and detail become entirely removed and the goal of the architecture is to actually suppress the elements that make the architecture. This wholistic approach is a top-down ontology where the whole constitutes it's parts. Architecture is itself a part-to-whole relationship and the Assemblages Theory and Mereology focus on these relationships of part-to-part, part-to-whole and whole-to-whole. These relationships between parts have been suppressed to allow Modernism and the digital tools to focus on form finding and a wholistic diagram of architecture. The digital tools within this research have not altered forms and geometries of architecture, rather the tools have altered the processes in which we work between digital space and fabrication.

The foundation of this research investigates the fundaments of architecture, examining assembly, joint, and detail. It is not an exercise in form finding and complex geometry but rather a study on relationships of the parts and processes of fabrication. A series of drawings was constructed that examined historical details relating to the column, the wall, and the corner to understand underlying relationships that compose these architectural elements. New fabrication techniques accompanied by digital modeling and drawing will reevaluate these conventional construction methods and relationships of parts to bridge the gap between digital representation and digital fabrication. Profile cutting wood, water-jetting concrete and steel, and 3-D printing prototypes are the main forms of fabricating these heterogeneous elements. These studies are small scale discrete assemblies composed of heterogeneous parts that pull away from the wholistic approach of modernism. The end result exposes these relationships and reorganizes them to develop new tectonic expression aimed at revealing architecture as a part-to-whole relationship. This is a Flat Ontology of architecture, where everything exists on the same datum and the whole does not constitute it's part but rather the parts assemble together to form a new whole.

The column, the wall and the corner define the fundaments of architecture that lead this re-examination into detail and joinery. These fundaments are composed of parts but have been stripped of joinery and detail under recent discourse. With the joint being the primordial element in which architecture exists there is a critical necessity that the joint and detail be re-evaluated under current digital discourse in relationship to emerging fabrication processes. Through this research, using a strong historical context, a new ontology of detail will emerge that focuses on joint and detail and ultimately a new tectonic defined by an architecture of parts.

"The joint is the primordial tectonic element as the fundamental nexus around which buildings comes into being."

-Gottfreid Semper

"The joint is the beginning of ornament."
-Louis Kahn

The Joint

The Modern Organism

To Berlage, concrete made a jointless modernism technically possible, and if joints were the beginning of ornament, then for Berlage, the end of ornament was a product of the end of the joint. The result of this jointless building was not of something monolithic but of something like an organism. Frank Lloyd reflected on this concept of continuity:

> *"Why not throw away entirely the implications of post and beam? Have no beams, no columns, no cornices, nor any fixtures nor any pilasters nor entablatures as such. Instead of two things one thing. Let walls, ceilings, floors become part of each other, flowing into one another, getting continuity out of it all or into it all."* [1]

Architecture was entering a new phase of the machine age where the building worked like an organic unit. Moving from an architecture that was described entirely through joinery, Berlage's Amsterdam Stock Exchange is one of his most animated , mechanistic, and least continuous joints in modernism [2]. Continuity is broken through the animated pin joint that separates the steel arch truss from the massive brick piers, although visually the catenary curve is completed. It is a moving joint in a static building, a mechanism within an organism. It was contradictory to the idea of an organism, a heavy brick mass being completed by a light steel frame.

Frank Lloyd Wright was also inconsistent with the ideal of the jointless organism. Continuity for Wright was about the part being a representation of the whole, and for this to happen, there had to be parts and this was most apparent in the Bogk House. The appearance of a frame building with infill panels but actually being a masonry and brick monolith. Representational as a tectonic building composed of frame and infill but actually stereotomic in nature, defining the modern organism.

Amsterdam Stock Exchange, H. P. Berlage, 1903

Bogk House, Frank Lloyd Wright, 1916

1 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 186
2 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 188

Arts and Crafts Joint

If the new architecture, in theory, was about the absence of joints, then by all appearances the old architecture was about their presence, even abundance or over exaggeration [3]. Greene & Greene completed the Gamble House which seemed to be an assembly of semi-autonomous parts, with each individual piece of wood maintaining an independent recognizable form. These pieces overlapped, extended and interlocked with other members to maintain each individual character and the joints were lapped and notched rather than mitered. This allowed for the discontinuity between elements. The concept for the Gamble house was of conscious assembly rather than of monotonous regularity. Arts and Crafts evolved into the articulation of the fasteners which resolved the discontinuous parts. The bindings, pegs, rabbets, and dowels described the joint and the type of internal forces acting at that connection. It would be overly simplistic to say that traditional architecture is about the presence of joints and that modernism is about their absence [4]. The arts and crafts joint was one of describing a reaction to the modern organism, almost a modernism of joints that characterized the thereness of architecture as a part-to-whole relationship.

Gamble House, Greene & Greene, 1909

Gamble House, Greene & Greene, 1909

3 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 189
4 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 188

International Style

The elimination and hiding of joint and detail defined the international style. Le Corbusier and the Villa Savoye lead this shift in modernism. The Villa Savoye was void of any real joinery, but rather defined by junctions, or the stopping of one form and the beginning of another. It appeared as a concrete monolith, a modern organism with a fixation on building as a mechanism. Although emerging in an age of machinery the architecture resembled nothing like a machine. The continuous slip-form technique was used as the concreted was poured and as it slowly moved upward it left a continuous surface, ultimately jointless. In theory, airplanes and ocean liners hid most of their frames under their skins, thus hiding the joints. Le Corbusier saw the machine not as a watch, but as an organism. He described the modern machine as:

> *"Organized like living beings, like powerful or delicate species of animal of astounding ability, that is never wrong since its workings are absolute.... The miracle of the machine thus lies in having created harmonious organs.... Broadly, one can say that every machine that runs is a present truth. It is a viable entity, a clear organism."* [5]

As Corbusian architecture shifted to one of steel the character of the buildings remained. Articulated steel elements began to appear in his work and the critical joints, column-to-beam and column-to-slab were all hidden above the ceiling and soffit. Much of Corbusian work that defined this mode of joinery or anti-joinery became simply lighter and thinner, showing a reluctance to reveal animated or articulated joints. At this moment architecture became ironic in nature, the goal of this architecture was to hide the very things that make it architectural.

Villa Savoye, Le Corbusier, 1929

Weissenhofseidlung Exhibition, Le Corbusier, 1927

5 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 194

Constructivist Joint

The idea of a building as an organism, and usually without joints, contradicted the realities of the machine age. The Constructivist joint was about the assemblage of recognizable parts in equilibrium, but most importantly these parts were to have no technological manifestation; for example the fasteners. Russian, Kazimir Malevich, described this as a weightless, jointless assembly:

> *"The form clearly indicates a state of dynamism and, as it were, is a distant pointer to the aeroplane's path in space~not by means of motors and not the conquering of space by disruption, caused by clumsy machine of totally catastrophic construction, but the harmonious introduction of form into natural action, by means of certain magnetic interrelations in one form. This form will perhaps consist of all the elements, emerging from interrelations between natural forces, and for this reason will not need motors, wings, wheels and petrol, i.e. its body will not be built from various organisms, creating one whole."* [6]

The Schroder House by Gerrit Reitveld becomes a perfect example of this weightless assembly. The architecture is of planes, steel sections, and wood sticks painted in color and are technically joined but not visually joined. There is no real structural frame, and the asymmetry of this indirect support limits this type of construction at a larger scale.

A similar joint of this modern movement is illustrated in the Farnsworth House by Mies van der Rohe. The vertical columns maintain a side-to-side connection rather than a post and lintel type of construction. The beams are substituted with C-Channels to give a flat surface in which the columns are connected, allowing the plug welds to happen on the inside of the assembly. With the hidden welds and mechanical fasteners, the architecture appears to be weightless, it denies the force of gravity much like the Schroder House.

Schroder House, Gerrit Reitveld, 1925

Farnsworth House, Mies van der Rohe, 1951

6 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 198

The Diagram (Modern Organism....Again)

Modernisms reaction to the joint had become about reading form, about reading the diagram. Mies van der Rohe and the Barcelona Pavilion were exactly this, a diagram of shifting spaces defined by points, lines and planes. The joints were suppressed in ways to hide the assembly of the steel frame and even the intricacy of standard machined parts that made up the crucifix columns. The frame was hidden with thin layers of plaster, diverting a tectonic frame into a stereotomic mass, and the columns were wrapped in chrome coverings to dematerialize them and visually allow the shifting of space. Mechanical fasteners were exposed on the columns, something very unlike the modernists before him, but the material qualities of the chrome maintained the continuity of the organism, allowing for these joints, these seams, and these fasteners to fade away.

The idea of jointless architecture had reappeared from the first writings of Berlage, stating the death of the detail in 1906. Now with the modern movement focusing around digital architecture and digital information, Greg Lynn proclaimed nearly a hundred years later "the death of the joint and with it the detail". This statement referenced the continuity of surface in digital space, i.e. blobs, folds and ribbons, and the technological advances in fabrication and composite materials that allowed for these digital forms to be achieved and visually understood. U.N. Studio, the architects of the Mobius House, understood this modernist approach, and the house became a representation of its program; a house for two people. The intersecting curves are a reflection of the interlocking lives of its occupants [7]:

> *"The diagram of the double-locked torus conveys the organization of two intertwining paths, which trace how two people can live together, yet apart, meeting at certain points, which become shared spaces. The idea of two entities running their own trajectories but sharing certain moments, possibly also reversing roles at certain points, is extended to include the materialization of the building and its construction. The structure of movement is transposed to the organization of the two main materials used for the house, glass, and concrete, which move in front of each other and switch places, concrete construction becoming furniture and glass facades into inside partition walls"* [8]

Ultimately this seamless detailing is part of the a larger societal condition, and can be realized with the tools and technologies available in this modernist movement of digital information. Digital technology has laid the foundation for a new architecture, an architecture of form, an architecture of surface, an architecture of diagram.

7 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 223
8 Ford, Edward R. The Architectural Detail (New York: Princeton Architectural Press, 2011). 223

Schroder House, Gerrit Reitveld, 1925

Farnsworth House, Mies van der Rohe, 1951

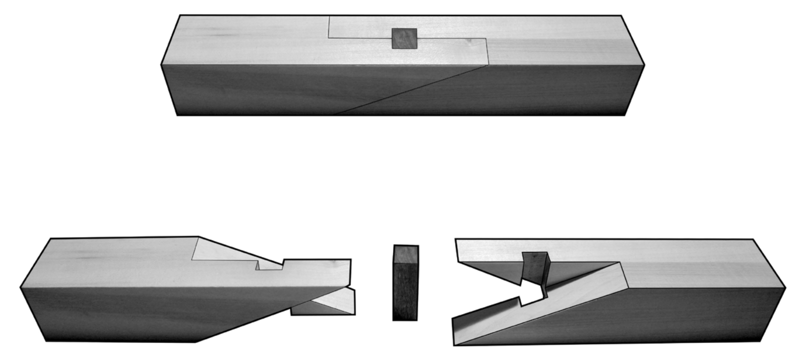
Japanese Joinery

Articulation of joint has been lost in the modern paradigm. Architectural detail and joint has fallen to continuity of surface and diagram. With Berlage and Greg Lynn stating the death of the joint and detail, the joint can now be re-examined in a context with digital tools and fabrication giving way to an architecture that embraces detail and joinery as an assemblage of parts.

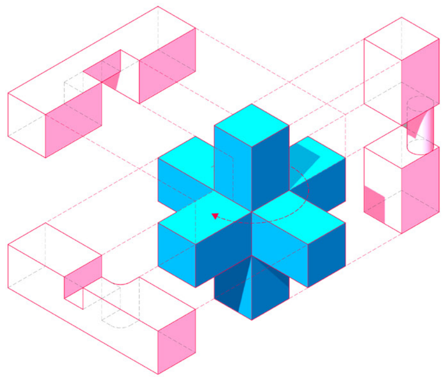
Japanese joinery relies on a complex level of craft and precision and the idea of architecture as an assemblage. This joinery is the embodiment of part-to-whole, with the joint relying on all of the parts and the skilled precision of those parts. This level of complexity has been absent or hidden from recent modern movements but with the precision of the computer and the file-to-fabrication related to digital technology architecture can take an ontological stance on detail and joints. Architecture as a mechanism begins with the joint and this type of joinery expresses not only an understanding of craftsmanship but it also describes the internal forces at these critical connections. The contradiction of Japanese wood joinery is the resistant to using mineral materials, such as mechanical fasteners, which makes this type of joining continuous with the fabrication methods of 3-d printing and composite materials that surround digital tools and architecture. Adopting this idea of hardware-less assembly runs concurrent with contemporary architecture and societal issues that surround material waste and commodity of material.

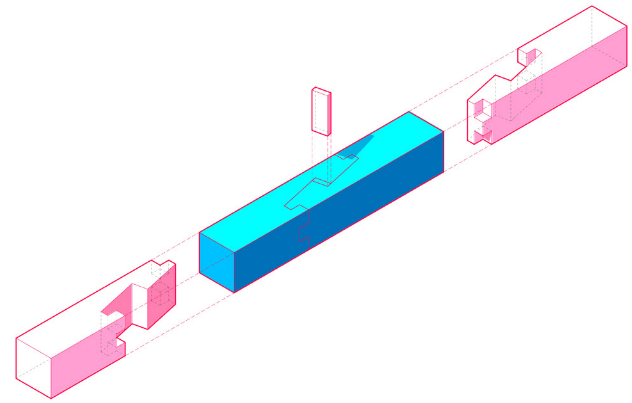
Studying these joints in this body of research has allowed for an investigation in architecture as a kit-of-parts. Drawings these joints in digital space leads to a fabrication of 3-D printed parts that can be assembled and disassembled to understand the mechanics of part-to-whole relationships, which gives a context for rapidly prototyping and testing of digital technology bridging the gap between digital representation and fabrication.

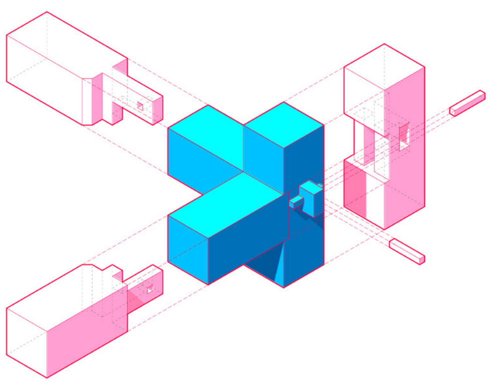
The hand fabrication of one of these joints lends itself to the human scale of these joints, celebrating the connection rather than erasing it. Making by hand also requires an understanding of material capabilities and limits, something that can becomes lost when the digital tools become involved. Current discourse involving digital tools is hyper-focused around grasshopper and other scripting techniques that completely remove the hand and post-rationalize about what materials should be used after a digital model is completed. It is crucial in this research that the hand remain present, even in digital space, designing with materials in mind and bridging the gap between the digital as purely a representational tool and the fabrication processes involved in making.

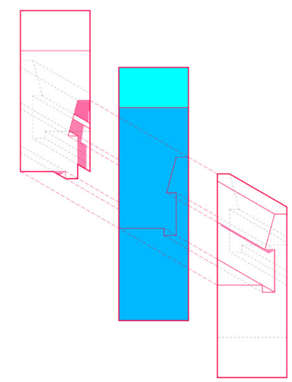


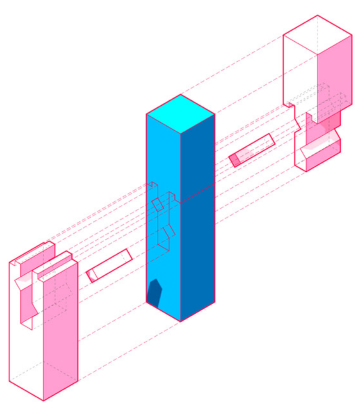
Japanese Friction Joint, Physical Model

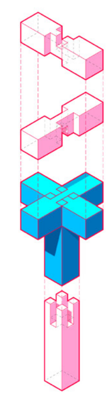


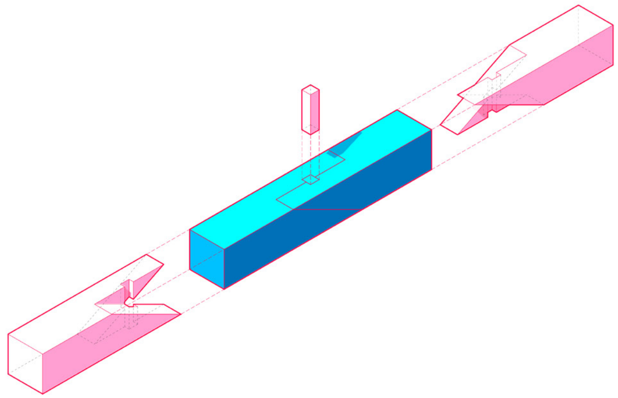


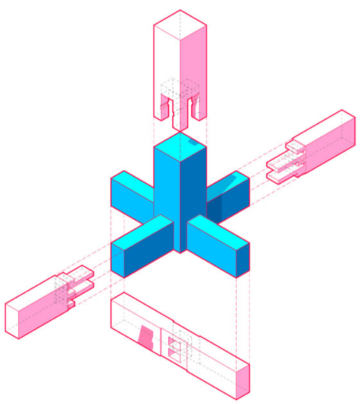


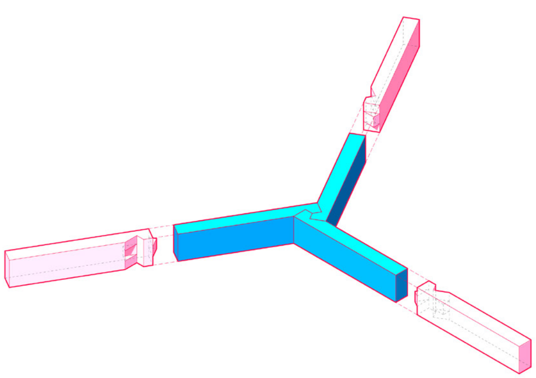












"Death of the detail and with it the joint"

-Greg Lynn 2006

"Less is More."
-Mies van der Rohe

The Fundaments

Exploring Mies

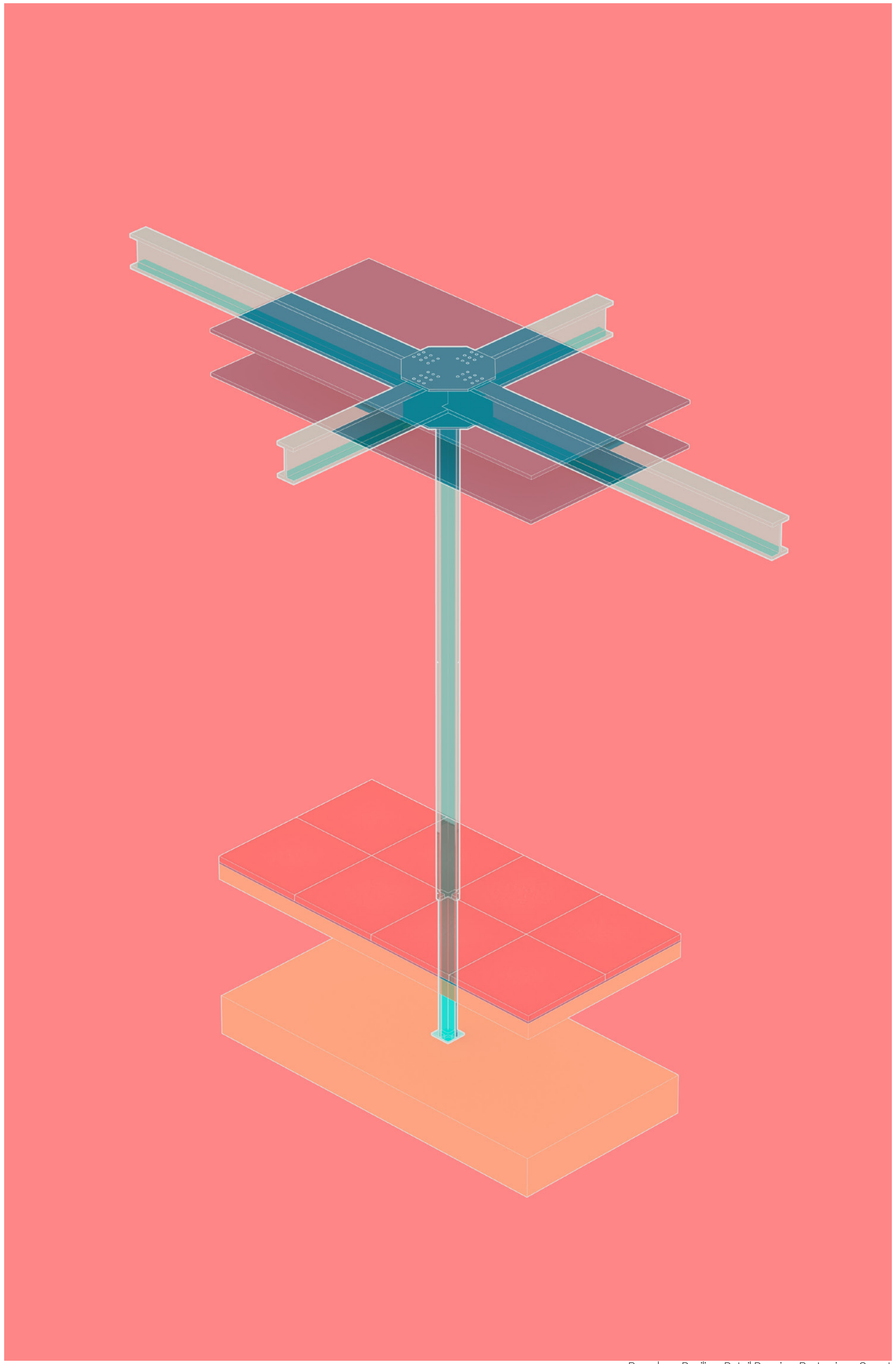
In the Barcelona Pavilion, the critical architectural element becomes the column. Without the dematerialization and thinness of the columns, the weightless diagram of floating planes and shifting of space is misunderstood. The modern exploration of digital tools allows for a re-examination of this idea of reading architecture as a continuity of surface and a continuity of form.

The pavilion was a critical moment in a series of studies looking at the idea of column and representation of diagram through a digital lens. With architecture concluding the death of the detail, again, itself in a way, has gone full circle and into a critical stage of re-examination. The columns of the pavilion, adopted a contemporary language of seamless assembly in these studies.

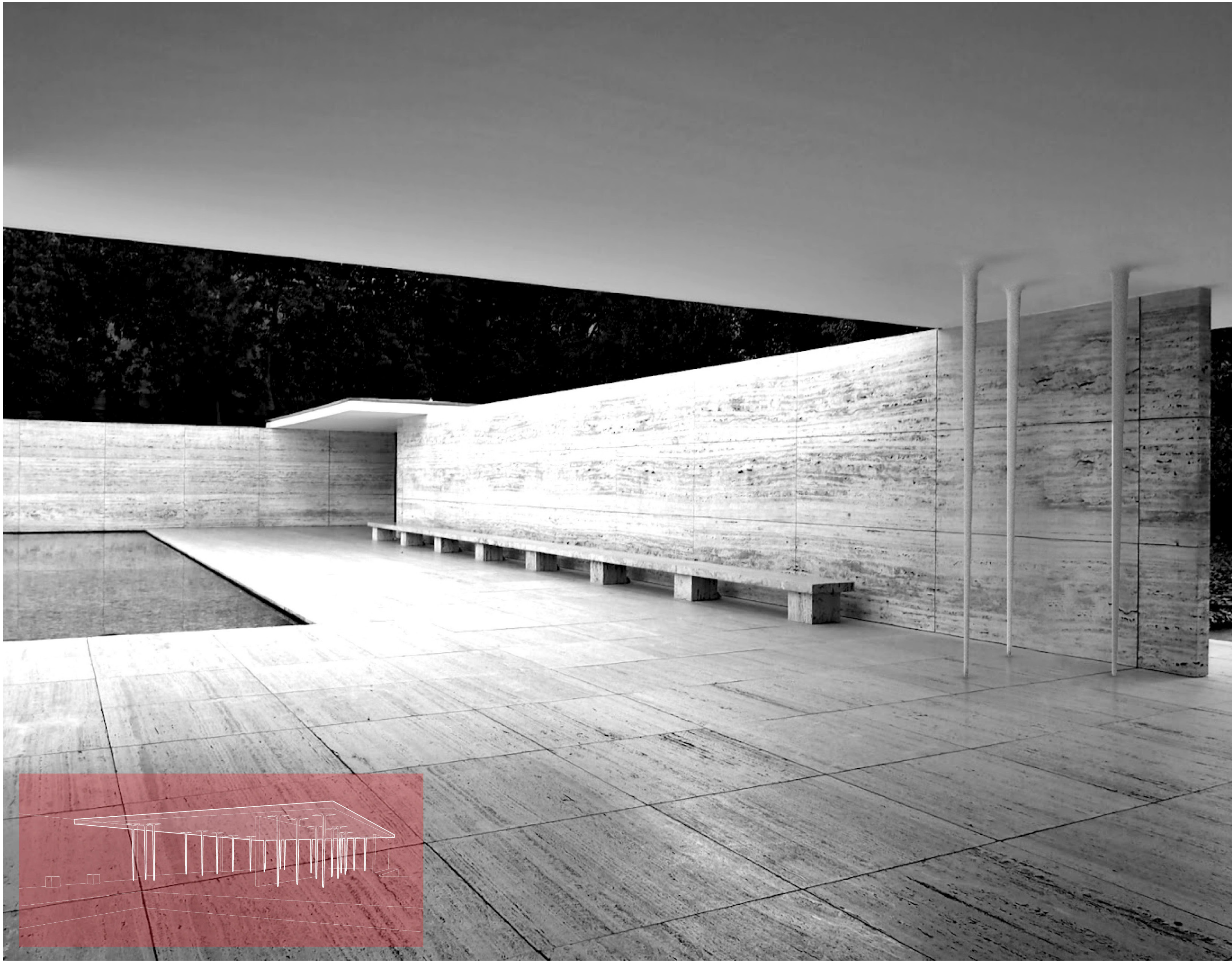
The first re-representation of the columns creates an object-like solid form that is autonomous with the ground. The splaying of the table-like legs follows more with the modernist ideal of organism. The pavilion shifts from a point, line, and plane diagram to a concept of continuity of form, where the columns and overhead plane seem to morph into one surface touches the ground at specific moments to define structure and space.

In the second study, the assembly of the column is the focus. The idea of architecture as an assemblage of parts reverts back to the argument made by Frank Lloyd Wright, stating that organic architecture is about continuity of the whole and for there to be a whole there had to be parts. The crucifix column method of assembly is one of aggregation of standard pieces or parts, complexity if achieved through symmetry and repetition. This set of columns looked at using standard steel sections in excess, to create a level of complexity through simple assembly methods of the original crucifix columns. Dematerialization is critical in this set, as the columns develop a stereotomic language the is contradictory to the simple idea of line the columns originally represented. The chrome material in this set enhances the complexity of form and detail, adding a level of aesthetic complexity that has been unseen in modern architecture.

The third re-examination of this diagram treats the column as a thin element but in order to work efficiently as a whole there had to be many parts. A forest of columns redefine the space of the pavilion, disrupting the continuity and creating conditions that allow space to be defined between the clustering of seamless columns. Joint is now understood in the pivoting of space around these columns rather than the physical construction of these forms.



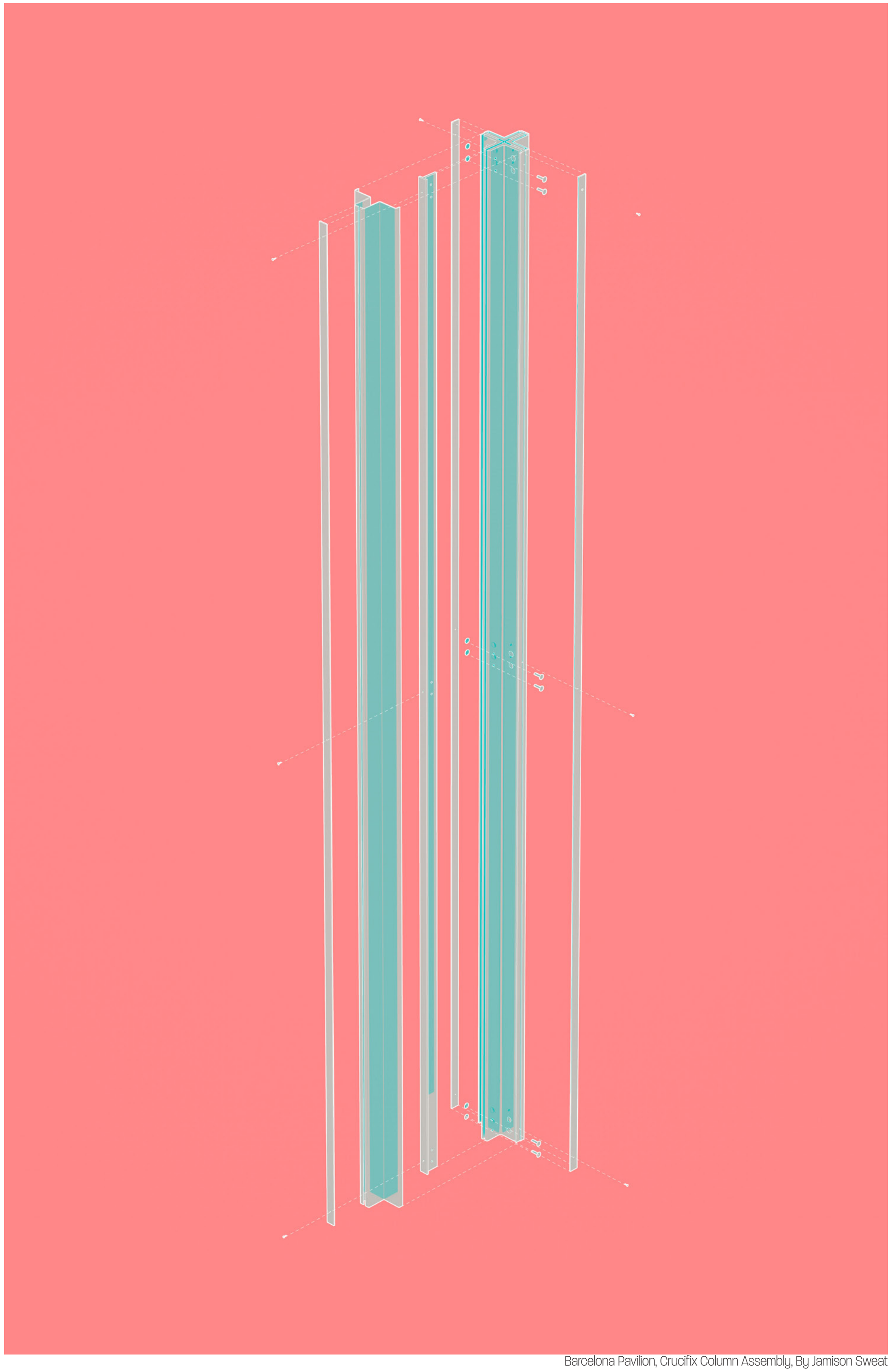
Barcelona Pavilion, Detail Drawing, By Jamison Sweat



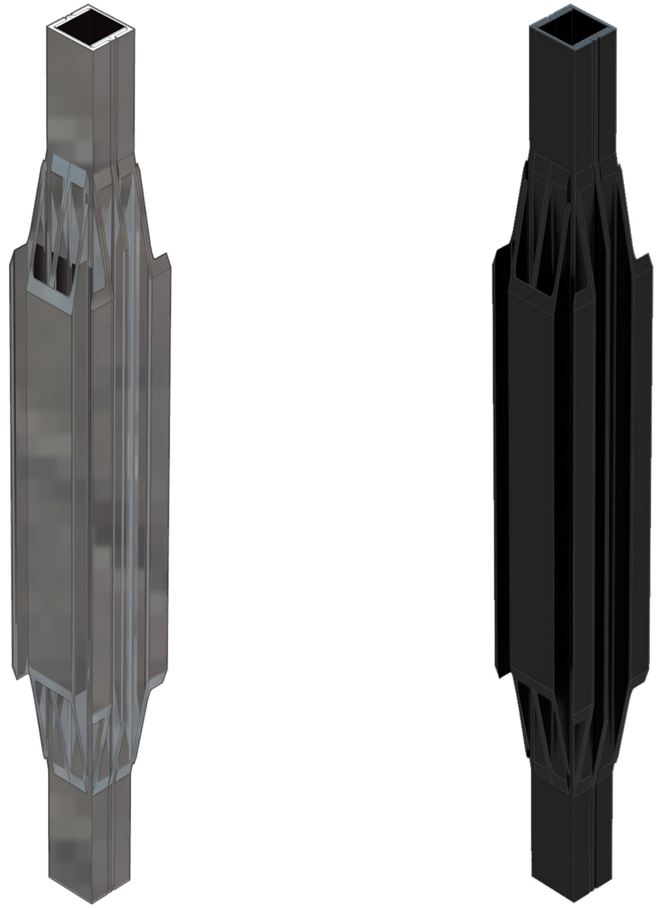
The investigation into the architectural joint and the architectural detail began with a fascination with the crucifix columns at the Barcelona Pavilion. The idea that the column, which is one of the fundamental elements of architecture, is actually composed of a parts begged the question as to why architecture is fixated on representing these fundaments as singular elements. The cruciform column is a simple aggregation of standard steel sections that through their assembly acquire characteristics of a larger discrete whole but by concealing the joints and suppressing the things that make architecture the tectonic reading of architecture shifts into a modernist ideal of continuity and visual reading of the whole.

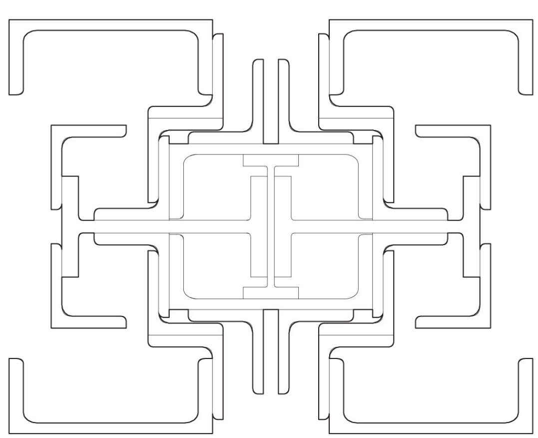
The crucifix column is the crucial element that allows the shifting of spaces at the Barcelona Pavilion and visually allow the occupant to read the entirety of the diagram. A series of studies was done focusing on replacing the columns of the pavilion to alter the visual reading of space and the diagram. These studies emphasized the importance of the column in the tectonic reading of architecture. So if the focus shifted to the assembly of the columns and the idea that architecture is composed of parts, at the most fundamental level, we can think about architecture in terms of joints, details and assemblies.

The assembly of the columns started an investigation that used the idea of standardized, readily available parts to create a more ornate architecture. The process of aggregating these simple parts together to make otherly wholes was an exploratory means of fabrication. The studies looked at using conventional steel sections aggregated together in a more intense manner relating to the simple assembly of the original crucifix column. The standard sections were cut at certain moments that revealed the sectional properties of the parts and generated unseen levels of detail and joinery at a multitude of scales. All the studies took sympathy towards the basic components of the column; the capital, the shaft, and the base. Each study evolved and challenged these conventional representations of the "ideal column" and the scale and proportions of the classical columns. With the underlying question being "how can we make a more ornate architecture through the use of standardized parts?".

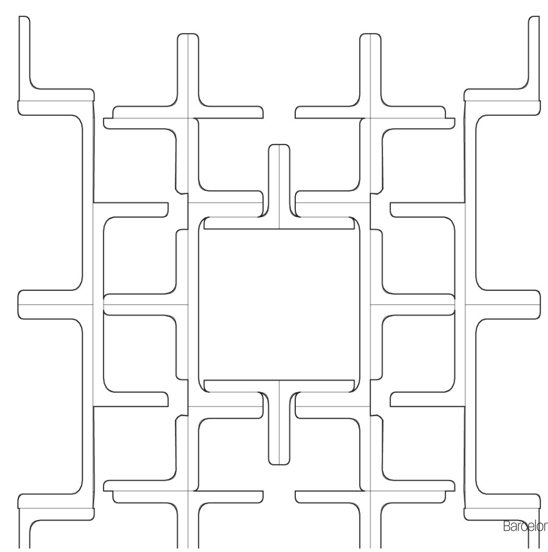


Barcelona Pavilion, Crucifix Column Assembly, By Jamison Sweat

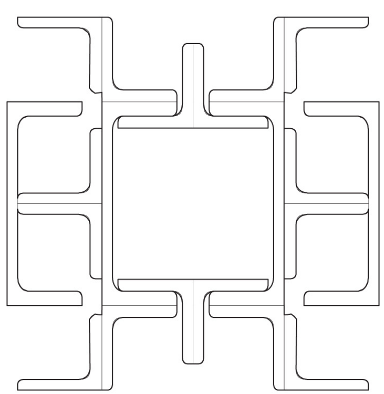




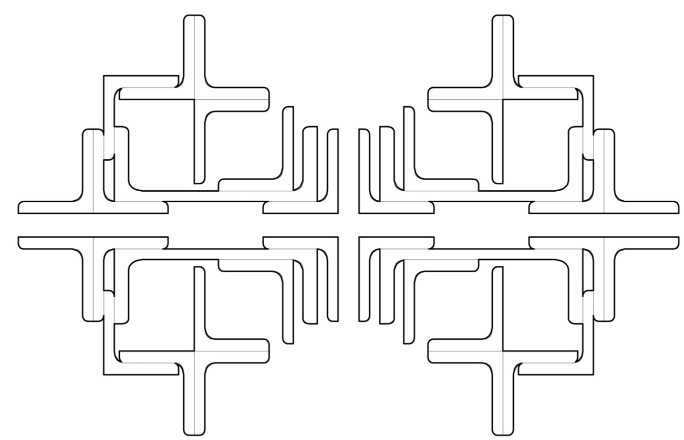
Barcelona Pavilion, Crucifix Column Aggregation



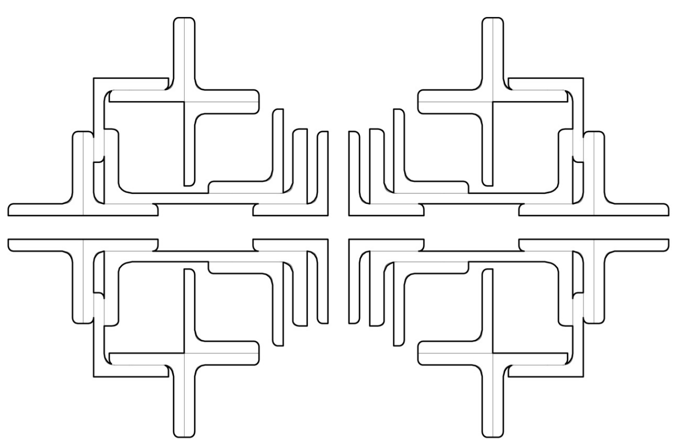
Barcelona Pavilion, Crucifix Column Aggregation



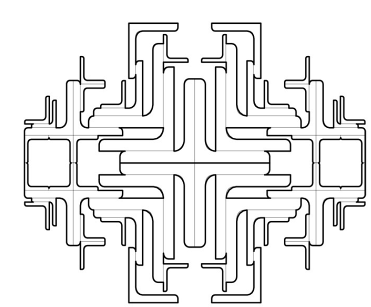
Barcelona Pavilion, Crucifix Column Aggregation



Barcelona Pavilion, Crucifix Column Aggregation



Barcelona Pavilion, Crucifix Column Aggregation



Barcelona Pavilion, Crucifix Column Aggregation

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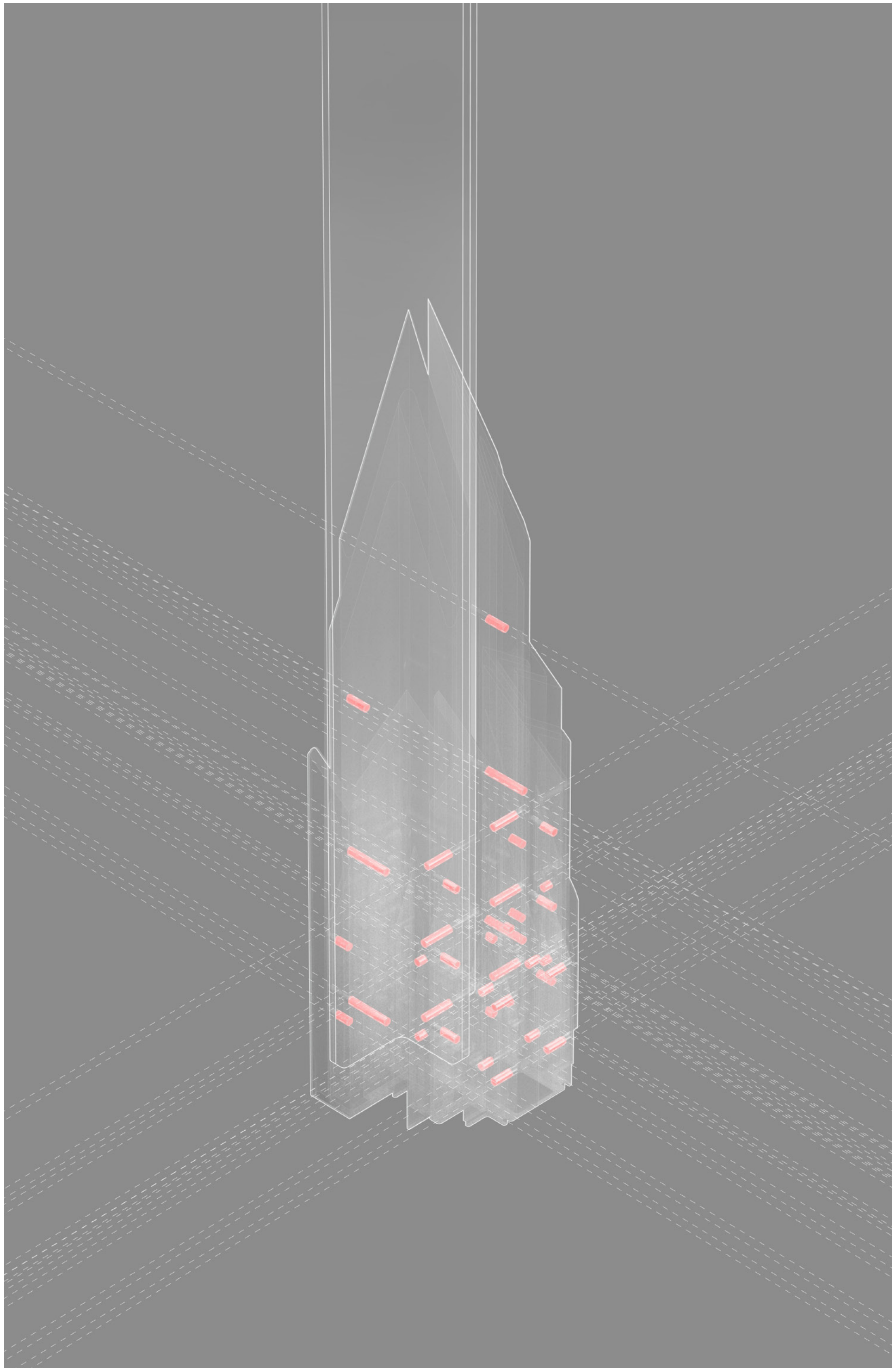
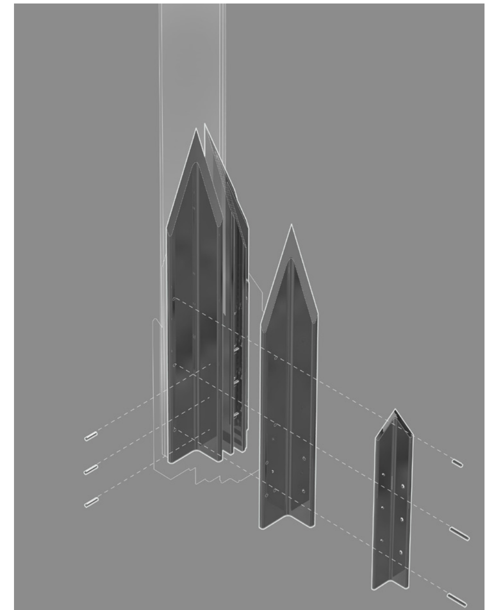
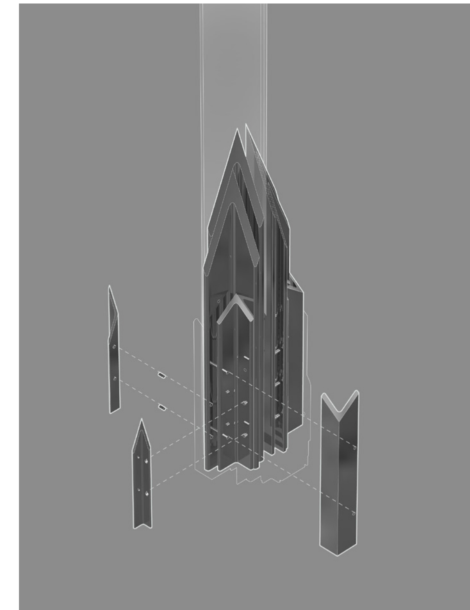
Barcelona Pavilion, Crucifix Column Aggregation



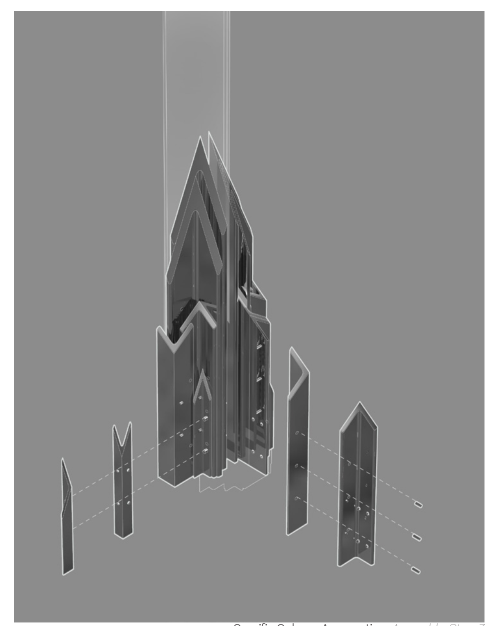
Crucifix Column Aggregation, *Pin System*



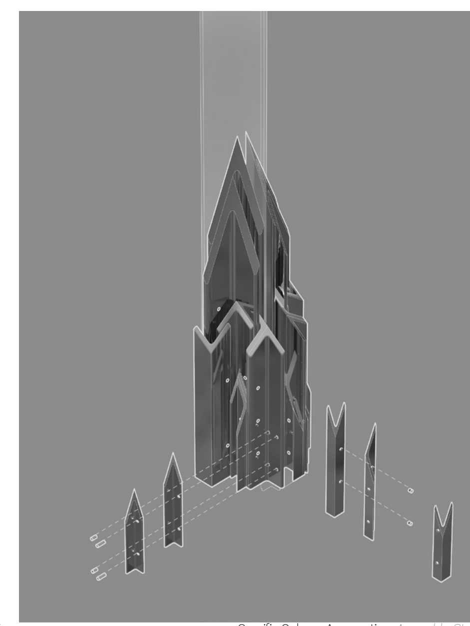
Crucifix Column Aggregation, *Assembly, Step-1*



Crucifix Column Aggregation, *Assembly, Step-2*



Crucifix Column Aggregation, *Assembly, Step-3*

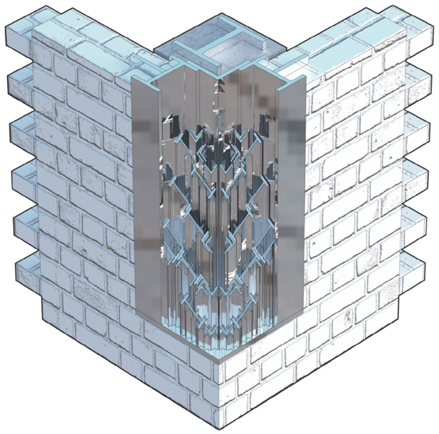


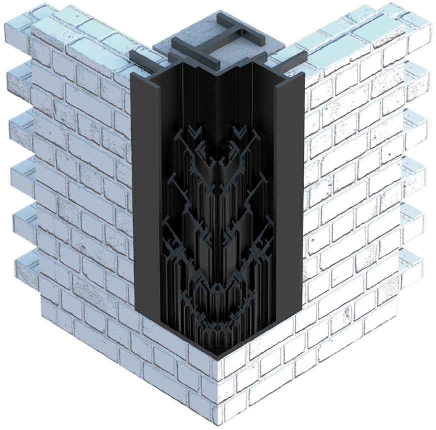
Crucifix Column Aggregation, *Assembly, Step-4*

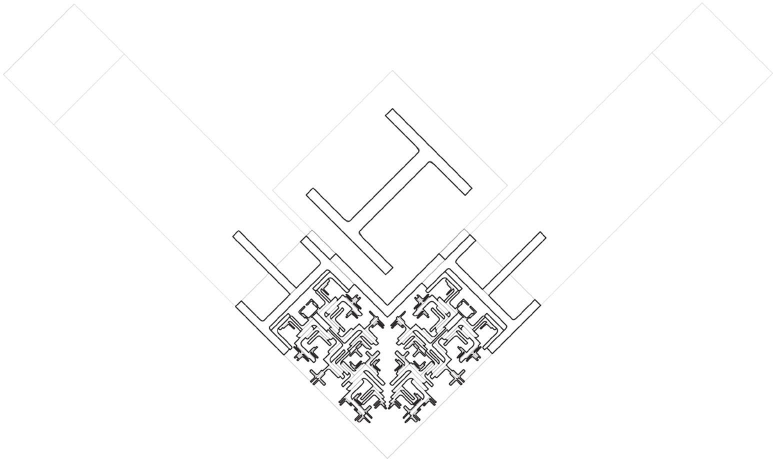
Modernism has not only focused on suppressing the architectural joint and the architectural detail but also has denied architecture of the corner. The corner is one of the fundamental elements that allows architecture to exist and modernism has strived to deny the "thereness" of the corner, from the Rogers Laboratories by Louis Kahn to the corner conditions of Segel Hall by Mies van der Rohe, architecture has tried to erase the things that define architecture. Even in a more contemporary context with the presence of digital tools consumed by surfaces, the corner seems to be more absent than ever, walls become floors and roofs become ground, the corner is now softened and has become a continuous surface to allow a visual reading of the form or the diagrammatic whole.

Architecture is composed of these fundamental elements and this research, rather than deny their existence, zooms in and examines the parts that make up these fundaments. These studies focused on the Segel Hall corner conditions by Mies van der Rohe and these conditions take away the corner of a building that is composed of masonry units, and the corner is a crucial element in masonry building and construction. By Mies removing the corner, he is basically saying the building is not masonry. The fascination with this corner in this research, focuses on the parts and assembly that make up the corner, rather than further denying its existence these studies look at using the standard part to celebrate the corner and almost bring about a truthfulness to the architecture by saying the corner is fundamental element and we will celebrate it.

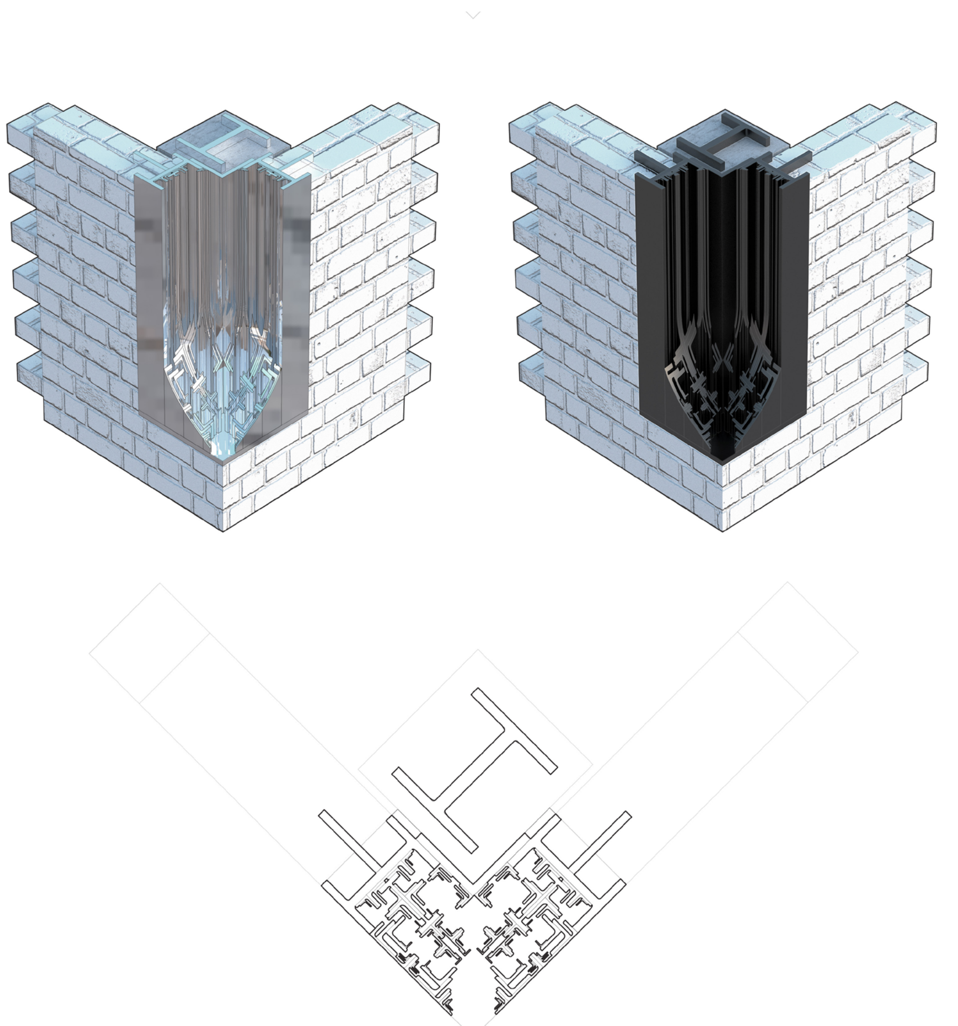
These studies use similar principles as the column studies, examining in close detail the intensity of these aggregated parts to define a new level of detail and ornamentation composed of standard steel sections. Each study uses an excess amount of steel sections to start to characterize a more articulate and ornate corner condition. Rather than deny or suppress the existence of the corner, the intense aggregation of these parts describe the *thereness* of architecture and these fundaments that architecture is built around.



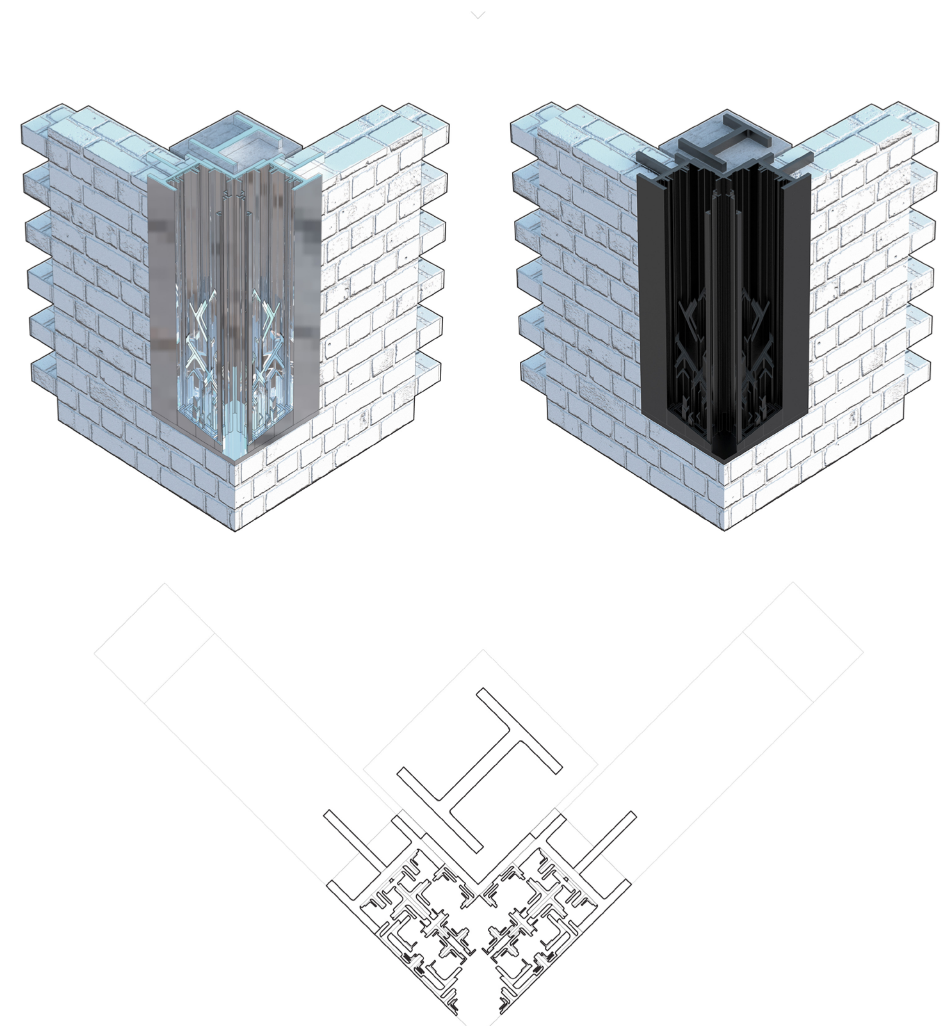




Segel Hall, Corner Aggregation



Segel Hall, Corner Aggregation



Segel Hall, Corner Aggregation

"of the way in which framework tends towards the aerial and the dematerialization of mass, whereas the mass form is telluric, embedding itself ever deeper into the earth"

-Kenneth Frampton

The previous studies evolved into a larger investigation of architectural joint, detail and assembly. The fundamental elements, the corner, the column and the wall, were investigated through a series of drawings that dissect these details to understand and bring forward that these elements are in fact composed of parts. This set of drawings defined a historical framework for the research and pushed for a re-examination at the scale of the architectural joint and the architectural detail.

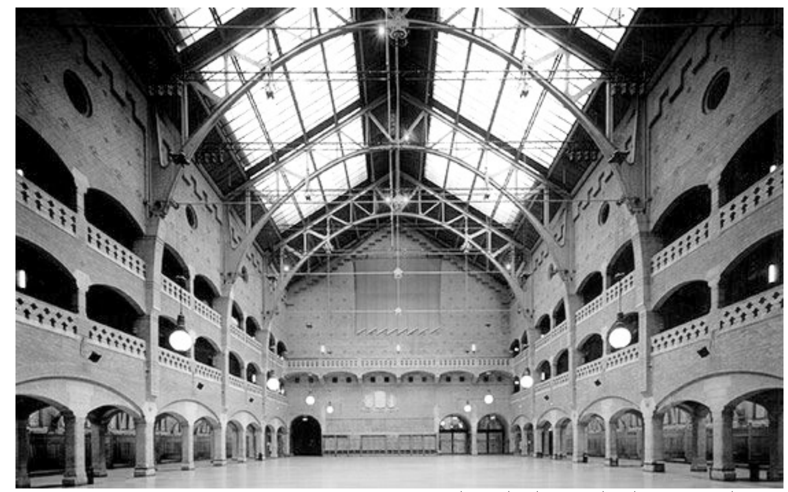
The drawings focused on the tectonic nature of architecture and were categorized into two sub-categories: *The Ontological* and *The Representational*. The ontological tectonic relates to how architecture comes into being, a visual reading of joint. While the other, described as representational, relates more to modernism and contemporary discourse and is defined as the representation of an element that is present but hidden.

Each drawing dissects the heterogeneous elements that are composed in each assembly. They investigate the need for parts in architecture, as architecture is a part-to-whole relationship and it is perhaps the oldest part-to-whole relationship and when you have parts you have joints. This set of drawings brings forward these relationships and allows for a basic understanding of construction, assembly and ultimately joinery.

Tectonic

It is natural that architecture returns to the origin of the structural unit as the irreducible essence of architectural form. This was divided by Semper into two separate material procedures: into the tectonics of frame in which members of varying lengths are conjoined to encompass a spatial field and the stereotomics of compressive mass that, while it may embody space, is constructed through the piling up of identical units[9]. Modernist movements have currently stripped architecture of detail and the joint, the primordial elements in which building exists. In the mean time digital architecture and fabrication is becoming increasingly more interested in the idea of tectonics. Not referring to the mechanical revelation of construction but the poetic manifestation of tectonic in the Greek sense of the word *poesis* as an act of making and revealing.

The dictionary definition of the term "tectonic" to mean "pertaining to building of construction in general; constructional, constructive used especially in reference to architecture and the kindred arts" [10]. The term, since the beginning of the nineteenth century, in an architectural context has indicated a structural and material probity but also a poetics of construction. Modern architecture has been about the suppression of detail, about representation, and the removal of tectonic expression, however architecture at its core is ontological rather than representational. Tectonic will always be a essential to building. It cannot be divorced from the term *technological*. It is possible from this to identify three distinct conditions: 1) The *technological object* that arises directly out of meeting an instrumental need, 2) The *scenographic object* that may be used equally to allude to an absent or hidden element, and 3) The *tectonic object* that appears in two modes, the ontological and the representational. The ontological refers to the constructional element that is shaped so as to emphasize its static role and cultural status. The second involves the representation of a constructional element, which is present, but hidden [11].

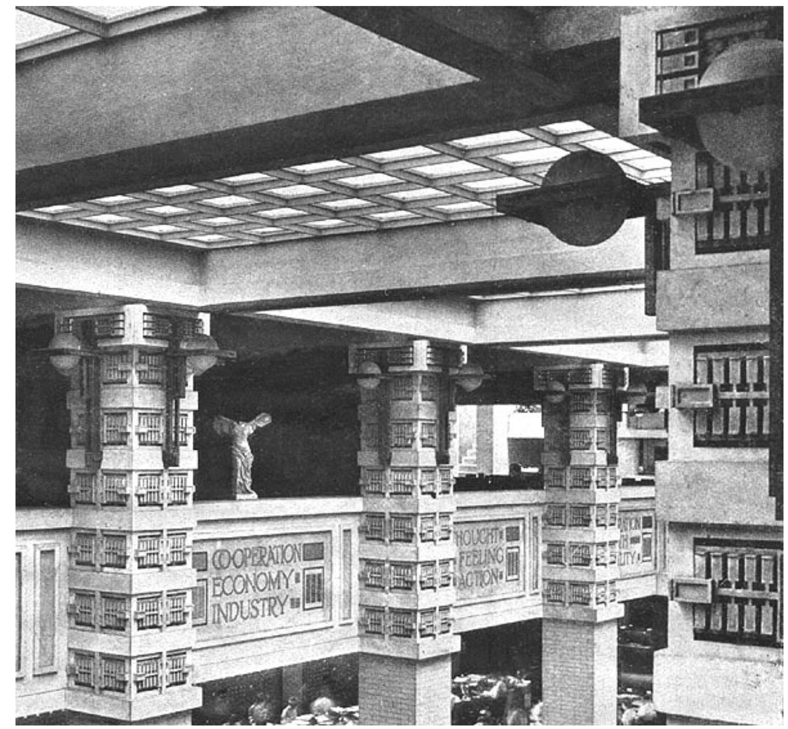


Amsterdam Stock Exchange, Ontological Tectonic, H. P. Berlage, 1903

9 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic" in Theorizing a new agenda for architecture: an anthology of architectural theory, 1965-1995, Kate Nesbitt, etd. (New York: Princeton Architectural Press. 1996). 521.
10 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 520.
11 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 521.

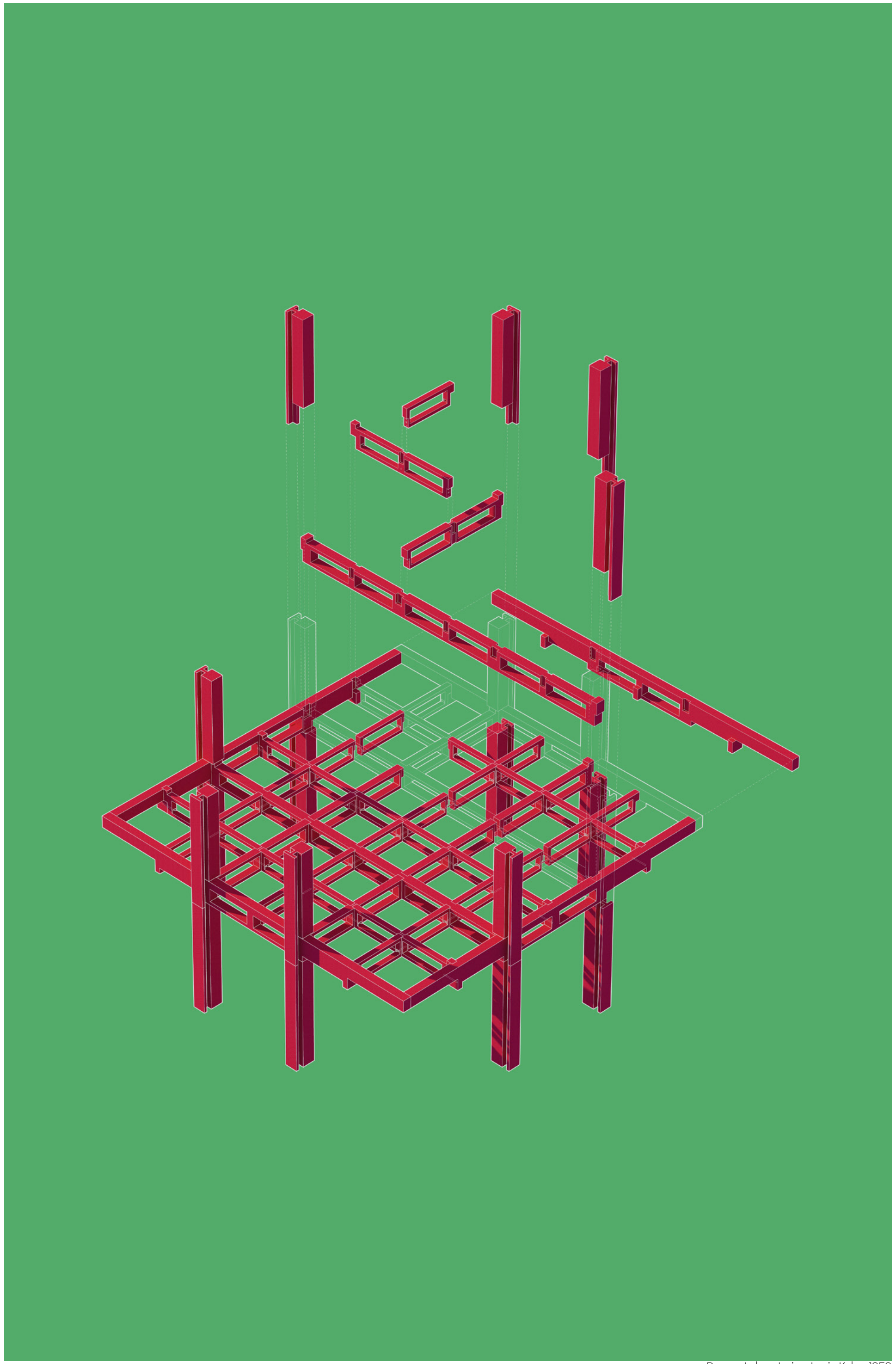
Ontological

The ontological tectonic is defined by the reading of architectural elements and their static role and cultural status, the visual reading of how architecture comes into being. The joint being that primordial element. There is spiritual value residing in the particularities of a given joint, in the "thingness" of a constructed object, so much so that the generic joint becomes a point of ontological condensation rather than a mere connection [12]. This is how architecture is read and understood, through the joint, and modernist organisms have stripped architecture of this point of condensation, focusing on the diagram and the reading of architectural continuity of form. The Larkin Building from Frank Lloyd Wright encompasses the idea of span and support that amounts to a tectonic syntax, visually defining how the gravitational forces are being passed from beam to column to ground. All of which are defined by a series of articulated joints. Maintaining a notion from Semper that the basic structural artifact was the knot, which supports his contention that the ultimate constituent of the art of building is the joint [13].



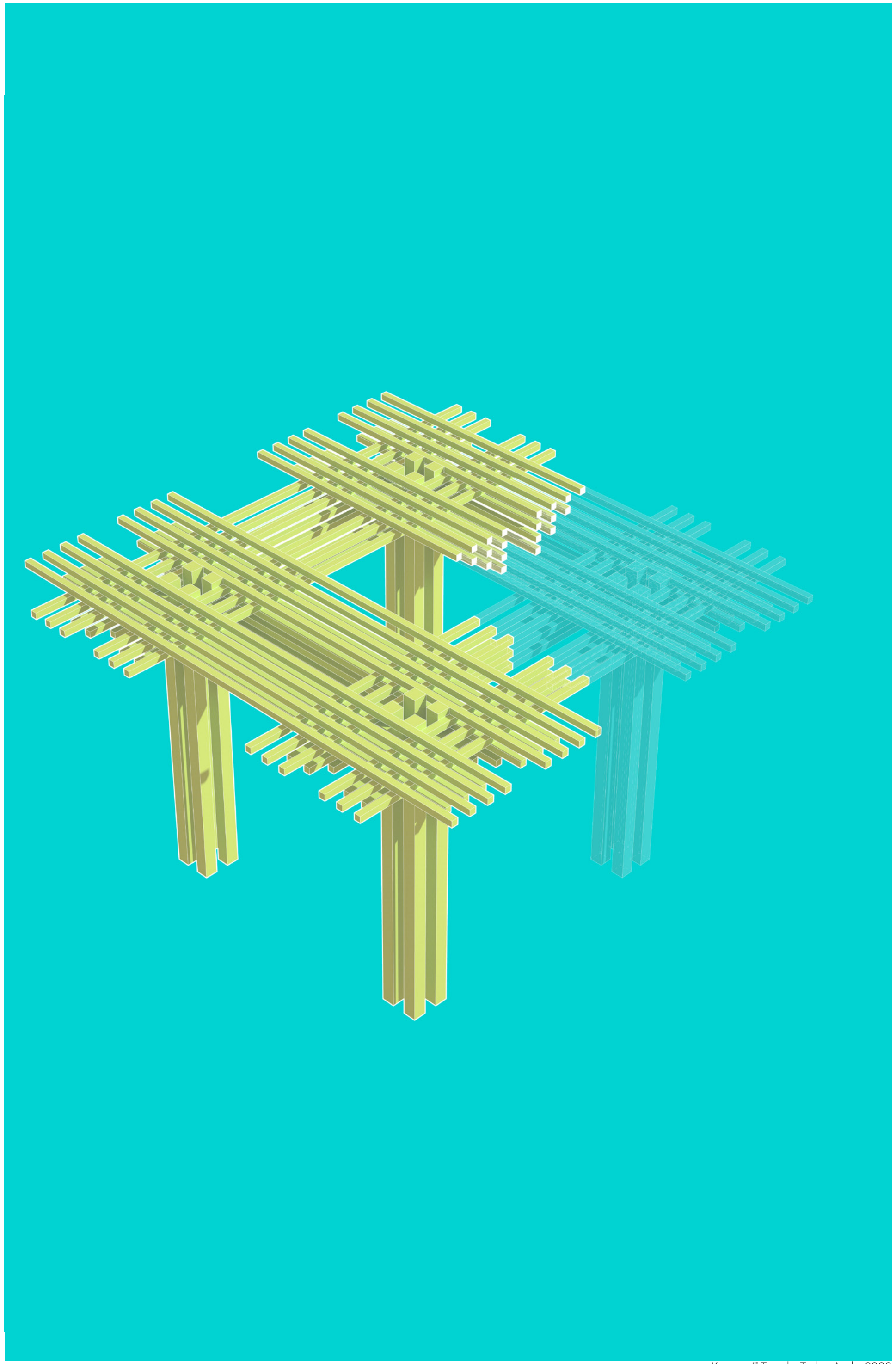
Larkin Building, Ontological Tectonic, Frank Lloyd Wright

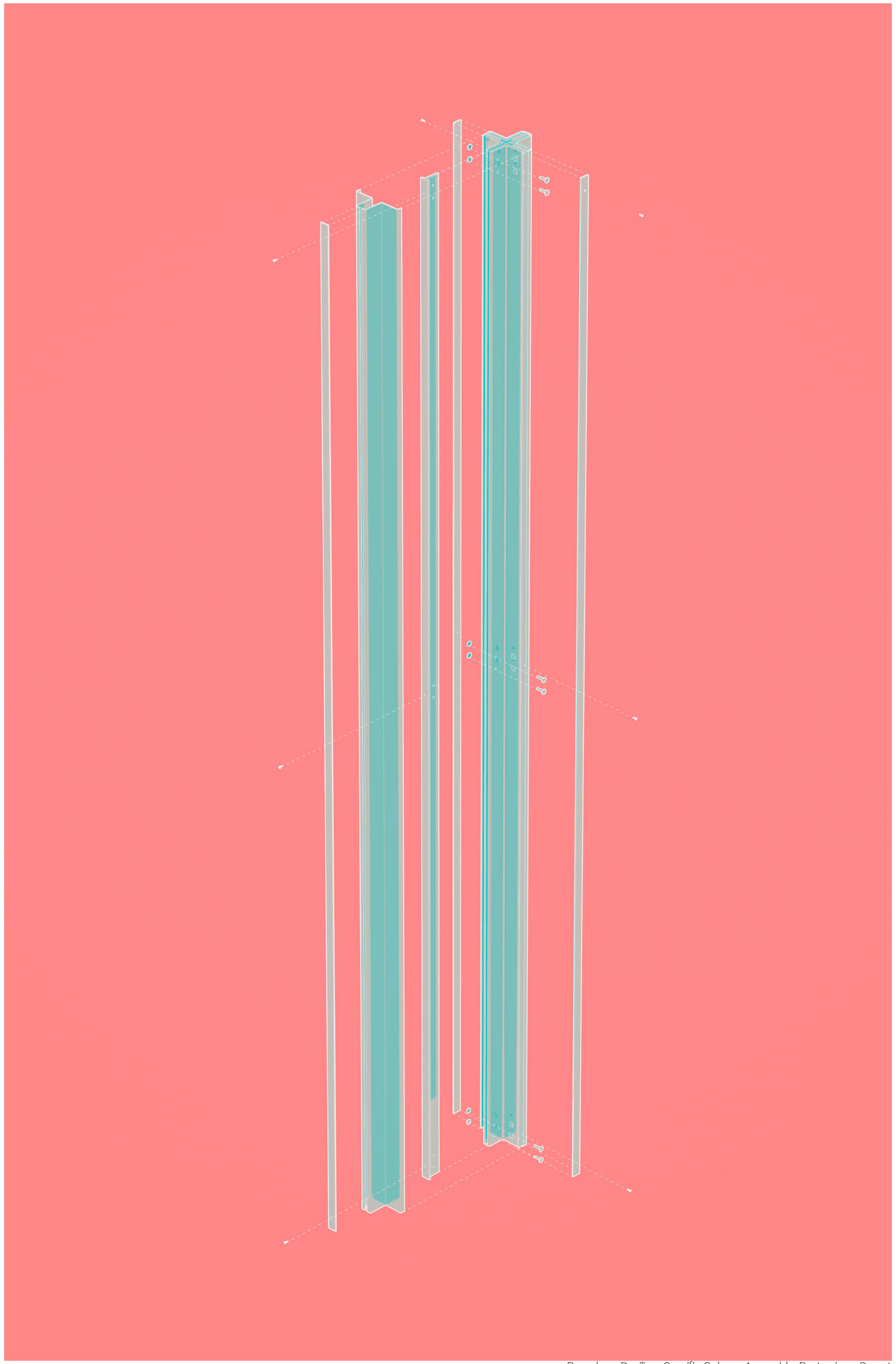
12 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 522.
13 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 524.

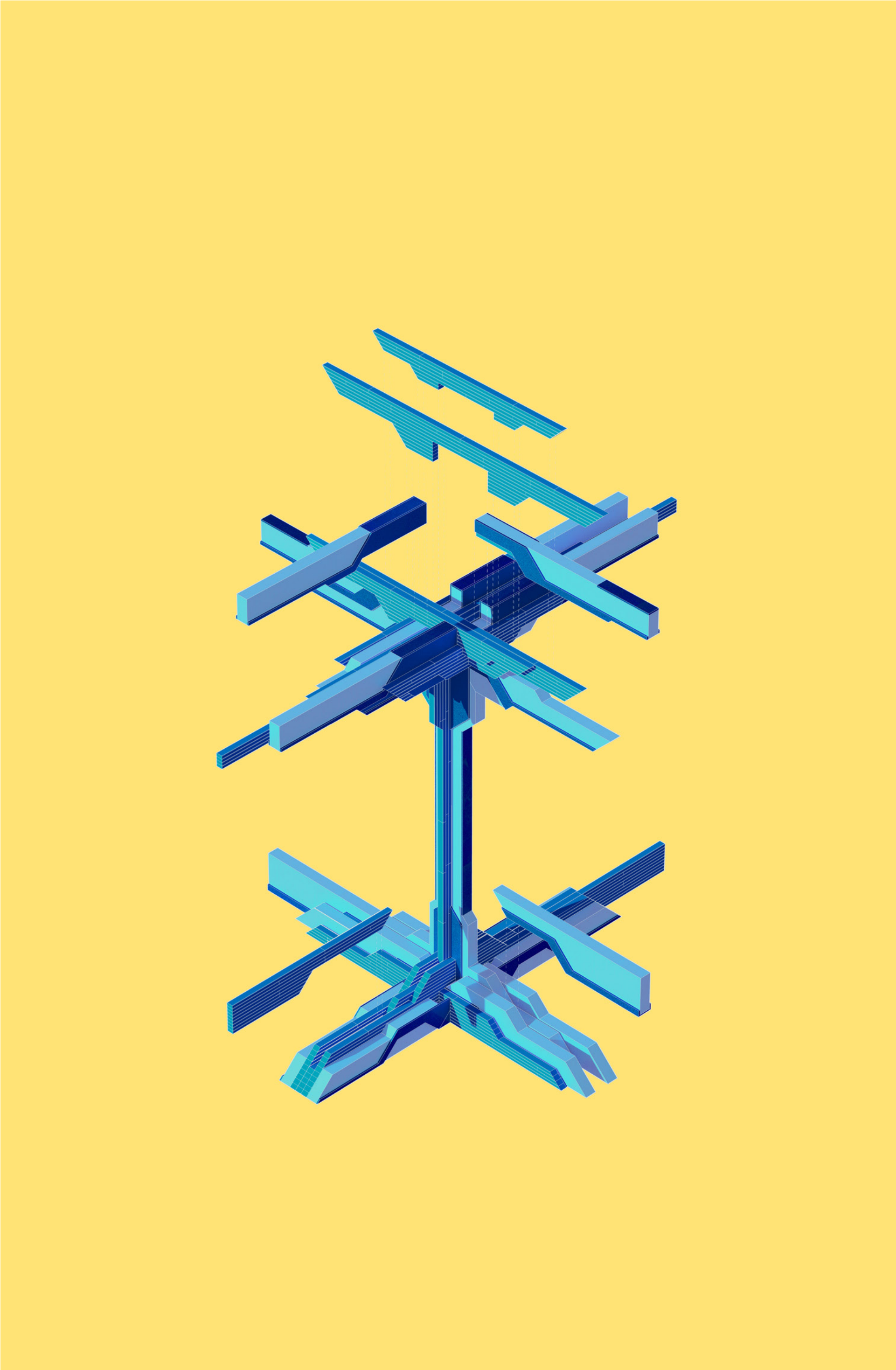


Rogers Laboratories, Louis Kahn, 1959

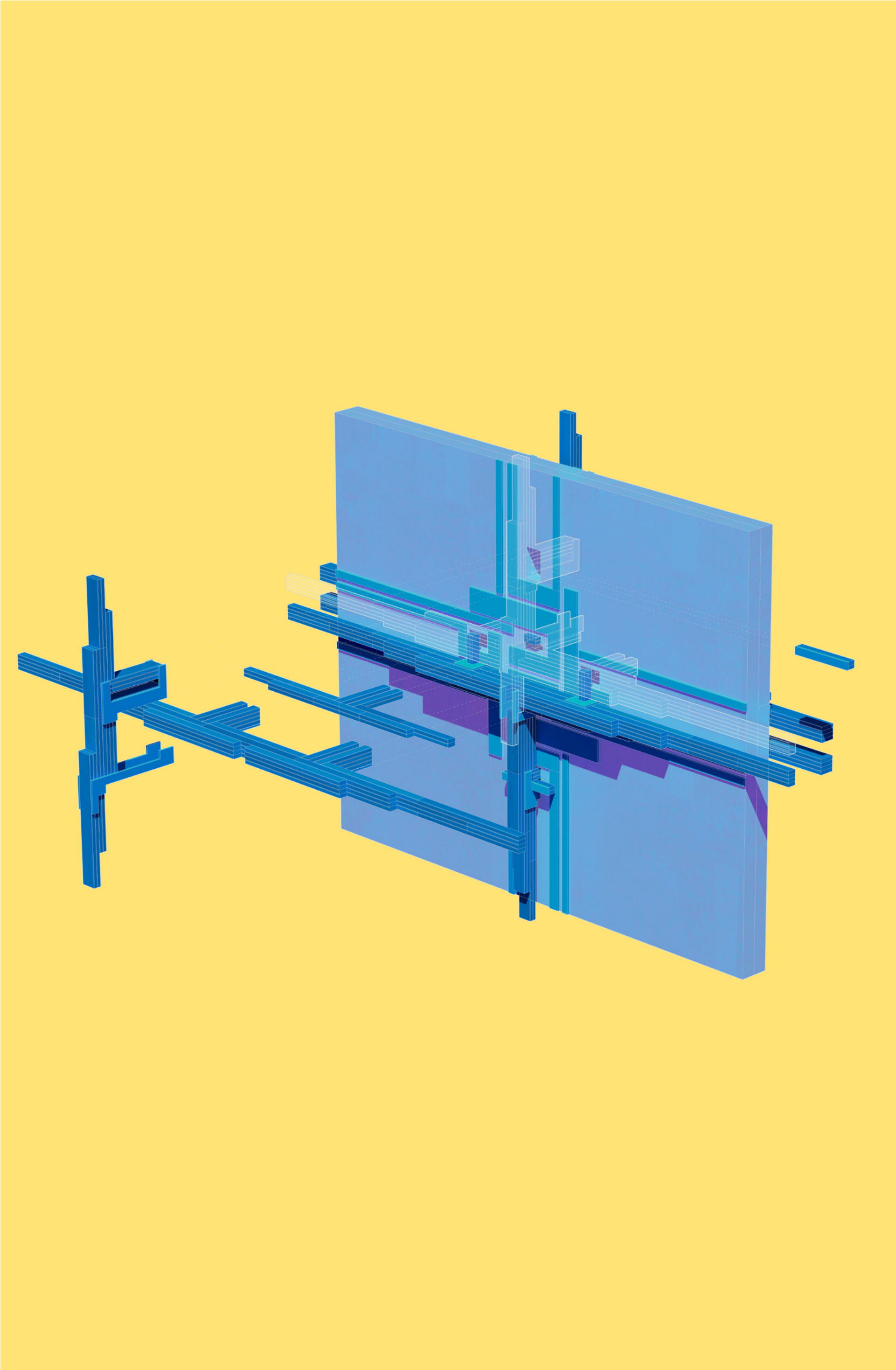
Meiso No Mori Municipal Funeral Hall,Toyo Ito, 2006


Komyo-Jii Temple, Tadao Ando, 2000


Barcelona Pavilion, Crucifix Column Assembly, By Jamison Sweat



Column Assemblage, Jamison Sweat



Wall Assemblage, Jamison Sweat

Representational

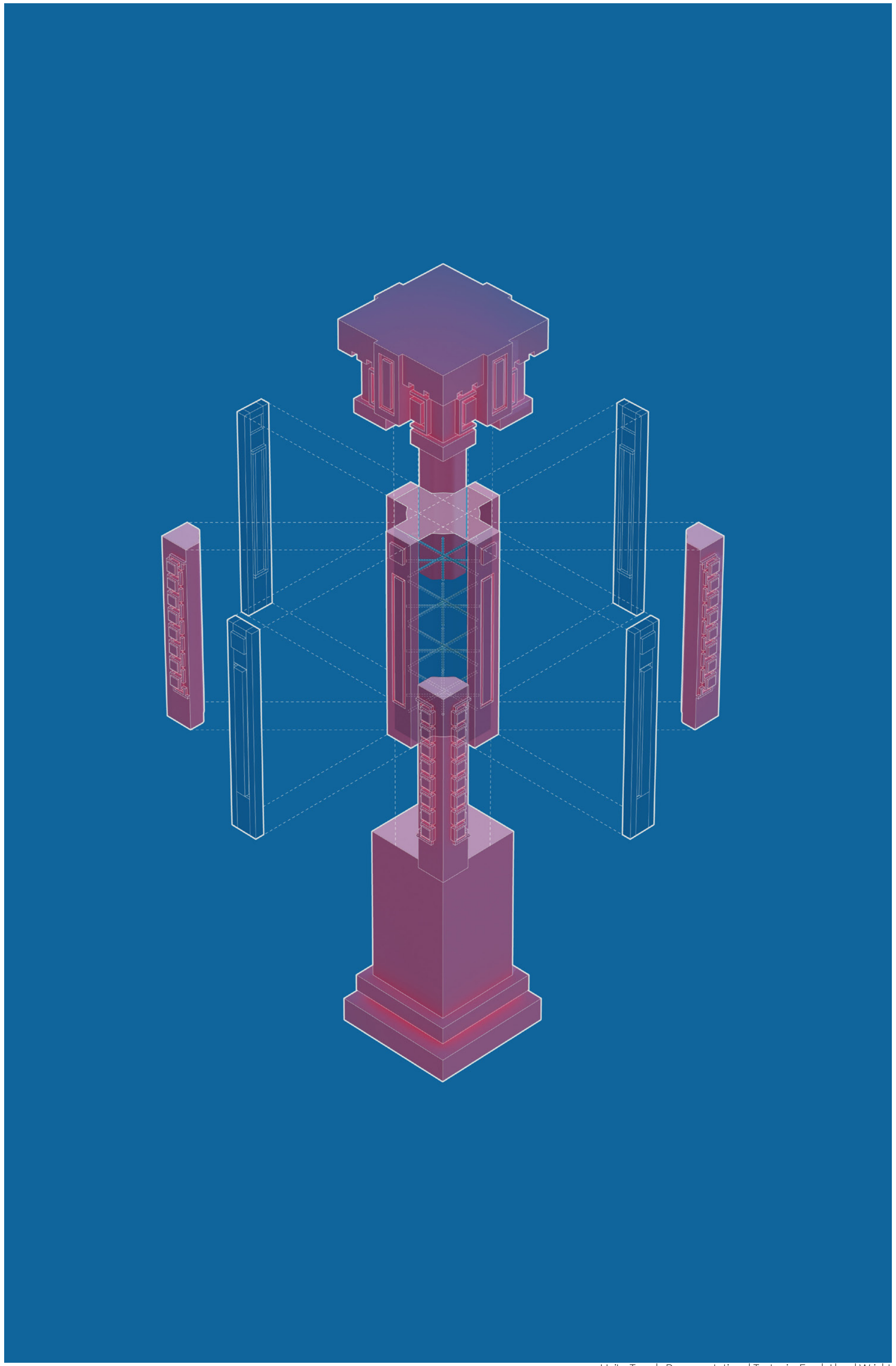
The representational tectonic is defined by Frampton as the representation of a constructional element which is present, but hidden. Botticher elaborated on this concept of tectonic, distinguishing between the k*ernform* or nucleus and the *kunstform* or decorative cladding, the latter having the purpose of representing and symbolizing the institutional status of the work [14]. And according to this the shell had to be capable of revealing the inner essence of the tectonic nucleus, the frame and interlocking of constructional elements. Botticher also emphasized the importance of distinguishing between the structural form and it enrichment [15]. With the ability of the latter as the shaping of these technical elements as in the case of the Doric column.

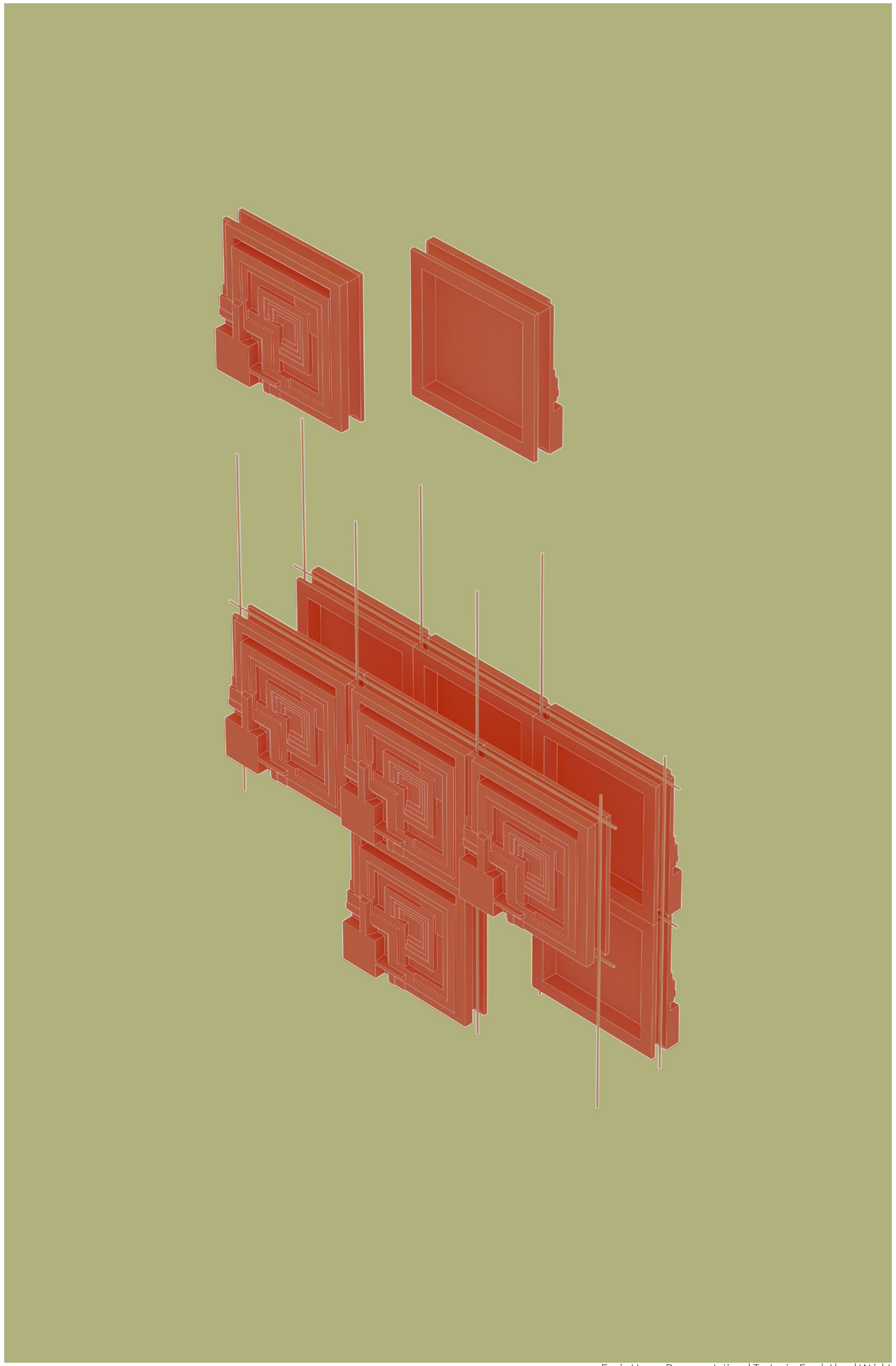
This concept was further developed by Semper into the literal idea of "dressing" the fabric of a structure. Reverting to the idea that this embodied man's underlying eroticludic urge to strike a beat, to string a necklace, to weave a pattern, and thus to decorate according to rhythmic law [16]. Frank Lloyd Wright and his textile block houses characterize this representation of tectonic, where literally columns become detailed elements in which the basic structural properties become hidden, working in parallel with the textile blocks that dress the building. It was in this manner that Wright created a continuity, a term defined by the jointless modern organism, but did not strip architecture of the joint and of the detail. To Frank Lloyd Wright, continuity of the parts defined the whole, because for there to be a whole there had to be parts and when you have parts you have joints.

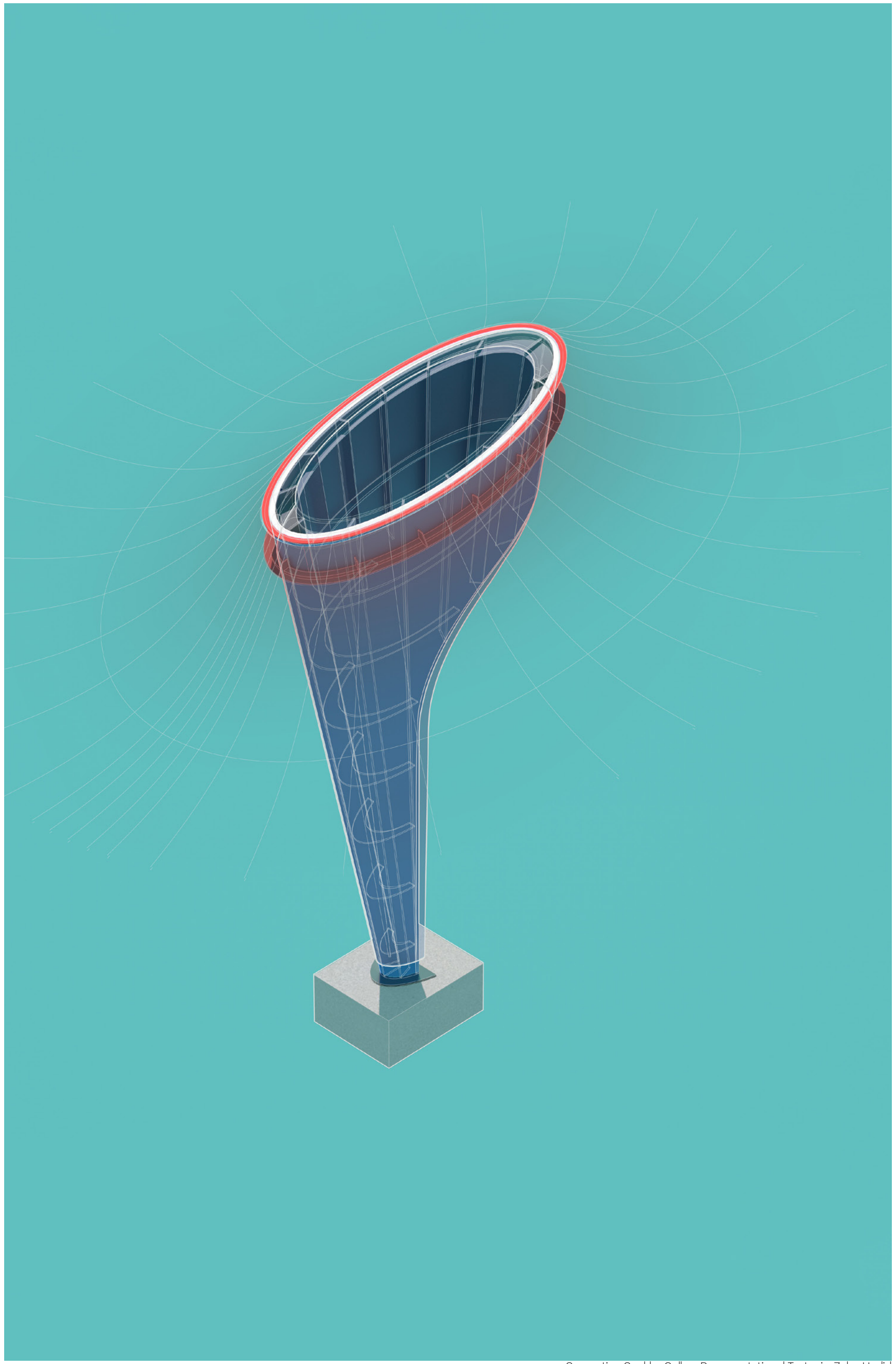
14 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 522.
15 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 522.
16 Frampton, Kenneth. "Rappel A L'ordre, The case for the tectonic". 523.

Larkin Building, Ontological Tectonic, Frank Lloyd Wright

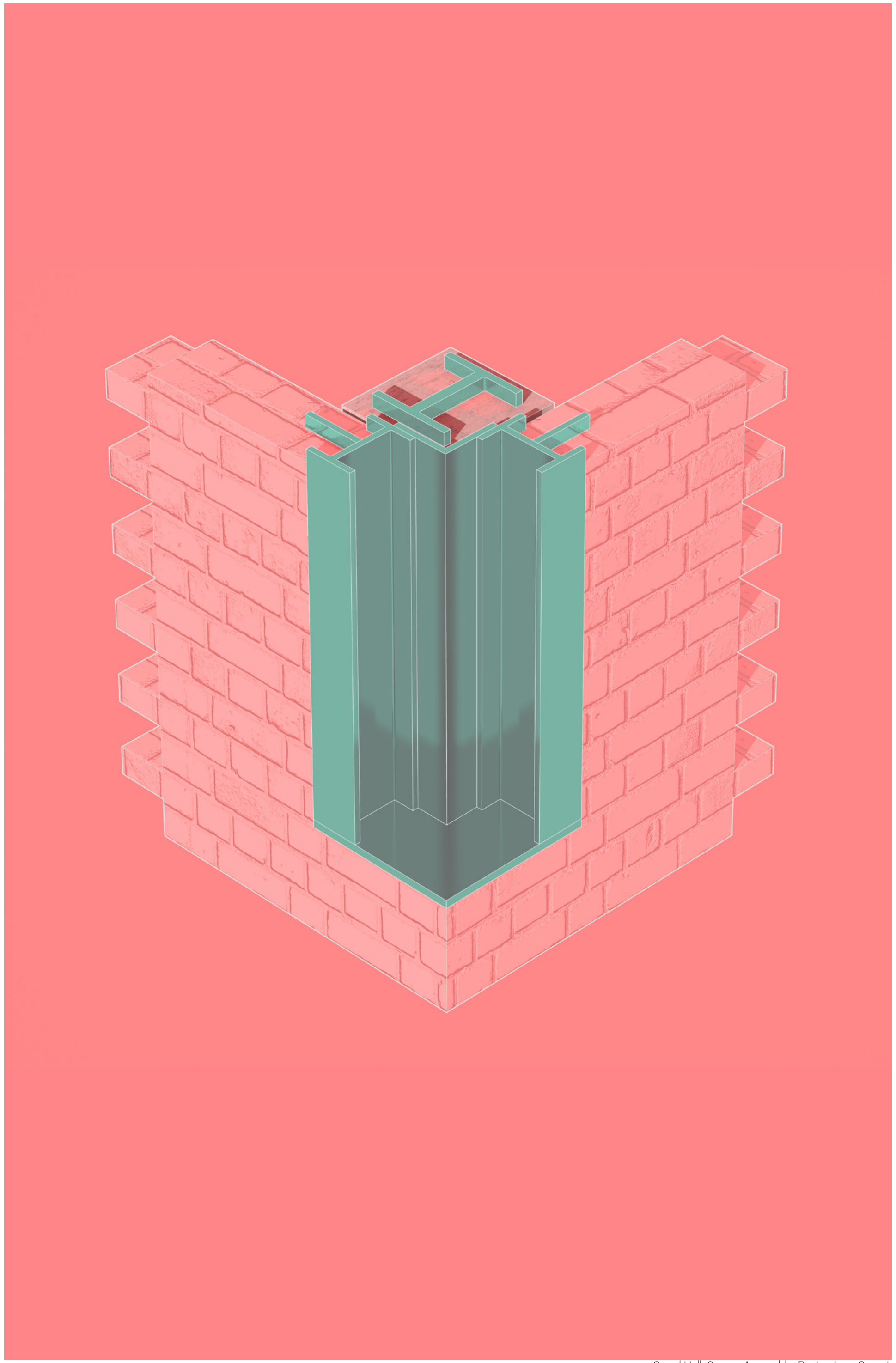
Larkin Building, Ontological Tectonic, Frank Lloyd Wright


Unity Temple,Representational Tectonic, Frank Lloyd Wright


Ennis House,Representational Tectonic, Frank Lloyd Wright



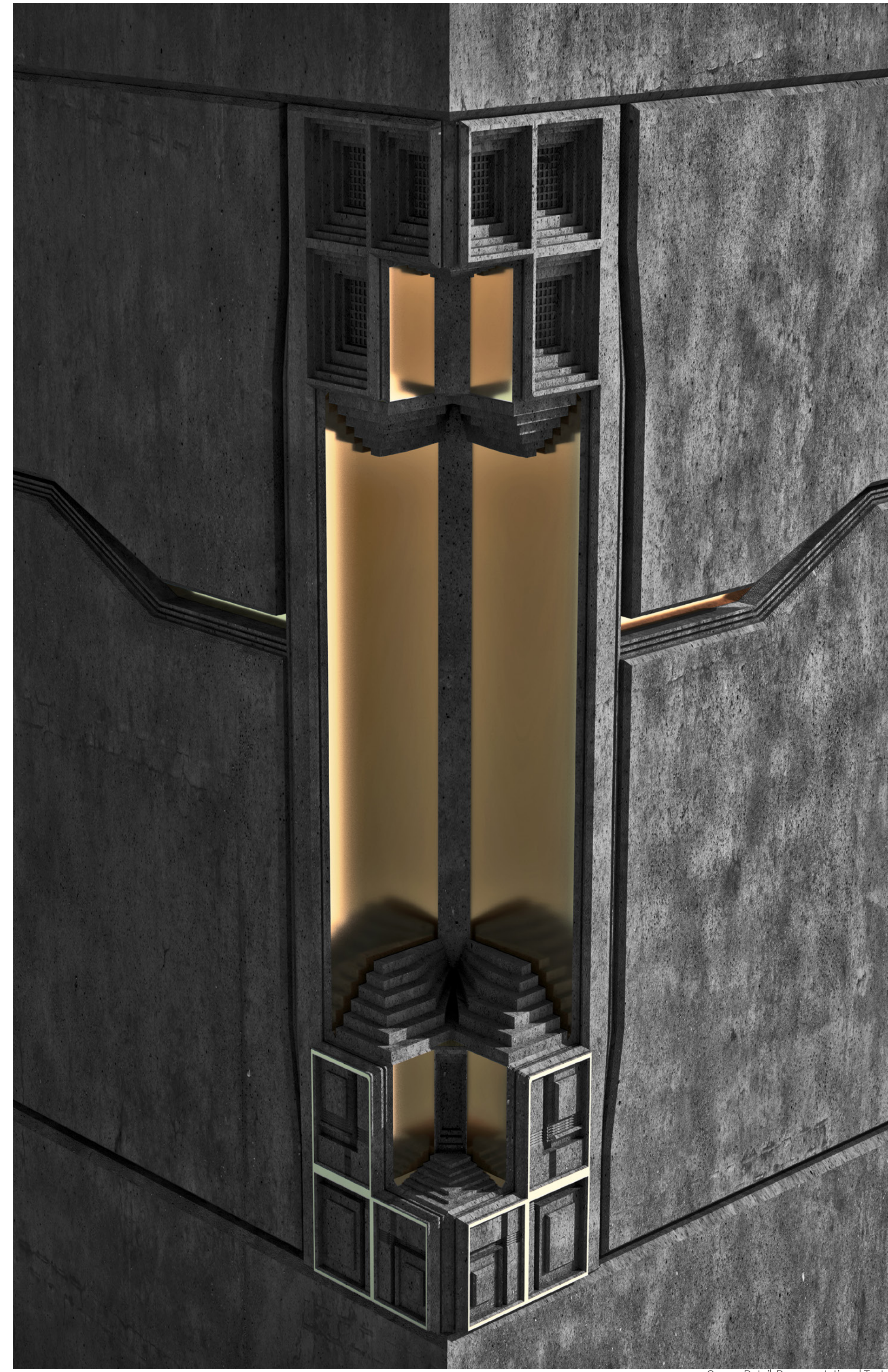
Serpentine Sackler Gallery,Representational Tectonic, Zaha Hadid



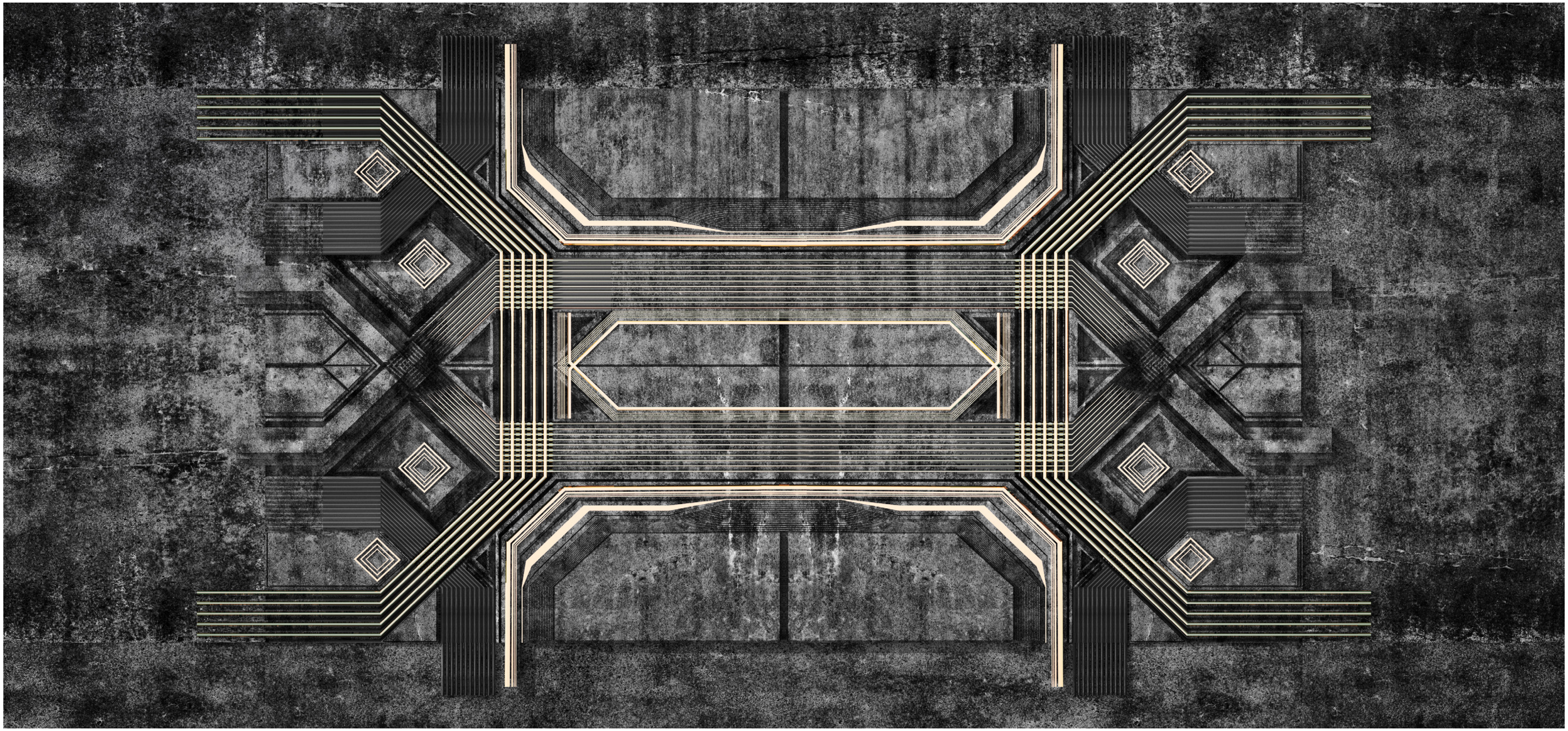
Segel Hall, Corner Assembly, By Jamison Sweat

Standardized Scales

The idea that some architectural ideas only reside at standardized scales of magnification at this point is nostalgic [17]. The computer has given us the ability to have infinite zoom-ability and different levels of magnification at which architectural ideas can unfold. These studies investigated architectural detail through the infinite zoom-ability provided by contemporary discourse and digital tools. Speculative drawings were generated from the previous studies, looking at the corner, the textile block (wall) and the column. Each of these drawings looked at the architectural detail in conditions of higher resolution to examine the intensities of the detail and ornamentation at these zoomed in scales. The architectural detail and tectonic in the 21st century could mean something very different with the enhanced ability to zoom into to scales that were no able to be investigated previously. Although these studies were solely representational, as most digital projects are, this step in the process brought forth an area that needed to be bridged. Materiality is an after thought when working in infinite space and this research will begin to unfold into physical studies that seek to challenge traditional means of fabrication that inherently generate a higher resolution architecture using the ability to zoom in and examine architecture at these higher degrees of magnification.

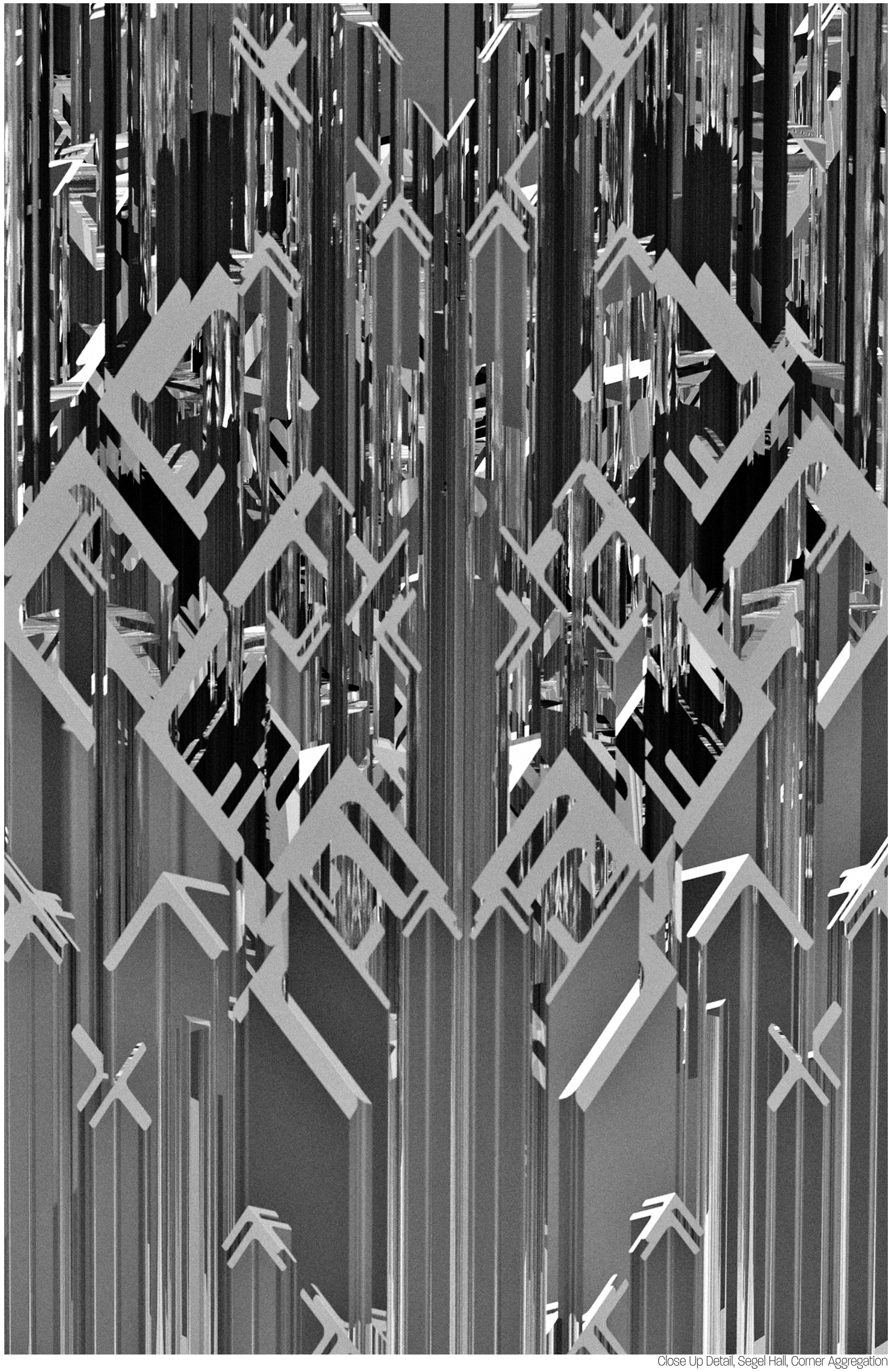

Corner Detail, Representational Tectonic

17 "Close-up." SCI-Arc. Accessed April 26, 2017. https://sciarc.edu/events/exhibitions/close-up/.

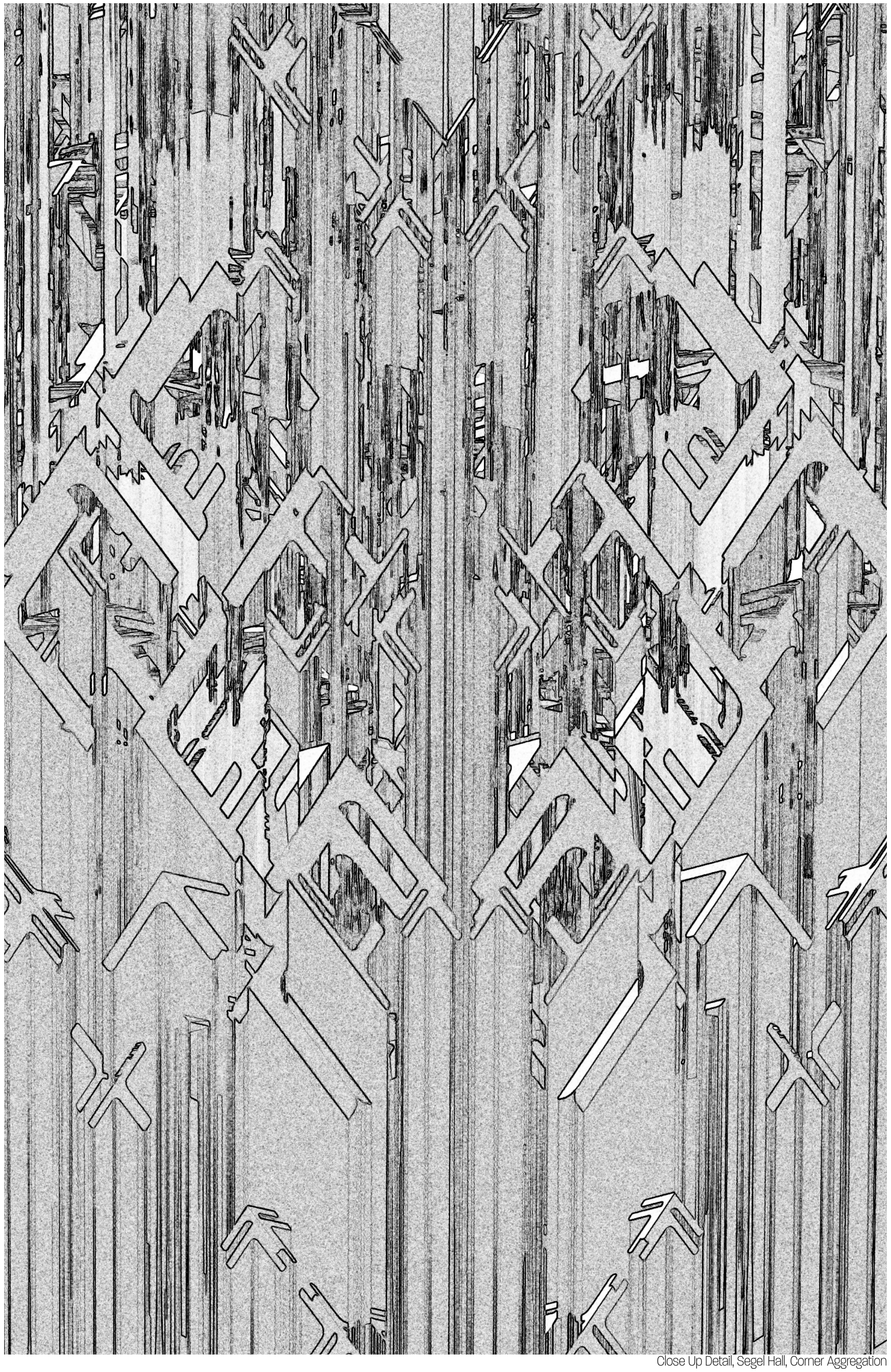


Textile Block Detail, Representational Tectonic

Textile Block Detail, Representational Tectonic

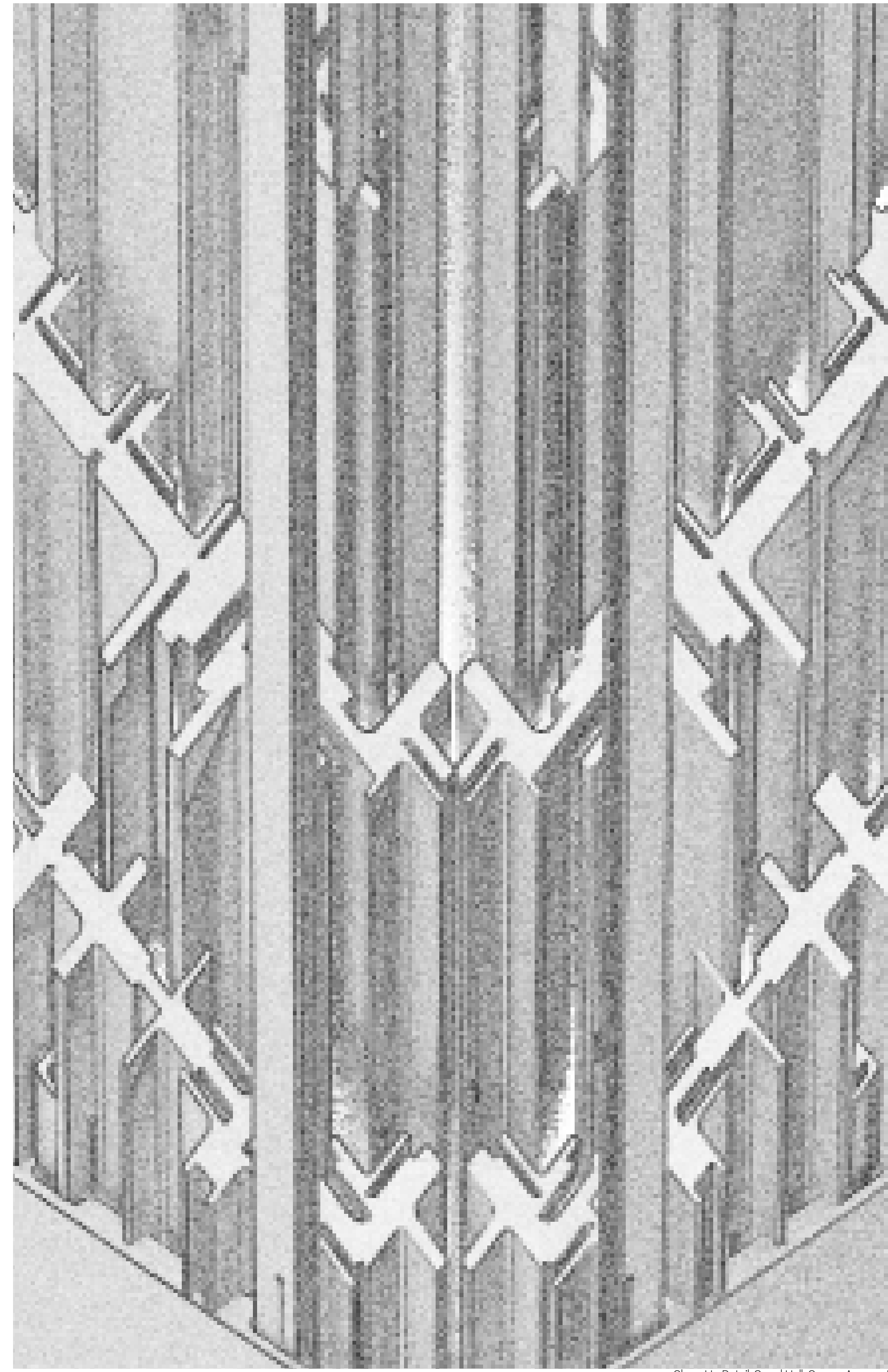


Close Up Detail, Segel Hall, Corner Aggregation



Close Up Detail, Segel Hall, Corner Aggregation

Close Up Detail, Segel Hall, Corner Aggregation



Close Up Detail, Segel Hall, Corner Aggregation

Digital Fabrication

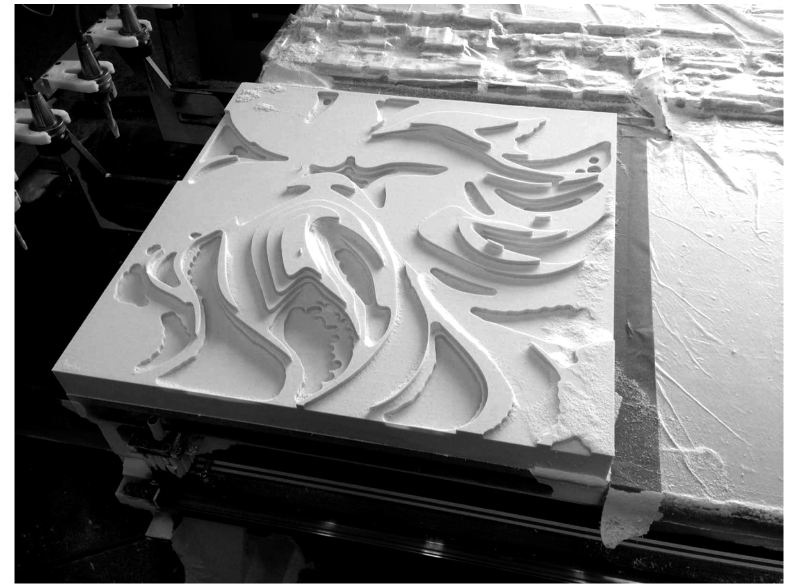
Subtractive (Contouring)

Contouring, refers to the ancient origins of carving away wood and chiseling stone, totally subtractive processes that require blocks of material and through a series of contours, the material is removed until the final form remains [18]. In the digital discourse in contemporary architecture this process uses the combination of 3-d modeling and CNC machining. This fabrication process is totally a 3-dimensional one, it does not require the layering or joining of parts to create a form. With the use of 3-axis, 5-axis and robotic arms, architectural detail can be refined to the most accurate level of detailing, leaving new architectural forms and details developed in the computer completely attainable for the first time in modern architecture. This technique of fabrication allows for more inventive ways to approach joints and the act of connecting with virtually zero tolerance for a more sensible approach to tectonic.

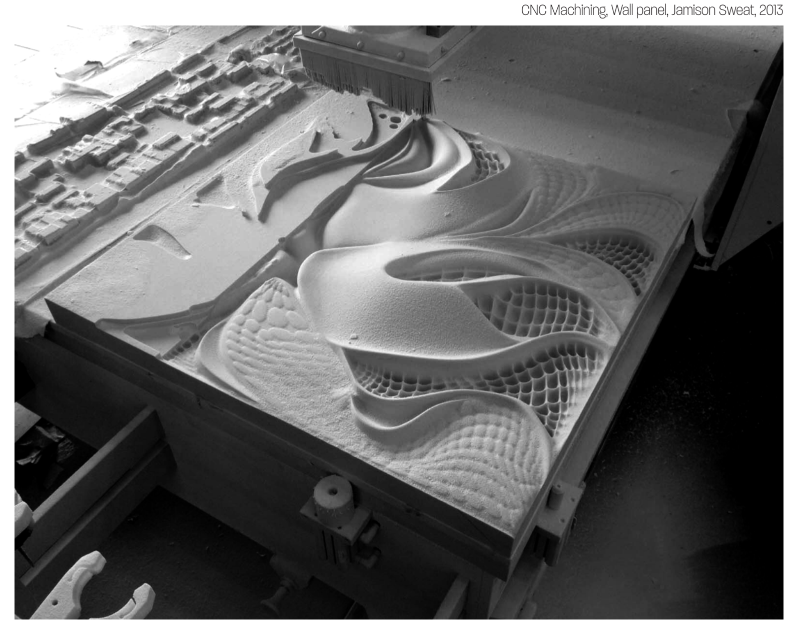
Subtractive processes also refer to simple removal of material from a larger piece of material, such as laser cutting or in this case water-jetting. Water-jetting is a technology that, in this research, can allow us to challenge conventional methods of making parts. Typically concrete is delivered in one of two ways, cast-in-place or precast elements. The water-jet has now allowed us to create more custom, high definition concrete elements without building intricate form-works and networks of steel reinforcing. Simple form-works can now be produced, saving time and labor in building these intricate form-works only to be used once. The process of water-jetting concrete begins to bridge the gap between digital surfaces that lack material qualities and the fabrication processes involved in creating these forms.

In this research concrete sheets were cast and then custom parts were cut out of these sheets, much like laser cutting, but these parts now adopt real world material logics and became more than representational models. Concrete and steel reinforcing are a relationship that are married to each other but within this process of cutting concrete the steel reinforcement can no longer be internalized. The steel's relationship becomes one of exteriority and is added to the concrete parts after they are cut out. The relationship between the steel and concrete becomes realigned and now challenges architecture as a relationship of parts, joints and details.

18 Iwamoto, Lisa. Digital Fabrications: Architectural and Material Techniques (New York: Princeton Architectural Press, 2009). 90.



CNC Machining, Wall panel, Jamison Sweat, 2013



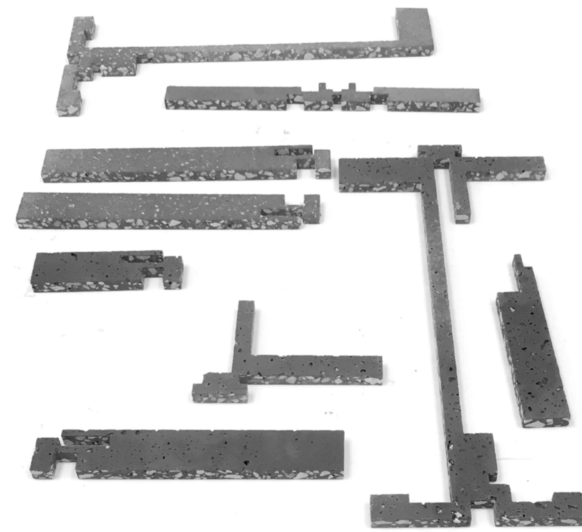
CNC Machining, Wall panel, Jamison Sweat, 2013

20" x 30" Concrete Slab, Pre-Waterjet

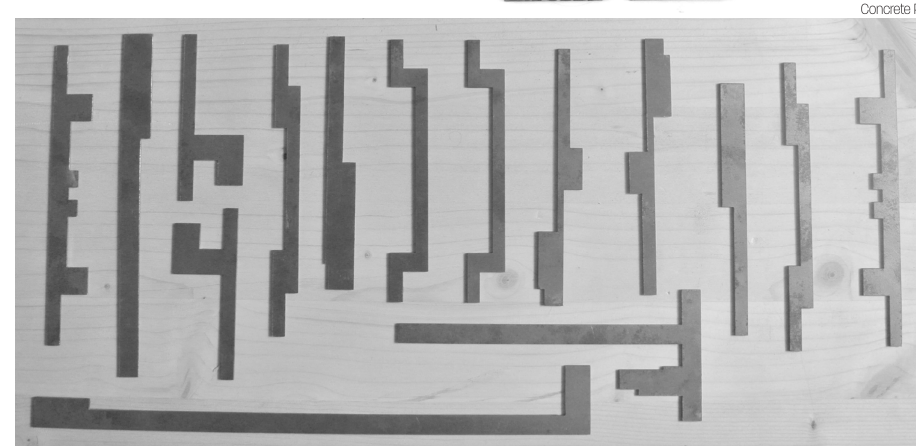
Water-jetting Process, Concrete Cutting

Concrete Slab Surface Finish

Concrete Parts with Steel Reinforcement



Concrete Parts



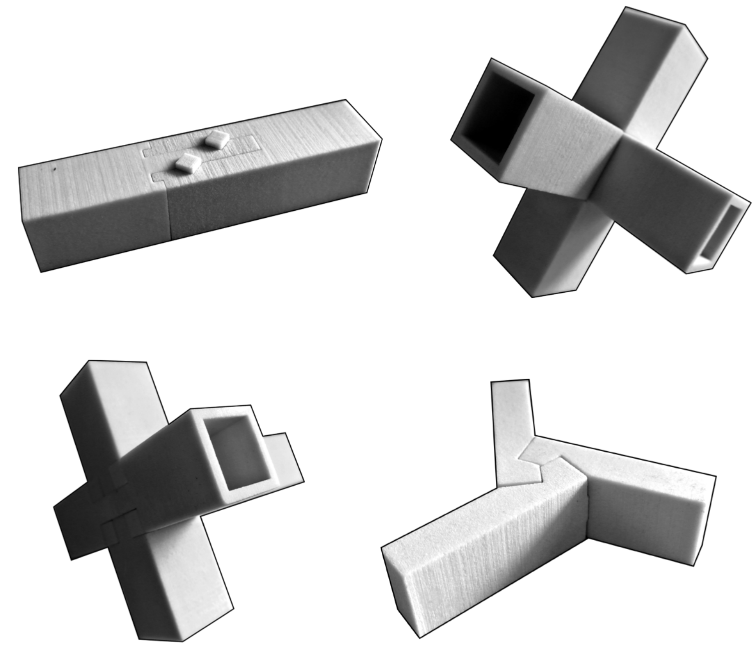
Steel Parts

Additive (Forming)

In disagreement with the definition of forming in the book by Lisa Iwamoto, *Digital Fabrications*. Forming has been described as the direct manipulation of material into desired forms, stating it is not additive nor subtractive. Thought the use of digitally controlled equipment is necessary in the reforming of materials.

This idea of forming has changed since the publishing of the book. Forming now requires, like before, digitally controlled equipment, but the process relies on the additive process or layering of material to produce a volumetric object. It can be as simple forming concrete, but this technique, in the current discourse refers to the process of 3-D printing. The fabrication process of 3-D printing is the building up or layering of material, and the tolerance of this technique relies on the scale of the micron. Rapid prototyping becomes the main objective when using these printers but the technology can work at a multiple of scales. The idea of fabricating and testing forms developed in digital space is crucial to this body of research, especially when addressing joinery and detail. Joints can be tested and re-tested, especially Japanese joinery, with the characteristic of zero tolerance being fundamental element of this type of joining.

The printing of this series of joints has given the opportunity for understanding the mechanics involved in the joints and the process of working with forms in the computer and fabricating these forms using digital techniques. Removing the hand from the fabrication expands the possibility for a level of complexity in the joint that can not be reached by traditional techniques.



Joint Series, 3-D Printed

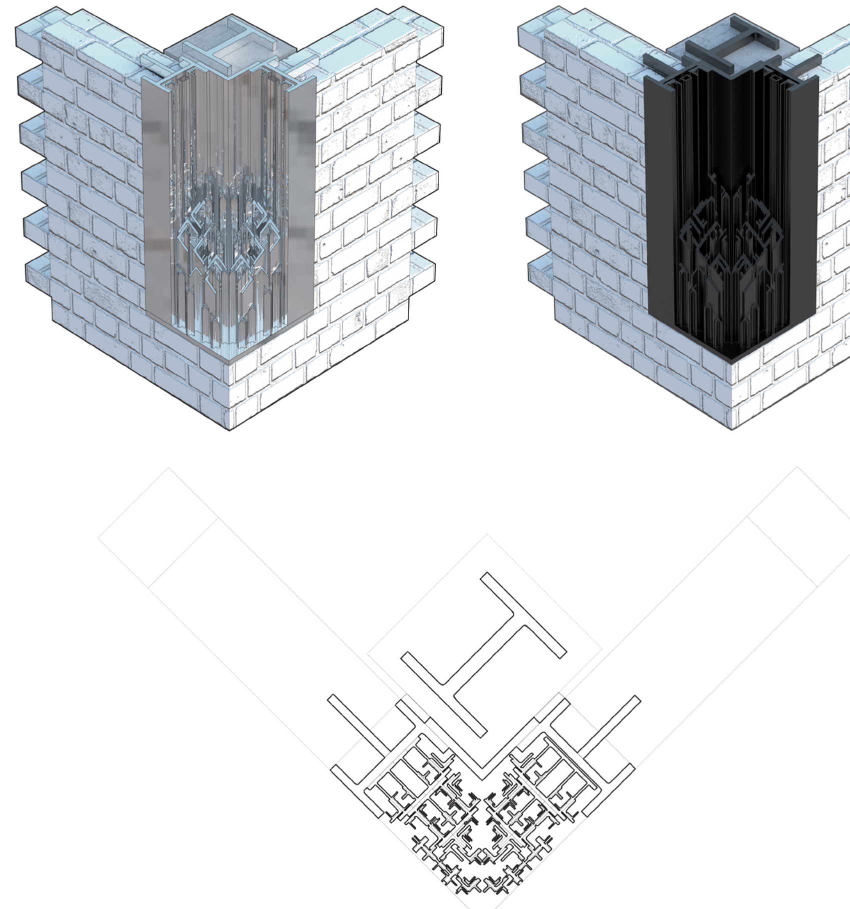
Aggregation (Standard Parts)

Aggregation relies on the idea of assembling like or dissimilar parts to create an entirely new whole. Sometimes these parts can be read as individuals but in the current discourse, aggregation refers to the assembly of discrete parts to form a new whole, shifting the part-to-whole relationship beyond recognition of the pieces that make up the whole.

Mies van der Rohe was a master at the idea of aggregating standard pieces. Primarily using machined steel sections, complex configurations were able to be generated through symmetrical arrangements of these pieces. Examples of this can be seen in the Crucifix Columns of the Barcelona Pavilion and the corner conditions of Segel Hall. Though these aggregations use very few parts, the arrangements defer from the singular parts and begin to create a new whole of discrete pieces. These sections are structurally weak as stand alone objects but gain strength through redundant combination. Understanding the assembly method of these moments in modern architecture led to a series of studies re-examining this idea of aggregation beyond recognition of the singular standard part. The column and corner were re-imagined through a lens of complex detail and digital prototyping focusing on the current absence of detail in modern architecture and challenging the traditional reading of the modern diagram.

Barcelona Pavilion, Crucifix Column Aggregation

Barcelona Pavilion, Crucifix Column Aggregation, Physical Model



Segel Hall, Corner Aggregation

"No money, no detail"
-Rem Koolhaus

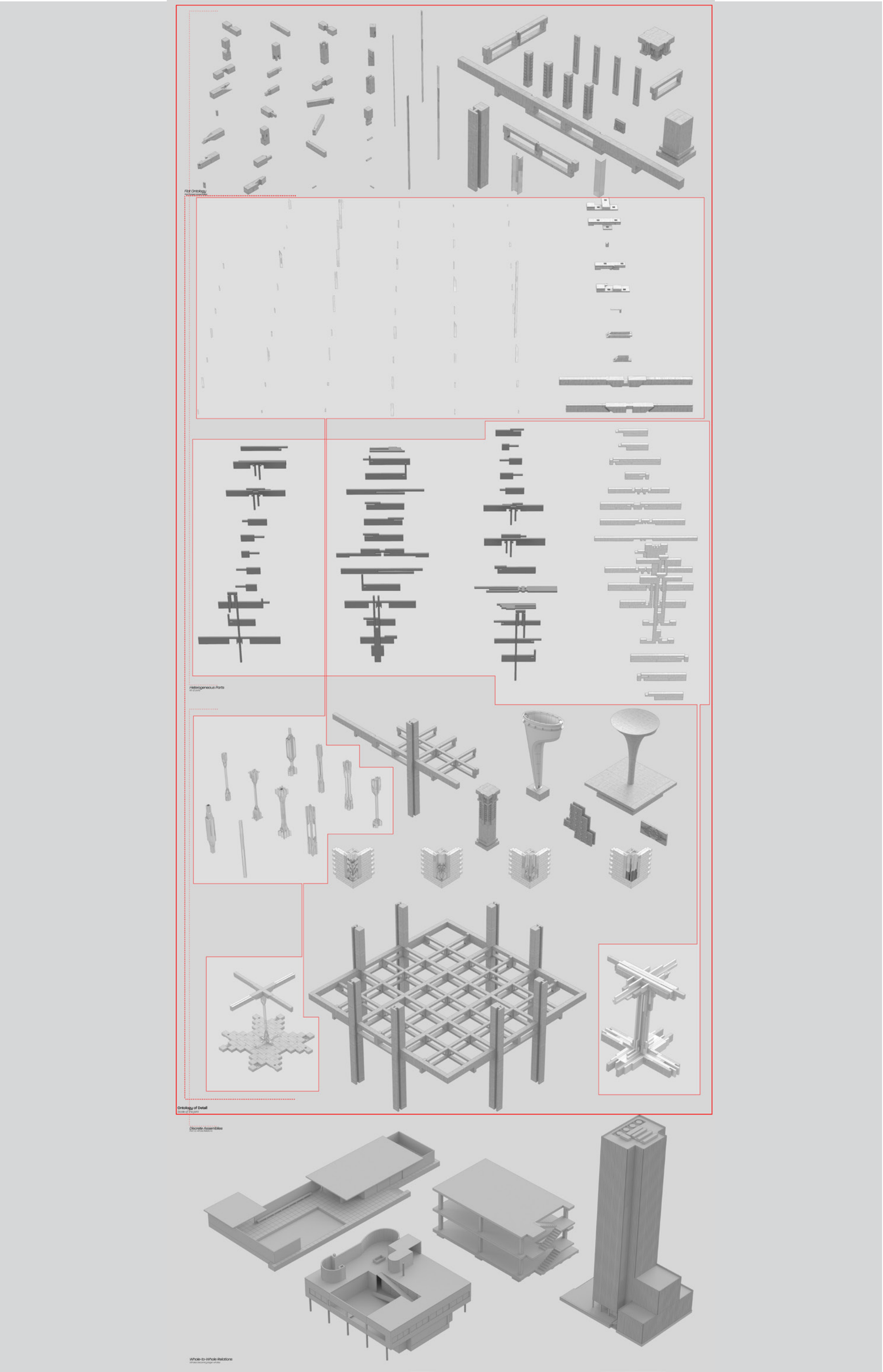
Assemblages

Assemblage Theory

Assemblage as a technique and theory has come to characterize the new and partly alien-species of 21st century details [19]. Though assemblage was mentioned by Yakov Chernikhov in 1931 in relation to detail-to-whole relationships, it was only theoretically developed in the last decades. Manuel DeLanda has led this development of the Assemblage Theory and it has become adopted by architects only in more recent discourse. This theory applies to a wide variety of wholes that are composed of heterogeneous parts, it becomes almost fractal in nature as parts become wholes and then wholes, in turn, become parts within larger wholes. The central idea within this theory is that the properties of a whole is not reducible to its parts compared to Hegelian totalities, where the parts form a seamless whole, an organic unity, describing Modernism. Assemblages are rather wholes whose properties emerge from the interactions between the parts, or relations of exteriority [20]. This gives a certain autonomy to the parts, and through their complex interactions there is an emergence of a whole. It can be described as a flat ontology, where everything exists on the same datum as opposed to a wholistic approach where the whole constitutes its parts.

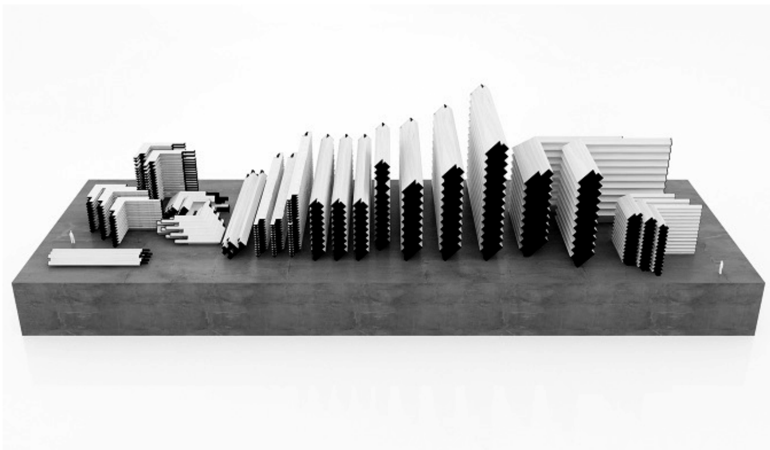
A new generation of architects had implicitly and indirectly designed and built with some of these new, more assemblage details. A wide range of scales and types of details have now become increasingly high-definition, high-resolution and zoom-able as well as more precisely designable and controllable by the architect. Details have now become more minutely designed and with that have become more valuable then previously thought.

Digital architecture has previously referred to the manipulation of information within computer space, but digital architecture should adapt the fabrication technologies for an architecture to become completely digital. Assemblages can become a process in which architecture is completely digitized, from form finding to fabrication. Gilles Retsin has taken a step in this direction, focusing his research around architecture as an assemblage of parts, similar to aggregation but these parts are no longer standard pieces but more of a kit-of-parts; discrete elements. Through this method higher resolution objects are achieved, increasing the understanding of hierarchy, heterogeneity, part-to-whole relationships, and composition.



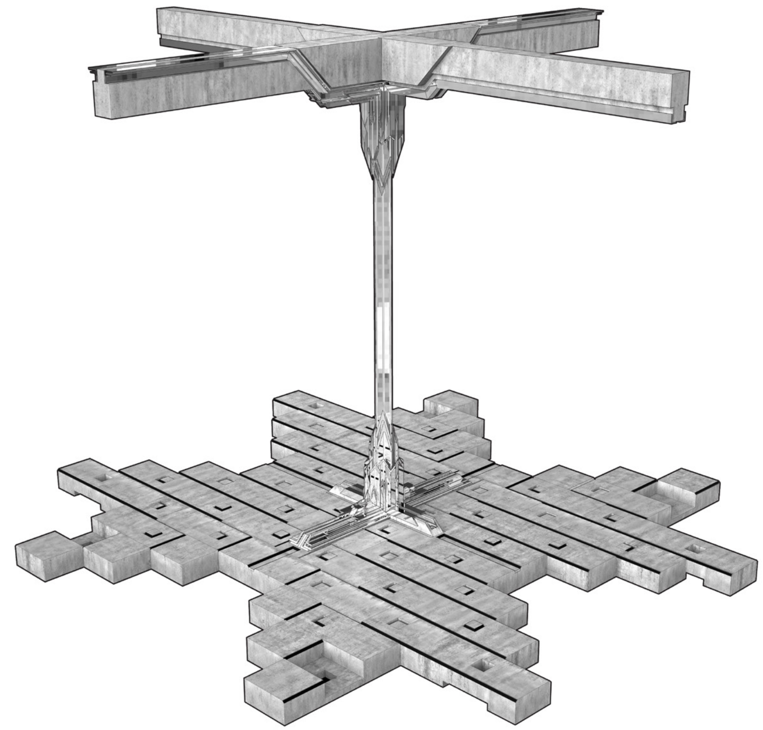
Assemblages Theory, *Mereological Drawing*

19 Garcia, Mark. Future details of architecture. London: Wiley-Academy, 2014. 21.
20 Nilsson, F. (2013) "Architectural assemblages and materializations - Changing notions of tectonics and materiality in contemporary architecture". Structures and Architecture. Concepts, Applications and Challenges pp. 408-416.

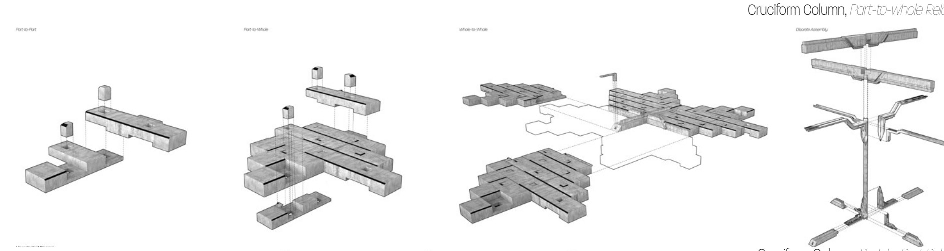


Suncheon Art Platform, Timber Elements, Gilles Retsin

Diamonds, Close-Up Detail, Gilles Retsin



Cruciform Column, *Part-to-whole Relations*



Cruciform Column, *Part-to-Part Relations*

Cruciform Column, *Kit-of-Parts*

The Column

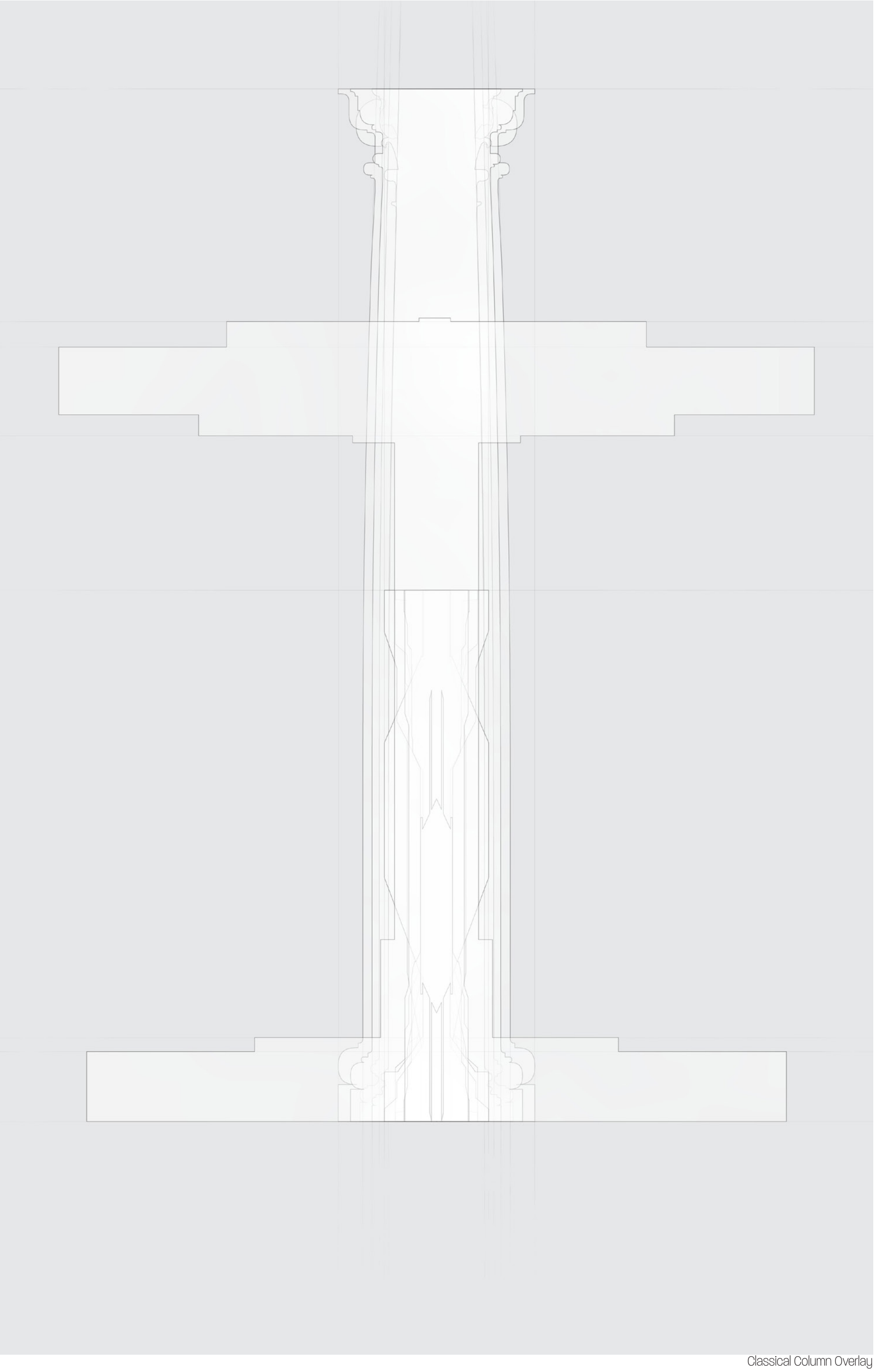
Relationships

The column has been a central focal point for this body of research, as it is one of the fundamental elements that makes up architecture. To understand the column as not just an element but within the greater context of architecture a series of analytical drawings was constructed that examine the relationships of the column in a historical context. Columns, defined in a classical sense, are characterized in terms of base, shaft and capital. It was vital in this research to examine classical column typologies to be able to challenge the conventional proportions and assembly of these elements.

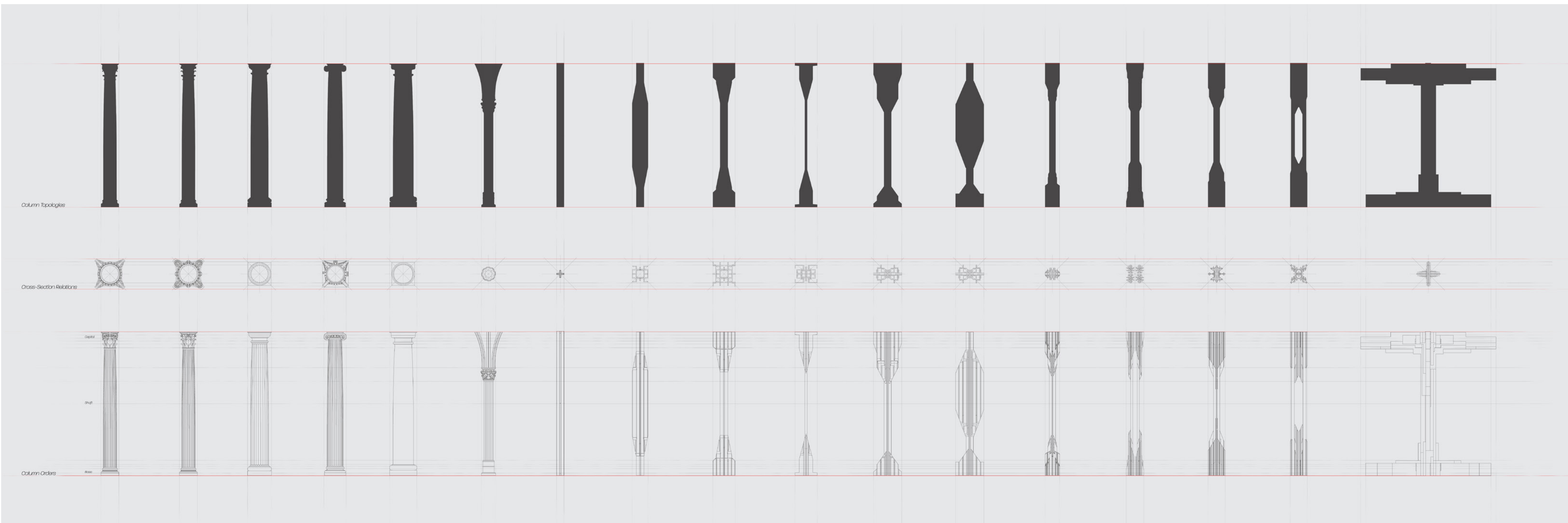
Classical Orders Drawing: This drawing compares classical columns to the column studies within this research to begin to understand base, shaft and capital as well as cross-sectional symmetries of the classical orders. Studies can now begin to challenge the classical column and the conventional means of representing proportion and aesthetic. Some studies are sympathetic towards these classical orders, while others increase the scale and proportion of the shaft, the capital and the base, but still recognize that columns are defined by these characteristics. The cross-sectional relationships of the standard steel sections increase in aggregation and symmetry to represent different levels and scales of details between the parts.

Assembly and Detail: This drawing dissects the wholistic approach of the classical columns. The base, shaft, and capital are a part of a stacked assembly, representative of a Top-Down Ontology or a Wholistic approach. The subsequent studies challenge the composition of the base, shaft, and capital, rather than being solid stacked elements, they become an assembly or aggregation of parts. Details are described by the relationships and intricacies between the parts as they enter into new relations with one another to form a new whole. The columns emerge as elements made of parts, characterized by joints and detail, describing a new articulation of tectonic.

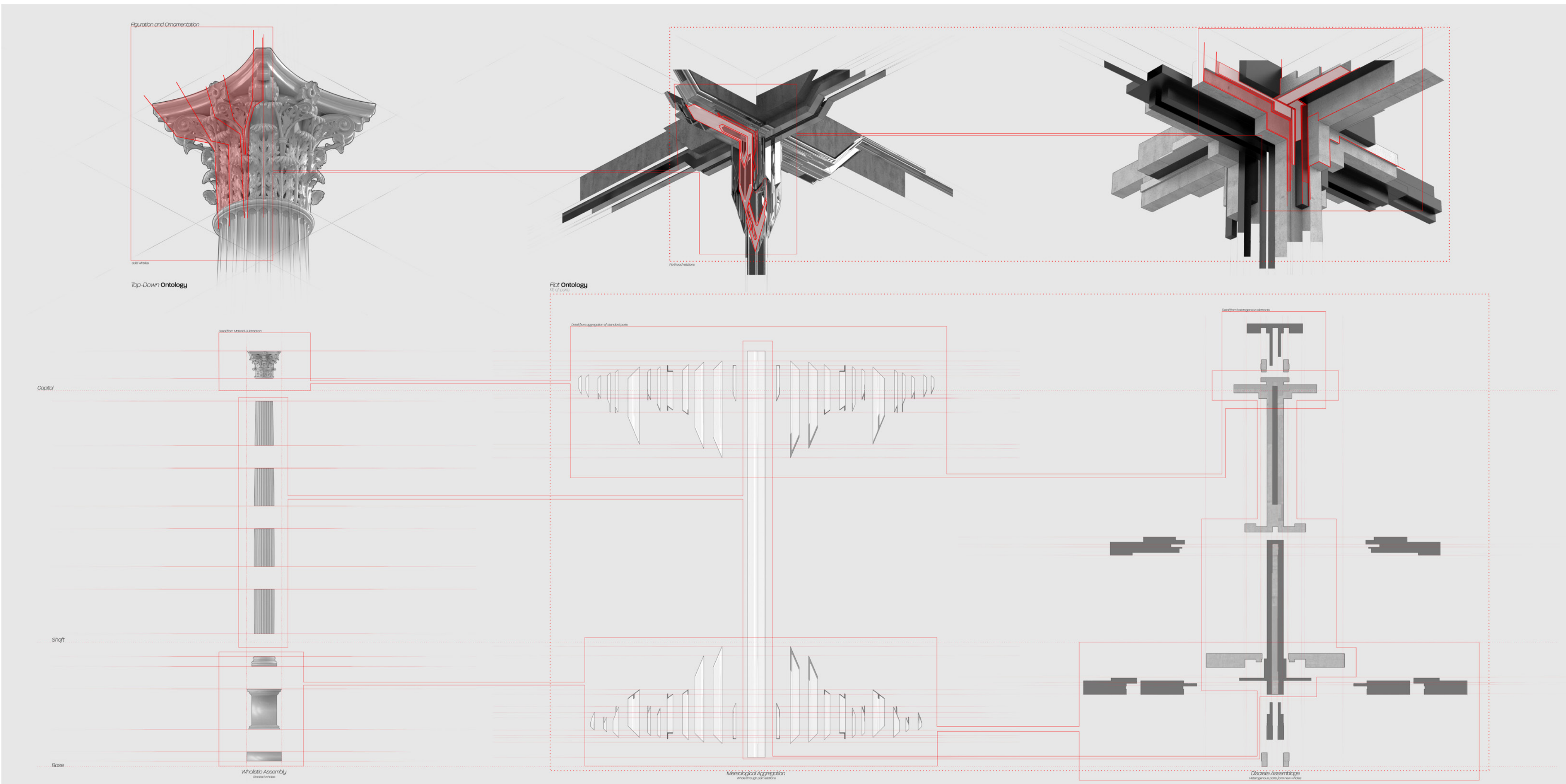
Relationship of Parts: Inherent with the column is the ability to support, so naturally conventional methods of constructing beams entered as a focal point in this research. The methods of fabrication allowed for a realignment of the relationships between steel reinforcement and concrete. Normally an internal relationship, the process of water-jetting concrete externalized this relationship and the steel became a meta-assembly of parts. Reinforcement, now externalized, revealing that in fact beams are composed of parts and this adds a level of detail and joinery that is normally concealed.



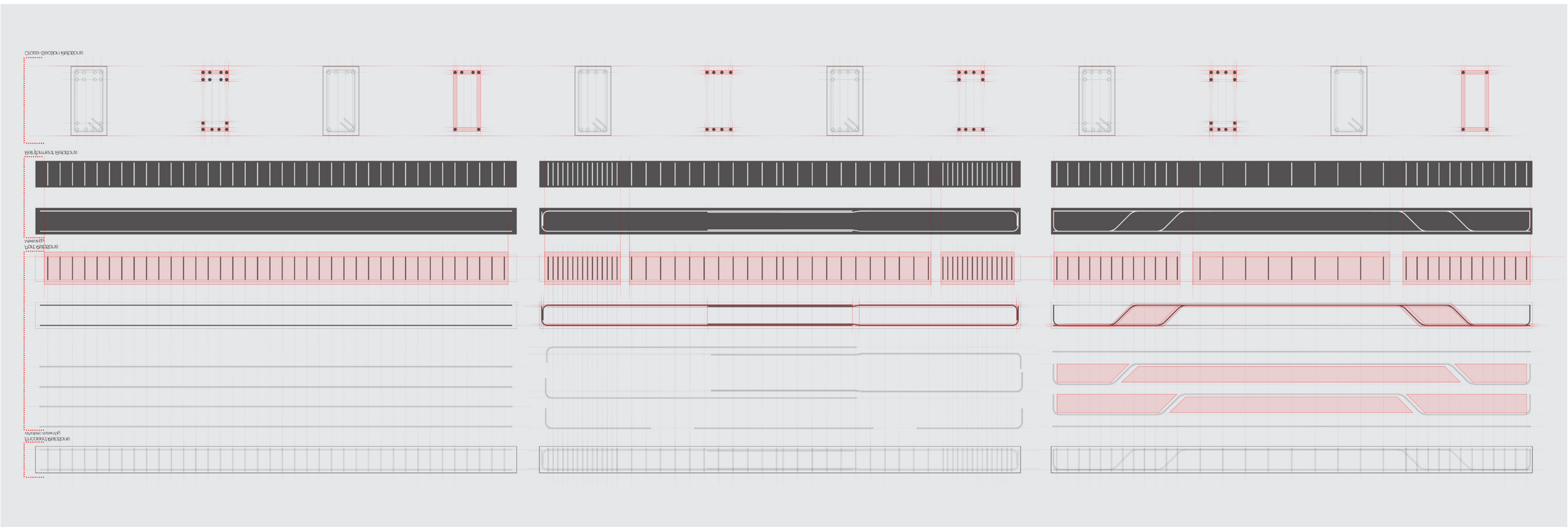
Classical Column Overlay



Column Relationships, *Classical Orders*



Column Relationships, *Assembly and Detail*



Beam Relationships, *Relationship of Parts*

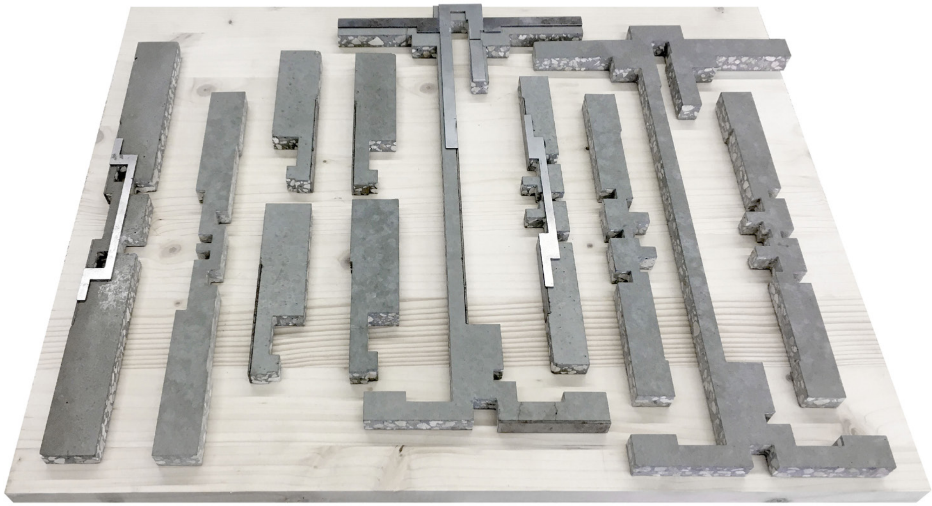
Parts

Architecture is a Part-to-Whole relationship and these studies investigate just that, the parts. Each Study is composed of concrete, timber and steels parts, with each system relying on each other as they enter into new relationships, forming a kit-of-parts that compose a larger whole.

Concrete: The concrete parts adopt a subtractive fabrication process in which the parts are cut from larger sheets of material. This process allows for more customizable parts with notching and inlays to receive necessary reinforcement and overlaps for the assemblage to come together.

Steel: Following a similar process, the steel parts are cut from larger sheets and added where reinforcement is necessary. By using real materials in these studies, real material logics had to be dealt with. Concrete does not act well in tension so the geometry of the steel parts follows paths that allow the concrete to resist those tensile moments. Notching and inlays are supported by steel to resist internal pressures of the intersecting parts allowing the system to become a rigid assembly. The process of working between digital space and fabrication with materiality as a driver allows for a higher level of resolution within the assembly.

Timber: Timber parts are composed of standard sections of framing elements, using 2x4 and 2x6 shorts from standard construction. This addresses material economy and in turn develops another level belonging to the Theory of Assemblages; these part are now in turn composed of parts. The timber elements within the larger assembly support the concrete parts and act as the key that locks the system together. The wood operates more efficiently in tension and in combination with the steel reinforcement allows the concrete to act solely in compression.



Concrete Parts, Water-jet Fabrication, Gilles Retsin

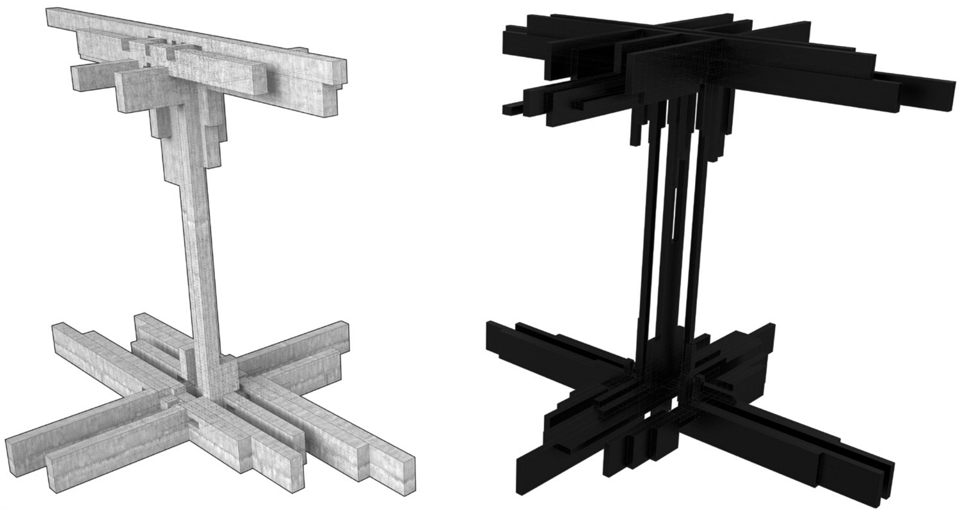
Column Studies

Study-1

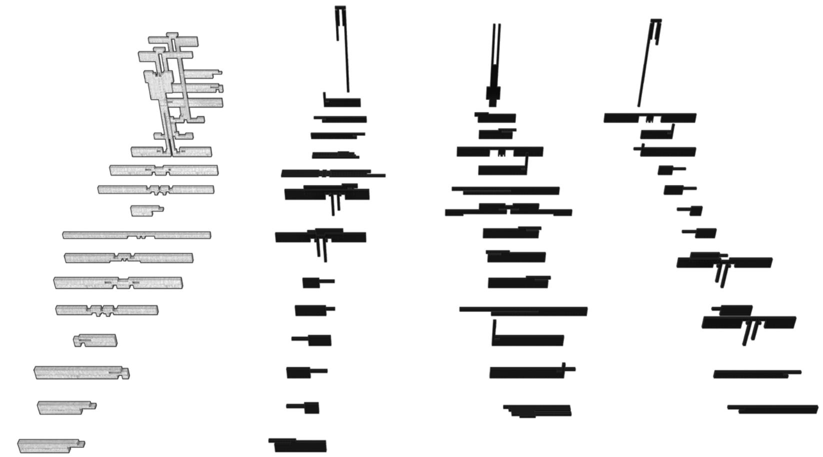
Excess was the underlying central idea that drove the first study of the column as an assembly of parts. The assemblage resisted extreme continuity and focused solely on the need for parts. This was not a study in form finding or complex surface logics, complexity was defined by intense interactions between concrete and timber elements.

This study was more representational in nature and did not address material logics and relationships between the materials. It became a study model to help understand certain conditions that did and did not work within the assembly. It helped drive decision making for further studies and created questions that pushed this research further in detail. Could the same aesthetic be achieved with less parts? How does the column become a whole within a larger whole? How does it address simple issues and conditions of structure? These questions helped drive the second study model and further the process of examining and investigating architecture as a kit-of-parts.

Column Assemblage, *Study-1*

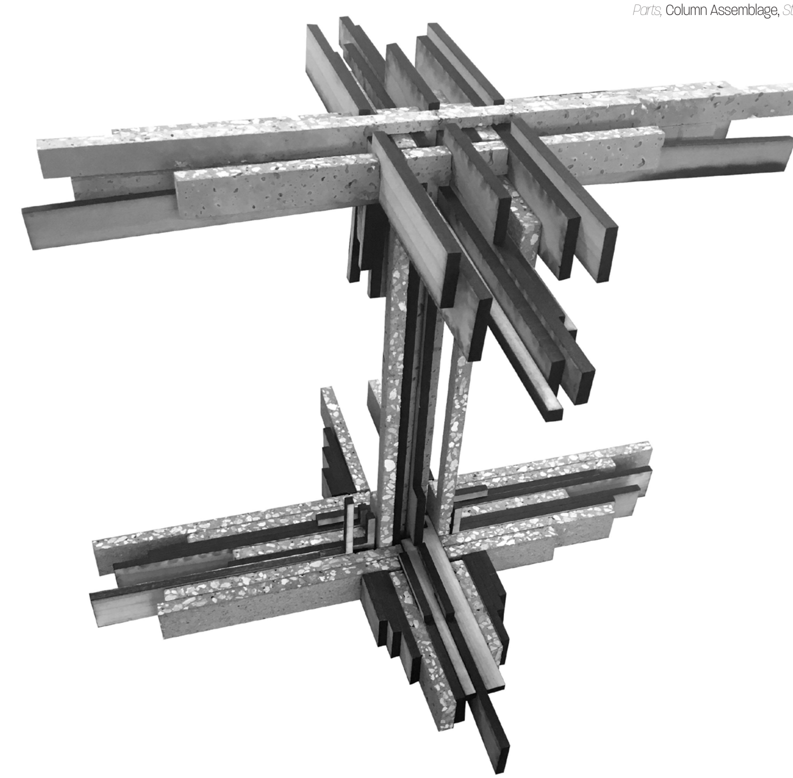


Meta-Assemblies, Column Assemblage, *Study-1*



Parts, Column Assemblage, *Study-1*

Framework, Column Assemblage, *Study-1*



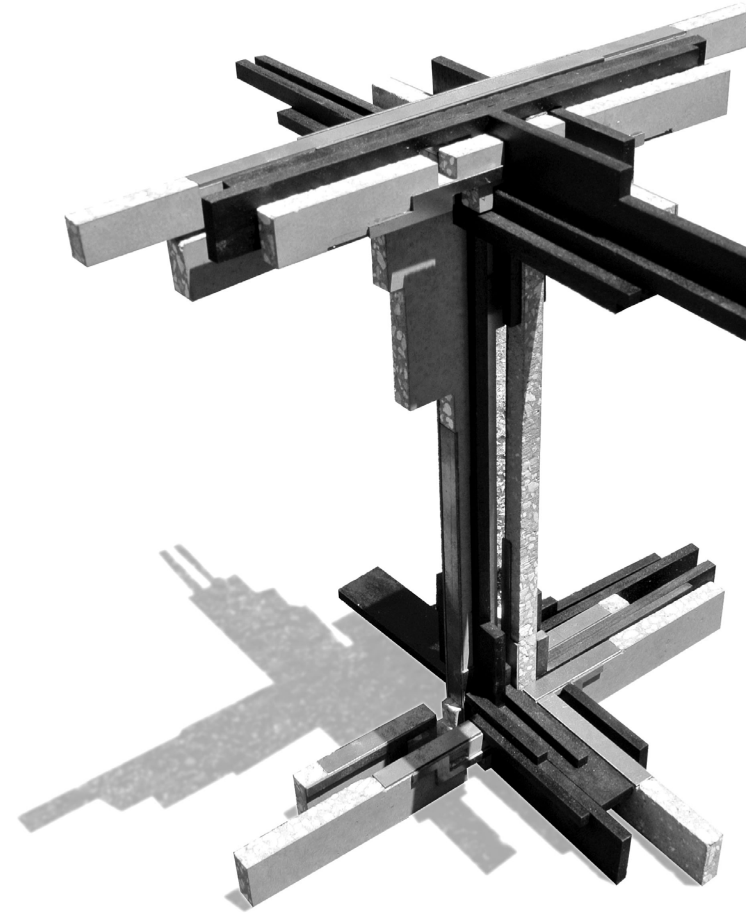
Physical model, Column Assemblage, *Study-1*

Column Studies

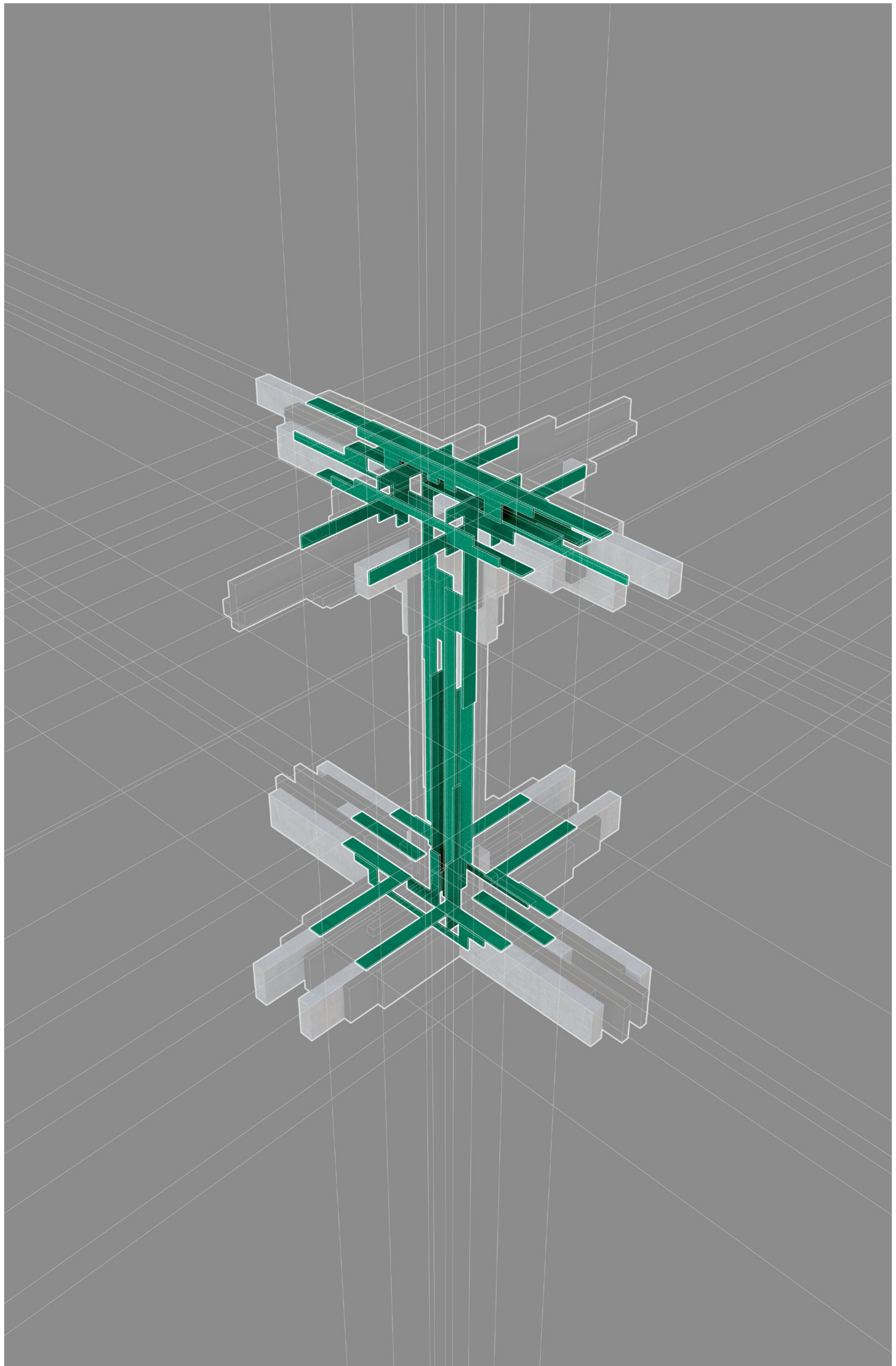
Study-2

This study actually started challenging the relationships between parts and the effect the fabrication process had on those conventional relationships. Concrete needs reinforcement but due to the fabrication process of water-jetting the steel reinforcement can not be internalized. The steel's relationship to concrete shifts and it becomes one of exteriority, the steel parts are added on the exterior of the concrete parts at certain moments. These moments were decided from the previous study model that showed where the concrete was weakest, which were moments of intersection between concrete parts and intersections between timber and concrete parts. At these moments internal pressures were exerted on the concrete and it caused them to crack and break due to the parts being in tension. The steel laminated itself to the concrete, only in moments of tension, to support the parts within the assembly.

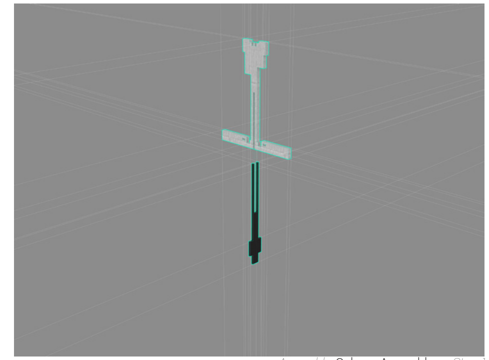
Also central to this study was the reduction of the number of parts. This model contain ed less parts but still strived to achieve a similar tectonic articulation of the whole. With the addition of steel the concrete parts could be more articulate, adding new levels of detail not seen in the previous study. Higher construction tolerances were also achieved in this study, creating a more rigid unity of the whole. But there were still unanswered questions after this study; How do you deal with material economy and commodity of materials like steel? What are the most basic elements needed in these assemblages? What are driving the formal conditions and geometry of these studies as a whole?



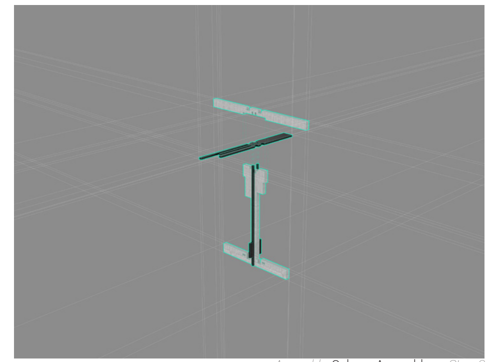
Physical model, Column Assemblage, *Study-2*



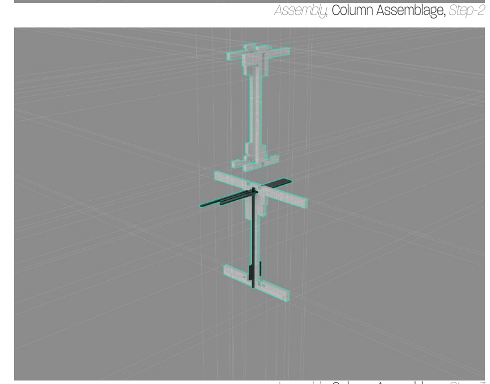
Reinforcement, Column Assemblage, *Study-2*



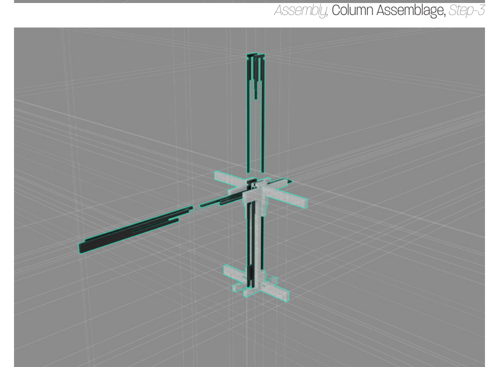
Assembly, Column Assemblage, *Step-1*



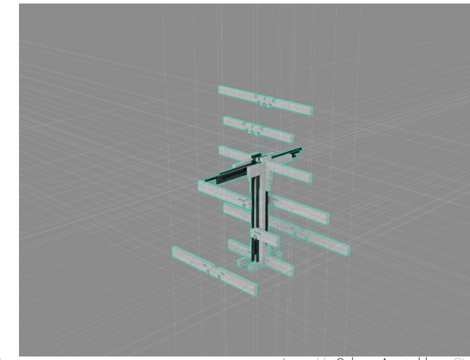
Assembly, Column Assemblage, *Step-2*



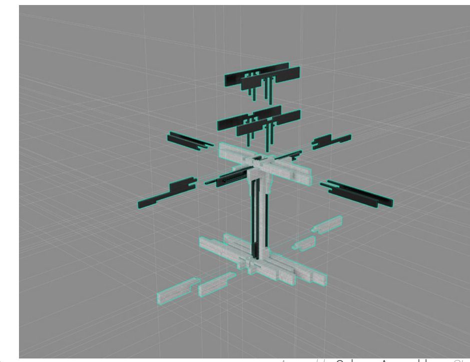
Assembly, Column Assemblage, *Step-3*



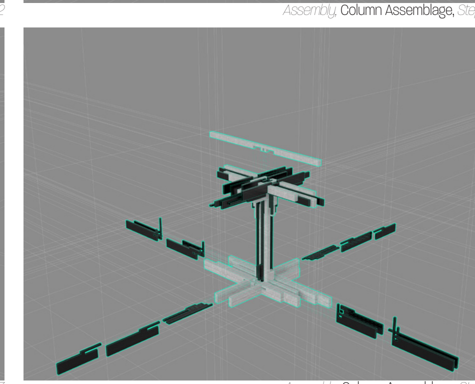
Assembly, Column Assemblage, *Step-4*



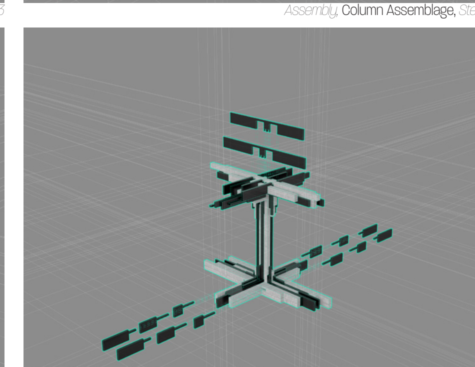
Assembly, Column Assemblage, *Step-5*



Assembly, Column Assemblage, *Step-6*



Assembly, Column Assemblage, *Step-7*



Assembly, Column Assemblage, *Step-8*

Close Up, Column Assembly, *Study-2*

Column Studies

Study-3

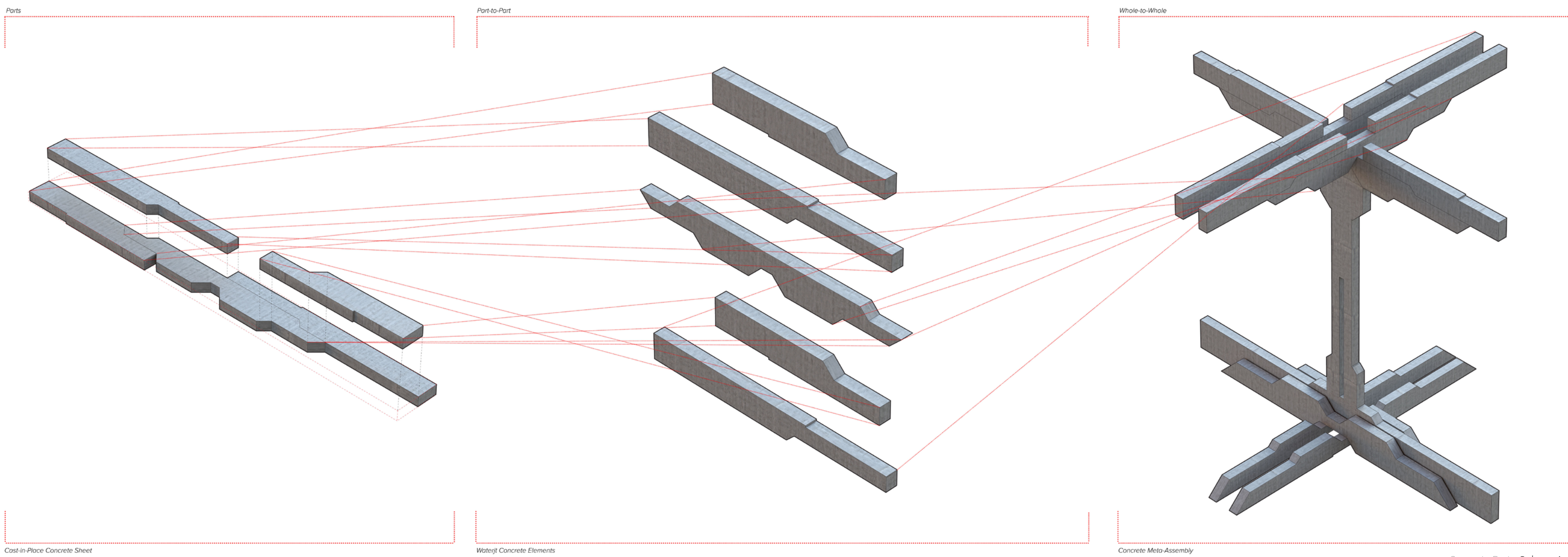
The third and final study of the column as an assembly of parts addressed issues like material economy and commodity, relationships between reinforcement and concrete and the ability to become a whole within a larger whole.

Material economy and commodity was addressed by using timber shorts from construction of typical framed buildings. These shorts were laminated together to form engineered beams and when parts needed to be cut down the excess was used somewhere else in the timber elements. The drawing describing the Timber Parts can be found on pages 120 and 121, showing the proposed construction of these elements.

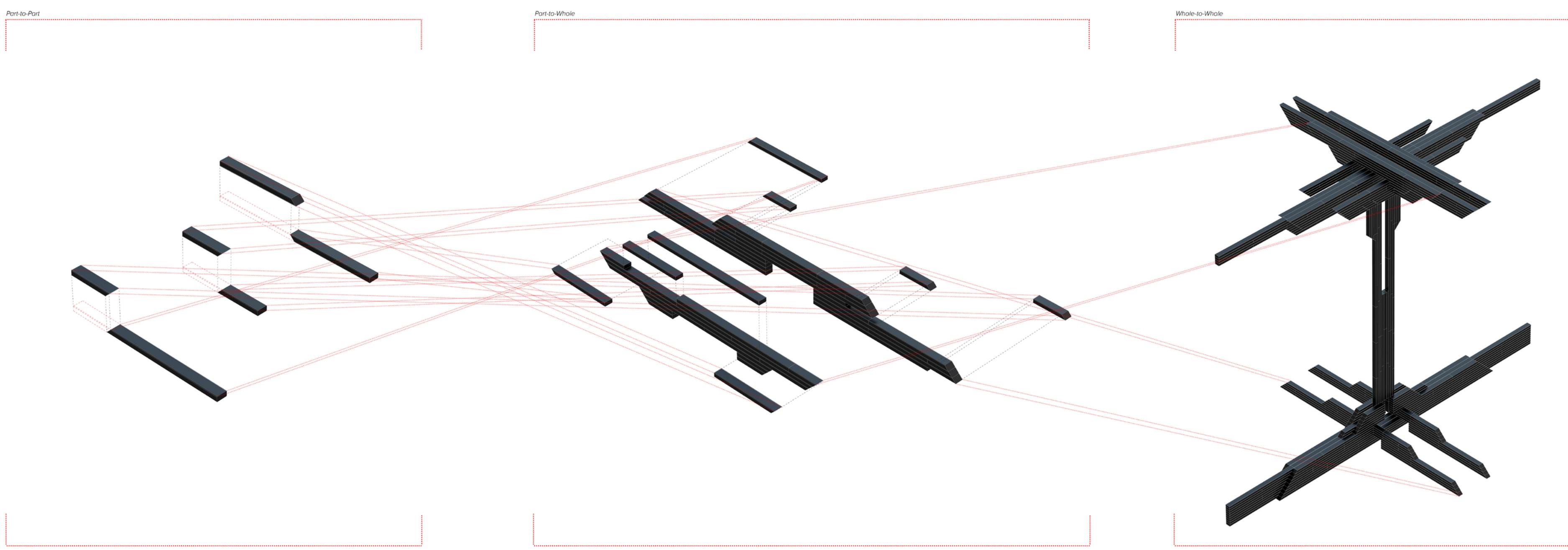
Steel is a finite material and a commodity in construction, so the steel parts in this assembly follow a strict geometry that reinforces the concrete based on the conventional relationships between steel and concrete. The steel parts were laid out on 4x8 sheets in a specific way that would allow for the parts to address the critical needs of these relationships but also would address the idea of "zero waste" relating to steel as a commodity. Each steel part is the negative or reversal of another steel part used in the assembly. The drawing showing this in more depth and detail is located on pages 122 and 123.

The concrete addresses similar issues as the steel, following a stricter geometry derived from the relationships between steel and concrete found on pages 104 and 105. These parts, having adopted new formal conditions relating to these necessary relationships, now are solely in compression allowing the timber elements to double up when necessary to lock the assembly together. With the new geometry of the parts, the column is no longer an autonomous detail but rather an assemblage that can be replicated and grow into a larger whole, as seen on page 125.

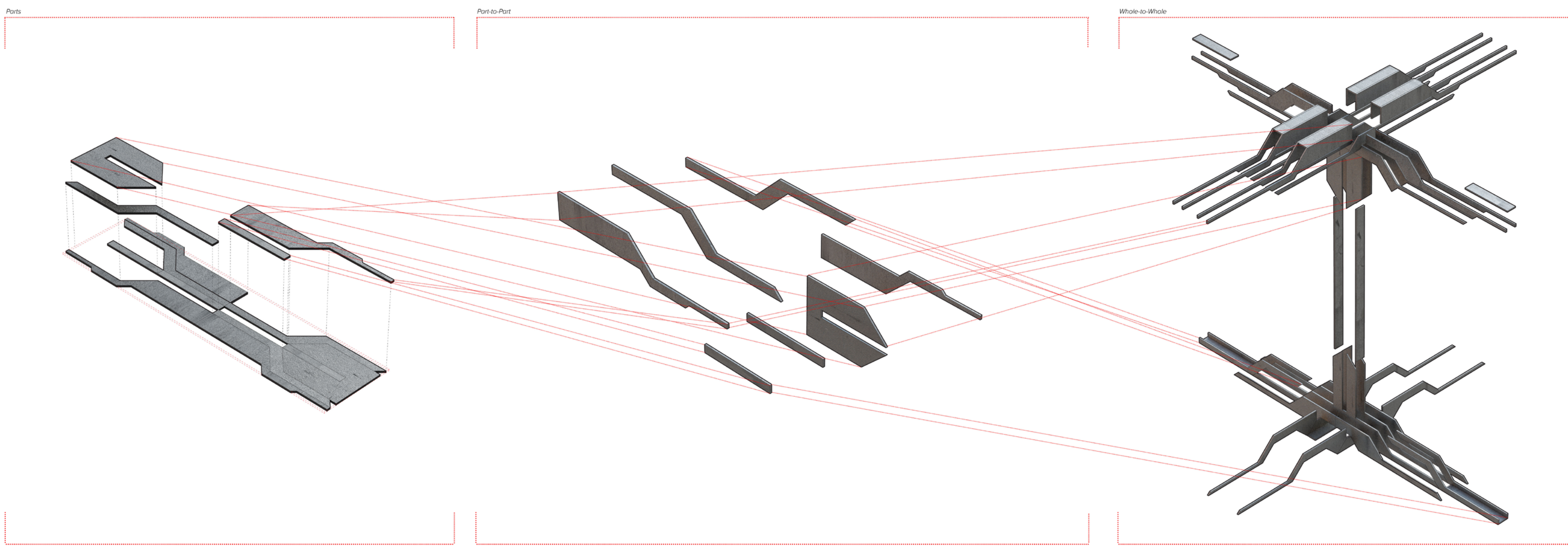
Physical Model, Column Assemblage, *Study-3*



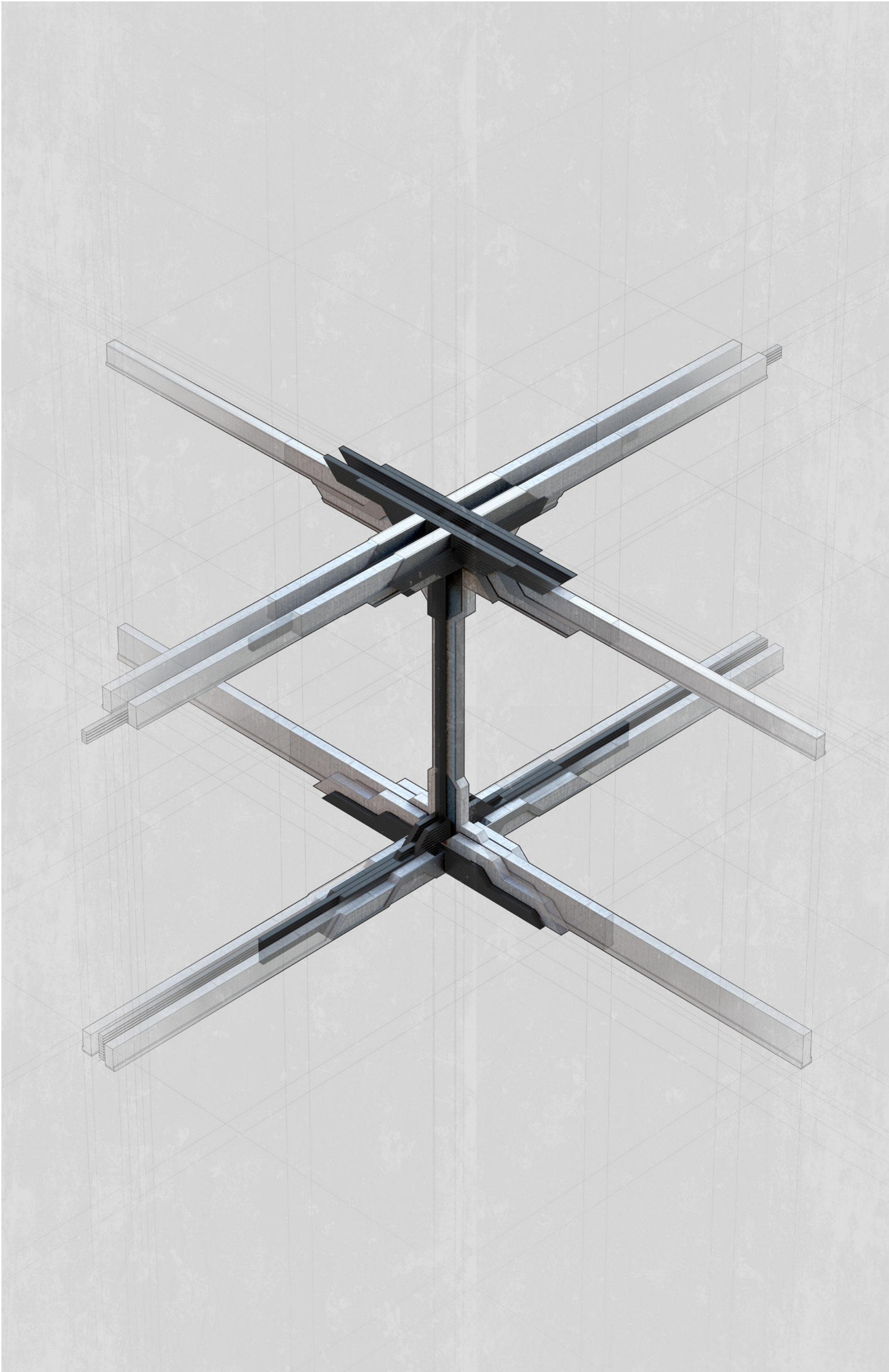
Concrete Parts, Column Assemblage, *Study-3*



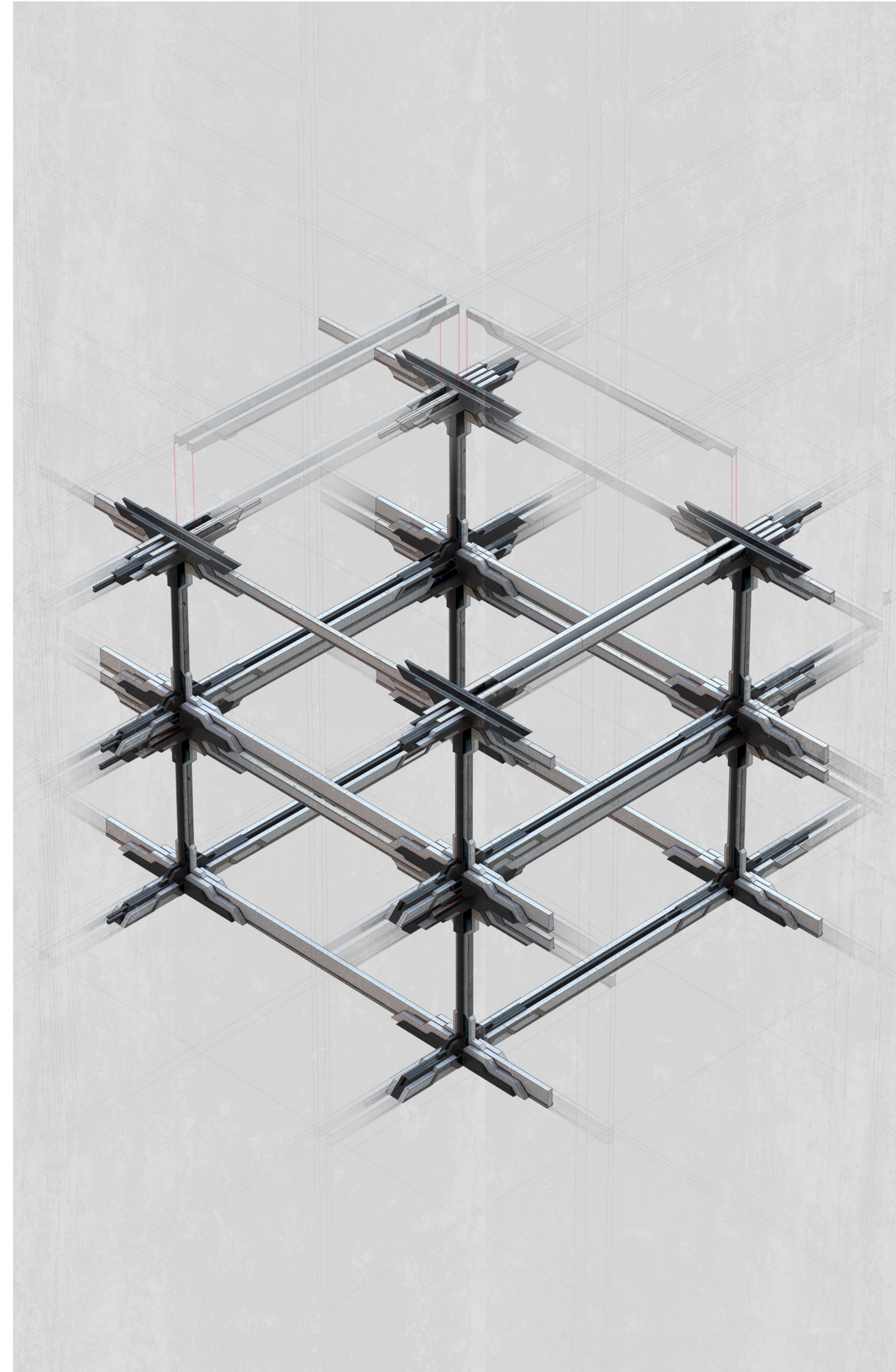
Timber Parts, Column Assemblage, *Study-3*



Steel Reinforcement, Column Assemblage, *Study-3*



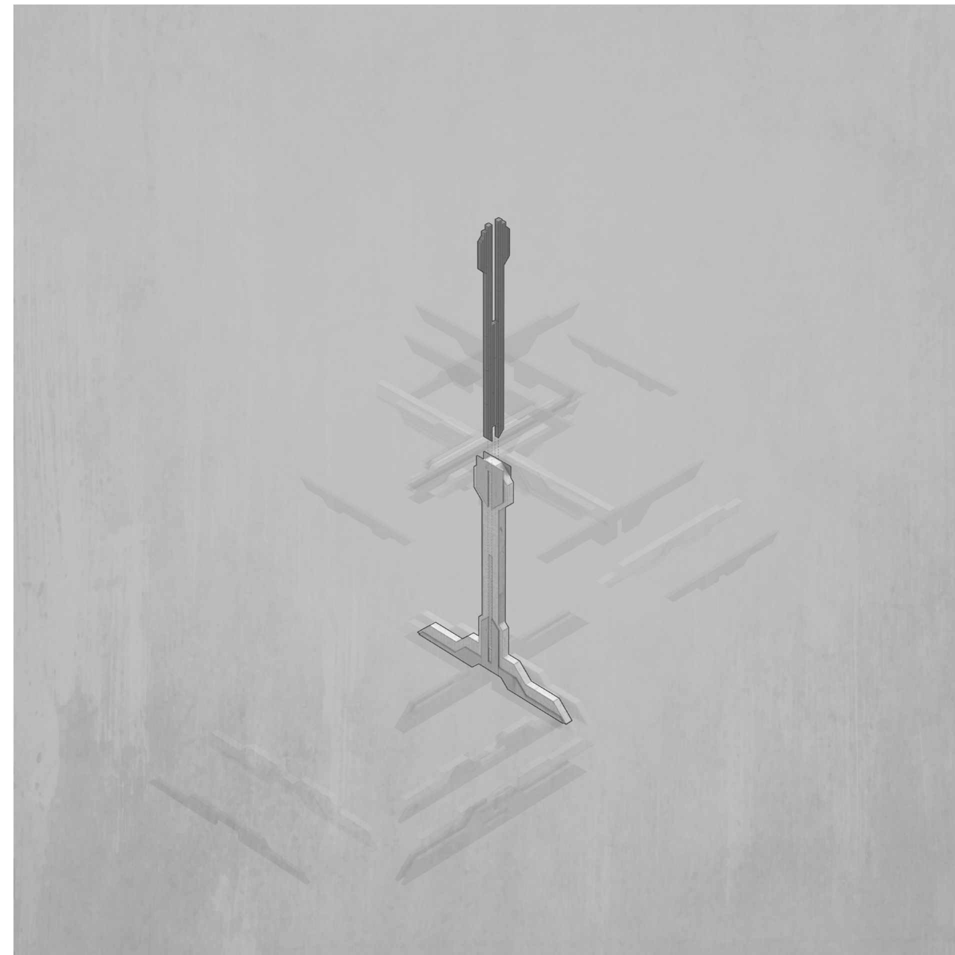
Column Assemblage, *Study-3*



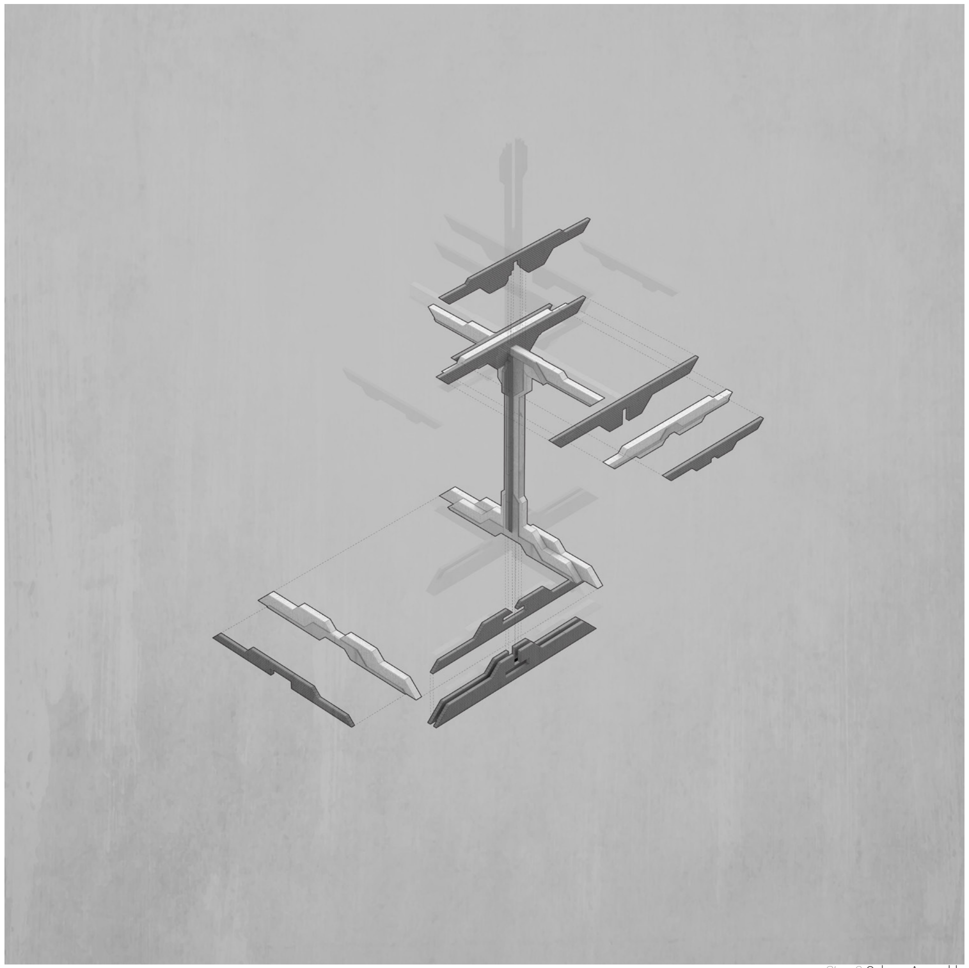
Column System, Column Assemblage, *Study-3*

Assembly

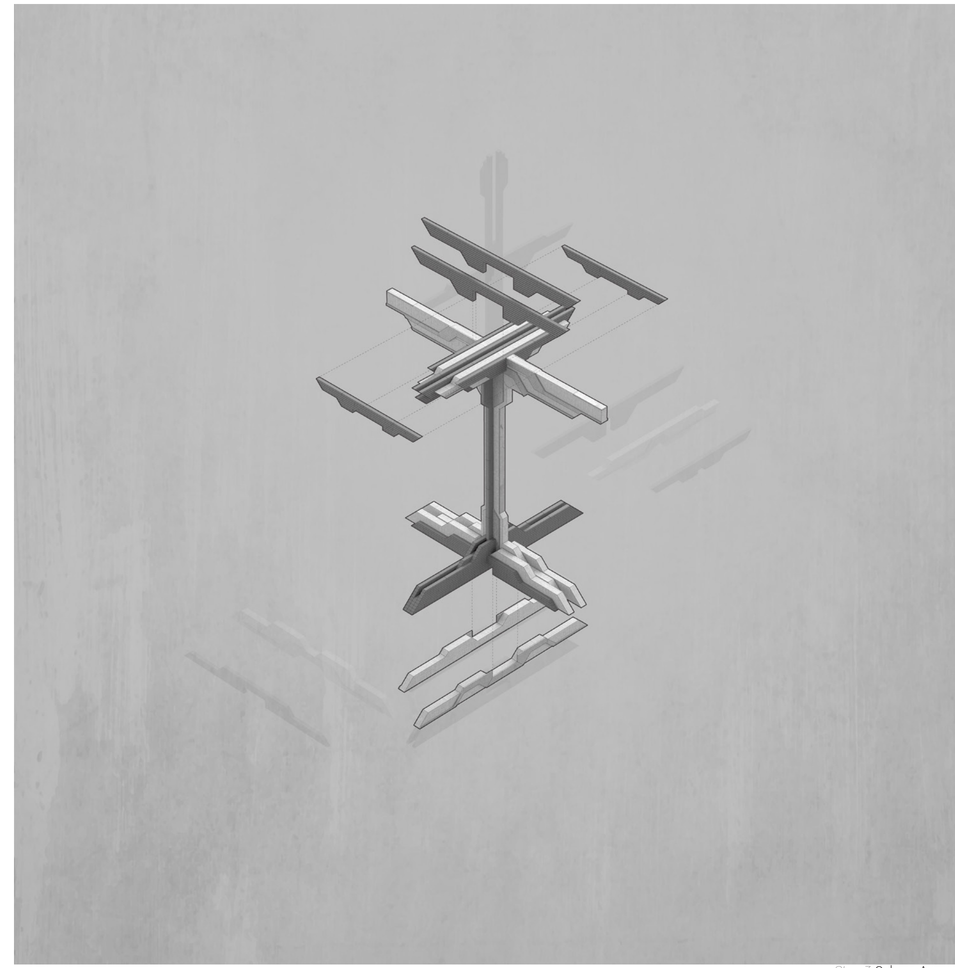
The column assembly process is a series of overlaps and intersections, relying on the relationships between the different material logics to gain rigidity and strength throughout the whole. Concrete elements act solely in compression with the notching now adopting a 45 degree angle reducing the internal tension pressures that were recently an issue with the first study models. The steel and timber elements receive the tensile forces and act as the locking members that hold the assemblage together. These parts allow the assemblage to take on three dimensional qualities characterized by two dimensional profile parts. The timber parts intersect and double up in certain moments to give added strength when locking the concrete parts in place. The drawings that subsequently follow show the assembly of the kit-of-parts but do not reflect conventional methods of construction, each meta-assembly is reliant on each other, not giving precedent or a hierarchy of one assembly over the other. This defines the flat ontology that these assemblages exist within, resisting a wholistic or top down approach.



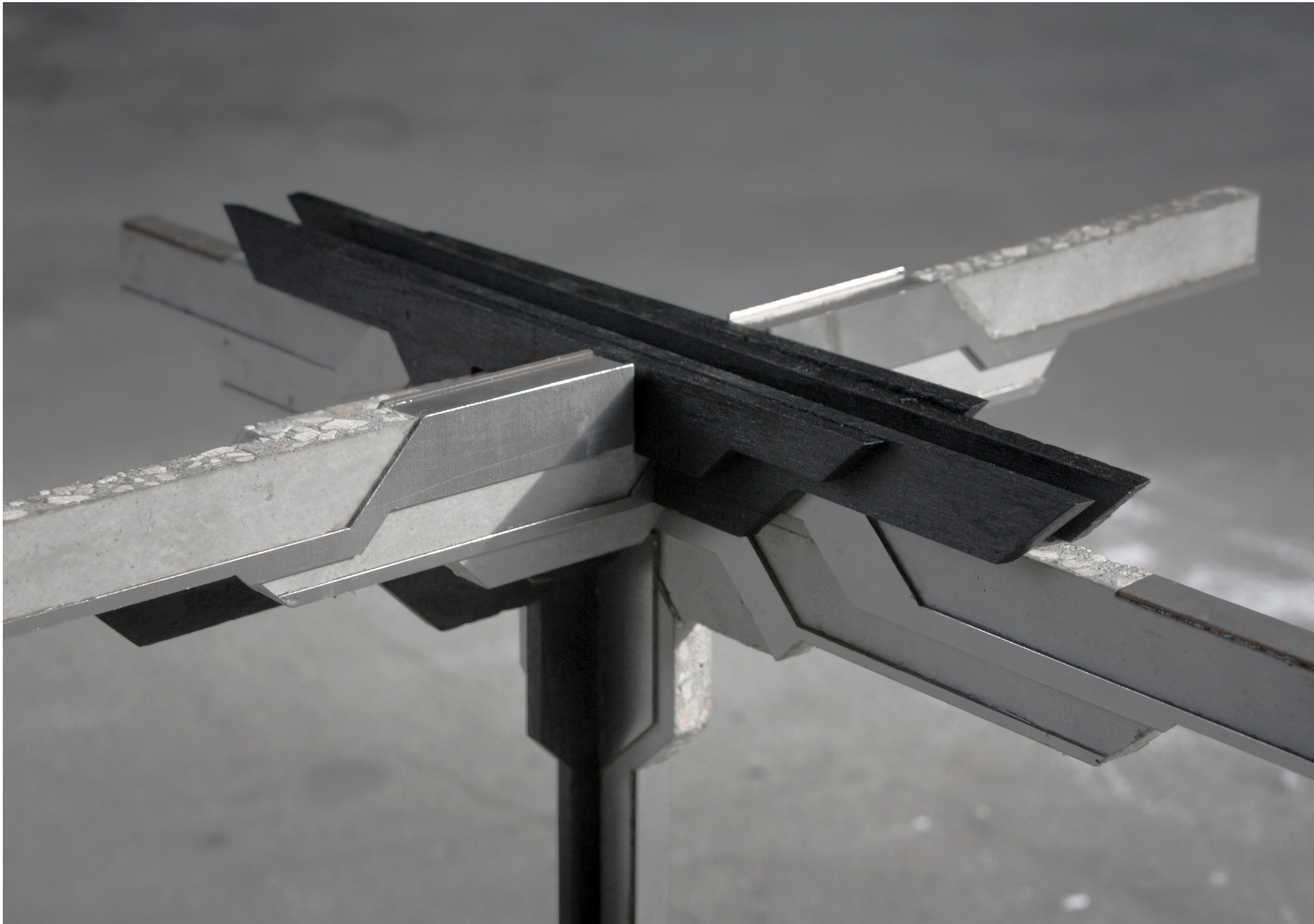
Step-1, Column Assembly



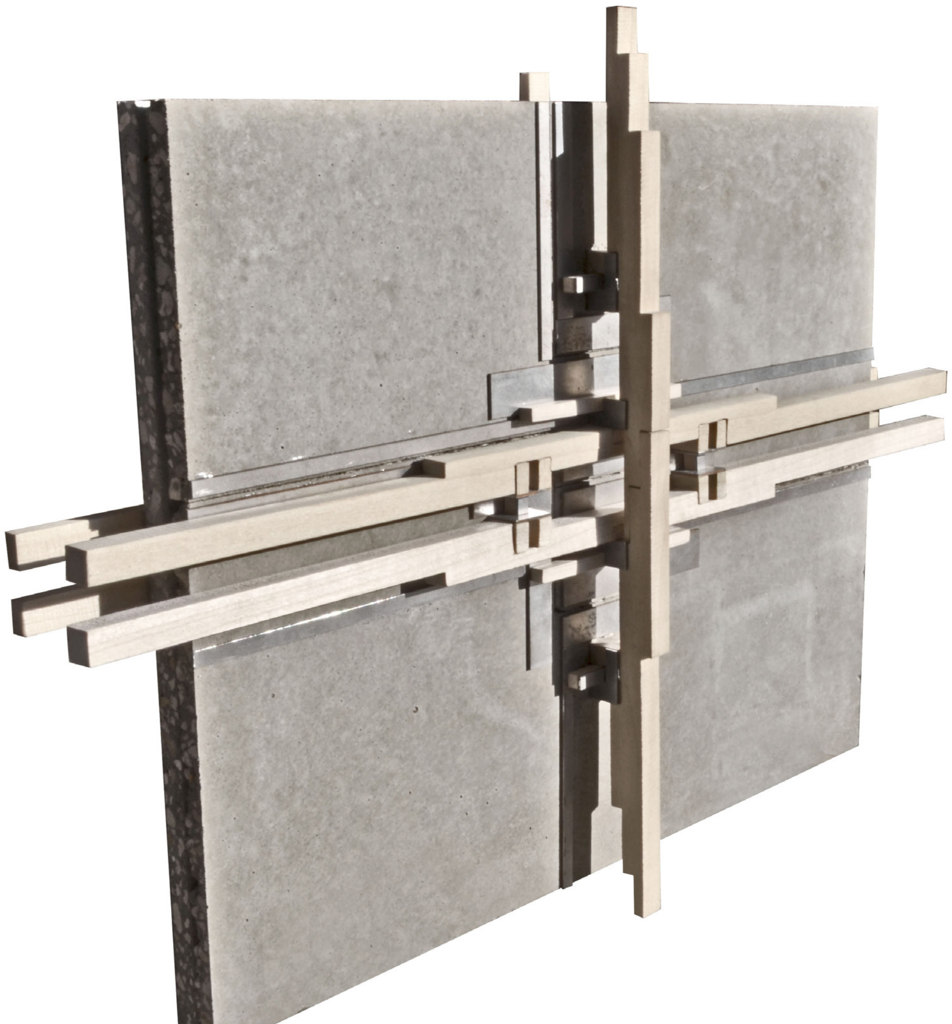
Step-2, Column Assembly



Step-3, Column Assembly



Close Up, Column Assembly, *Study-3*



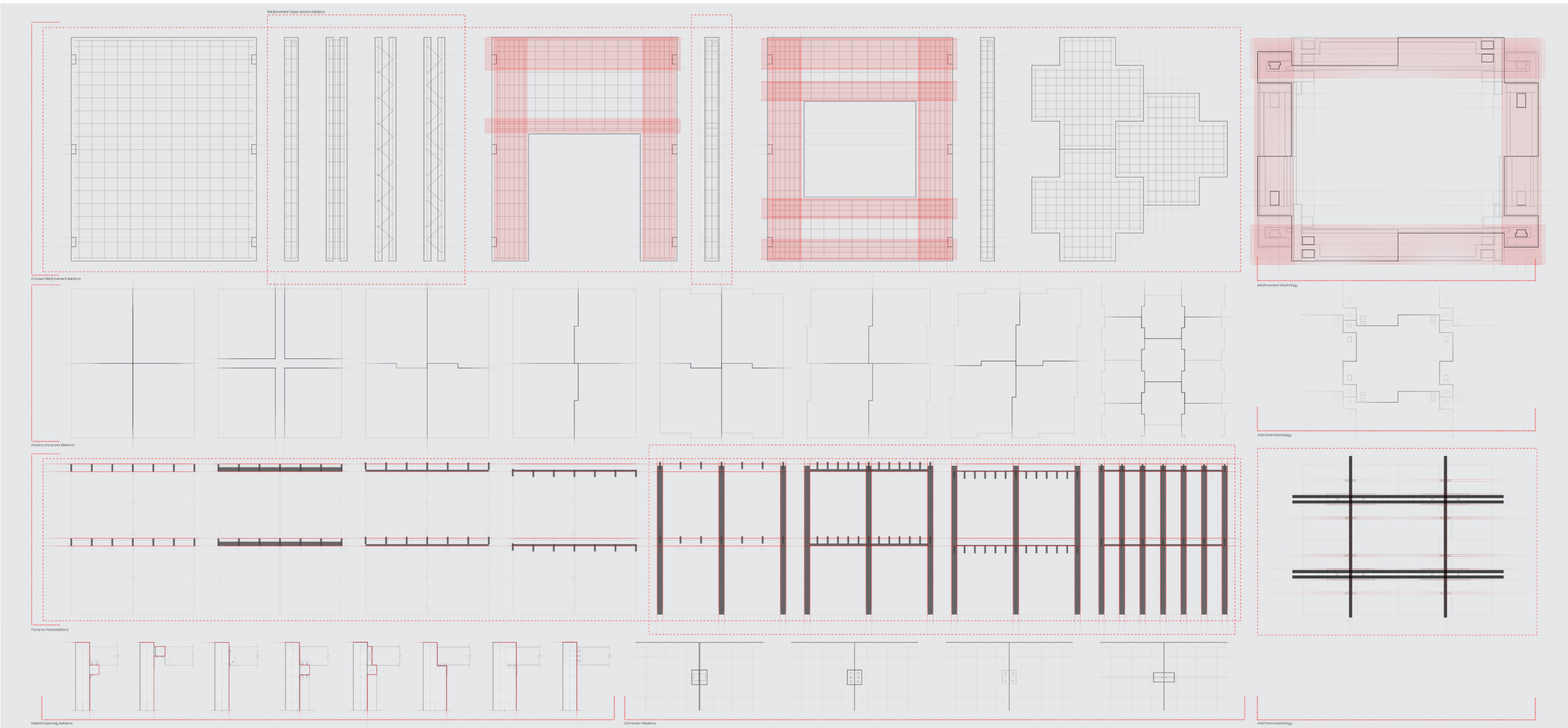
The Wall

Relationships

Another fundamental element of Architecture is the wall. In the past century the wall has gone from solid concrete that encases and conceals all of it's parts to a seamless blend between ground and overhead planes, both assuring the visual reading of continuity and purity of the whole. This research investigates the wall as more than just a plane or a surface but as an assemblage of heterogeneous parts. So to further understand the relationships that happen within conventional wall assemblies a drawing was constructed that dissects these relationships so they could be reorganized to characterize a new tectonic.

Wall Relationships Drawing: This drawing excavates conventional relationships between steel reinforcement, panel to panel relationships, panel to frame relationships and cross-sectional relationships. All these relationships exist in architecture everyday, architecture has just suppressed them to give different readings of form and tectonic. Relationships between steel and panel are drawn out to show how the arrangement of reinforcement tightens together and adapts to accommodate the panel. A series of panels are drawn out to show a morphological transformation of panel to panel relationships and how the edge to edge conditions can become more complex within these assemblies. Along with these relationships between panels it is equally important to understand the conventional relationships between panel and frame to begin to investigate with these studies *what is frame* and *what is fill*. Finally this drawing looks further into the cross-sectional relationships that happen in these conventional assemblies and this allows a re-examination into the methods of assembly. Most conventional wall assemblies are stacked or layered, which defines a hierarchy to the parts, and this promotes a top-down approach that eventually leads to these relationships being concealed. It is crucial that these relationships be drawn out so that they can be reorganized and realigned into an assemblage that is defined by the relationships between the parts.

Close Up, Wall Assembly, *Study-3*



Wall Relationships, Wall Assembly

Parts

Architecture is a Part-to-Whole relationship and these studies investigate just that, the parts. Each Study is composed of concrete, timber and steel parts, with each system relying on each other as they enter into new relations, forming a kit-of-parts that compose a larger whole.

Concrete: The concrete parts in the wall assembly studies adopt the same subtractive fabrication process as the column studies and through this process the relationships between the steel reinforcement and the concrete are realigned and reorganized. The concrete parts in these assembly studies are designed to fit a 20'X16' large format water-jet and the forms of the panels follow simple geometry that create friction joints between the panels to challenge the conventional methods of joining panels together, refer to pages 154 and 155.

Steel: Since steel is a commodity in construction the steel parts in these studies are formatted to fit within 4'X8' sheets to minimize the waste to a zero amount, refer to page 156 and 157. The parts reflect the relationships that must happen in conventional wall assemblies, supporting and reinforcing along the edges of the concrete and around cut openings in the concrete. Similar to the column, the steel becomes externalized due to the fabrication process of the concrete parts and ultimately this reveals these relationships that exist but normally suppressed.

Timber: Timber parts are composed of standard sections of framing elements, using 2x4 and 2x6 shorts from standard construction and the lengths used are 2 foot and 4 foot lengths. This addresses material economy and reuse and in turn defines another level of the Theory of Assemblages; these parts are now in turn made of parts. The timber elements form standard sections of engineered timber beams to address conventional issues of structure. When the large scale timber parts overlap the elements widen to maintain consistent with these standard beam sections, this causes a stepping to occur, and this assures strength and structural rigidity throughout the assemblages.

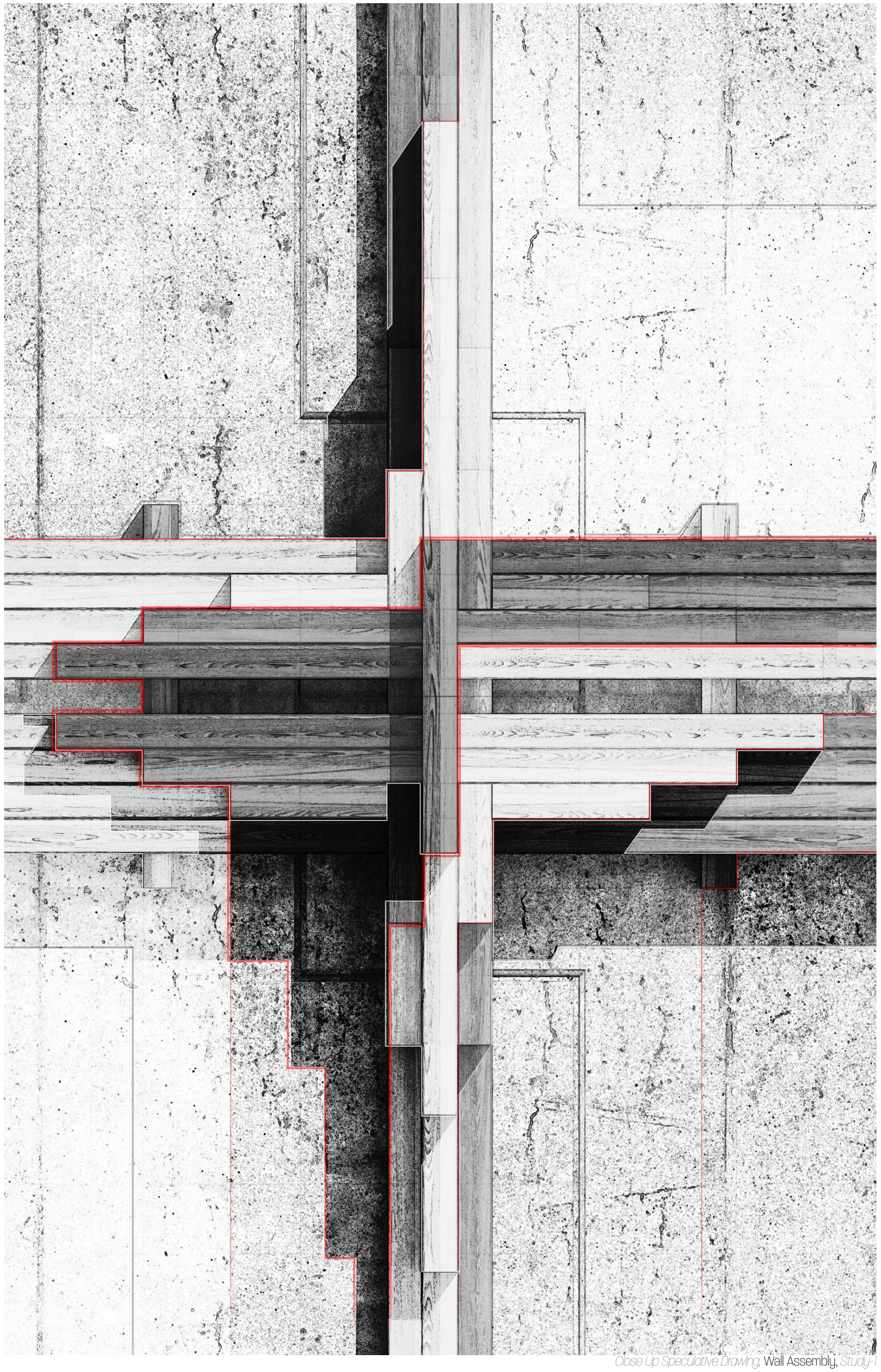
Wall Assemblage Parts, Wall Assembly

Wall Studies

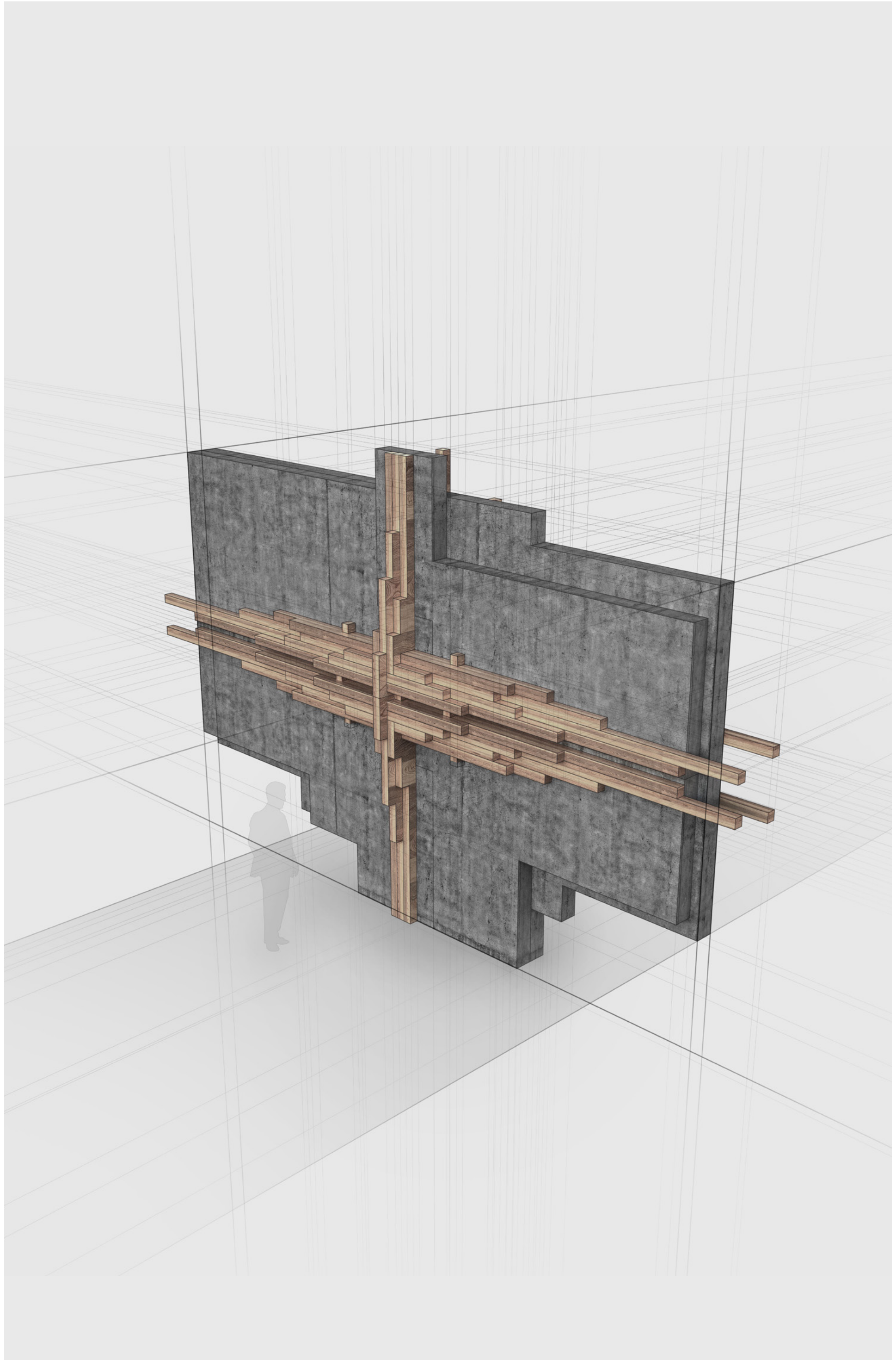
Study-1

Driven by the need for a part based architecture, this study investigated and challenged conventional wall assemblies to begin a dialogue that questions *what is frame* and *what is fill*. Central to this study was also the idea of excess and ornamentation, characteristics that have been suppressed in architecture in recent discourse. The assembly is a system of friction fit parts, adopting techniques and methods of joining related to the previous Japanese joinery studies. Constructing in this method, in terms of a wall assembly, reorganizes the relationships between frame and fill, and the assemblages resist conventional methods of stacking or layering. The timber parts act as the key that lock the assembly together, piercing and intersecting the concrete elements at specific moments giving rigidity to the overall assembly.

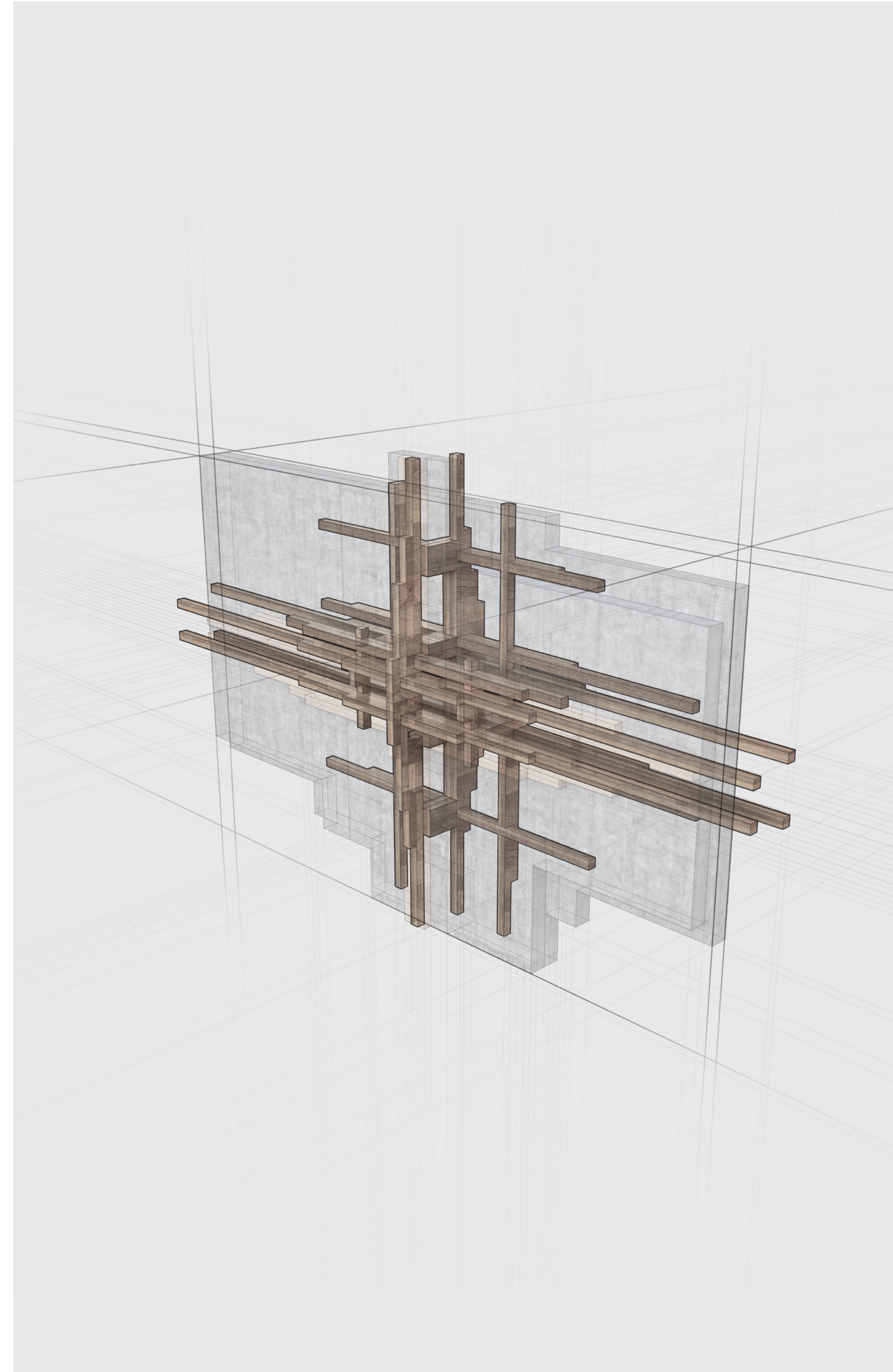
This assembly addressed issues that resisted extreme continuity, which is rooted in modernism but as an assemblage it became too autonomous and could not relate outside of its current state. Issues such as material economy, material commodity and cultural influence were left unanswered, and the study became more about ornamentation and the need for excess parts. This study was further developed as it influenced new ideas that were connected to the above issues and asked more questions deeply rooted in the fabrication processes and relationships between parts.



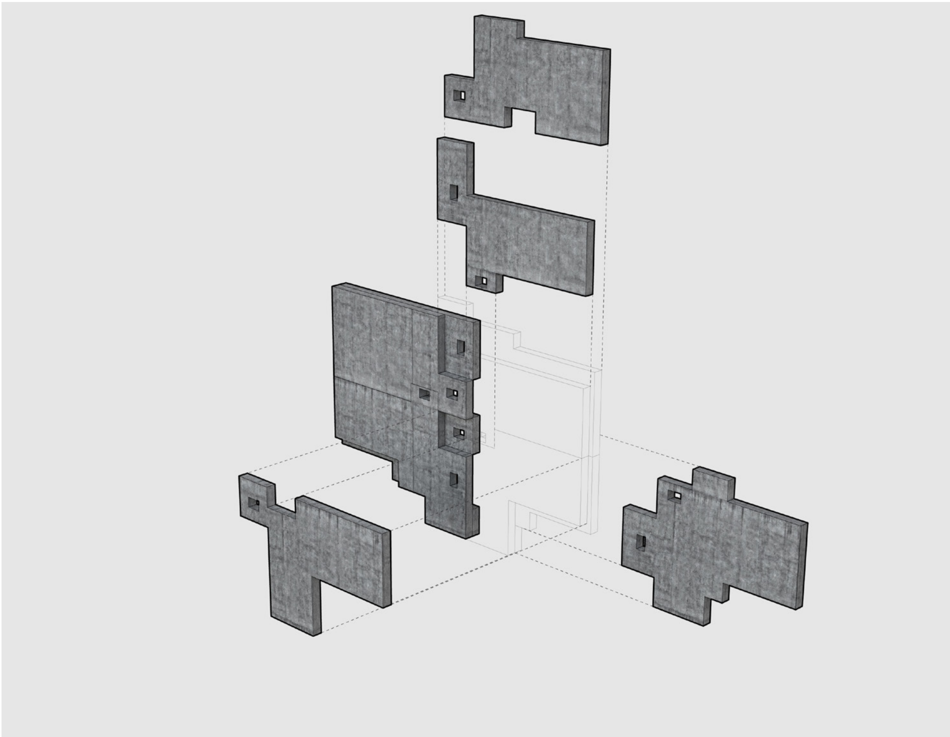
Close Up Speculative Drawing, Wall Assembly, *Study-1*



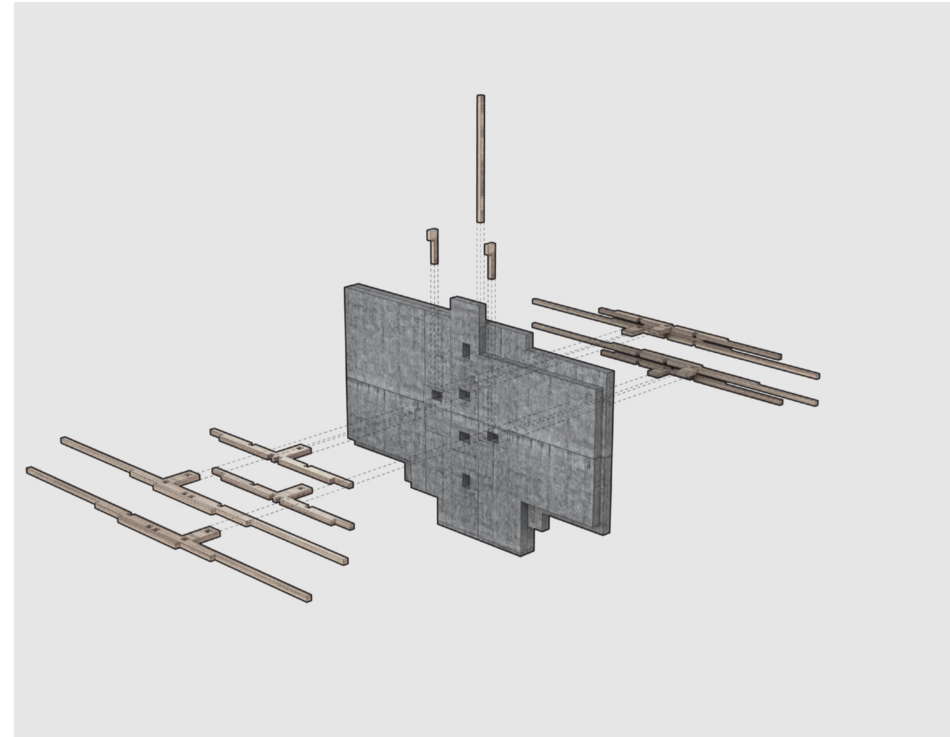
Wall Assemblage, Wall Assembly, *Study-1*



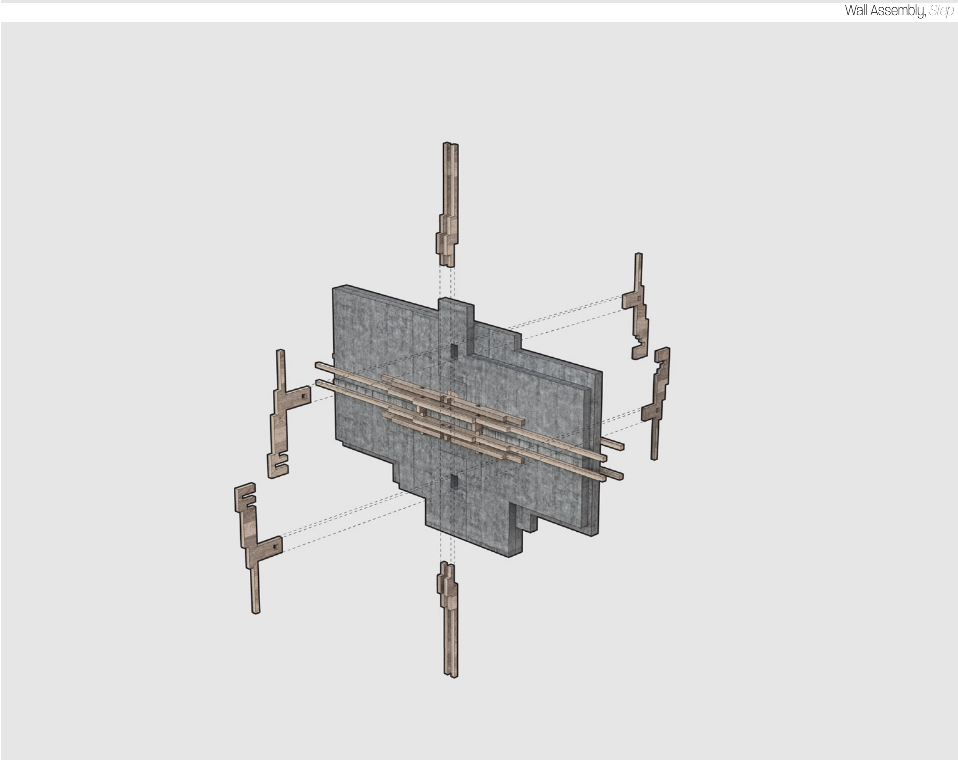
Timber Meta-Assembly, Wall Assembly, *Study-1*



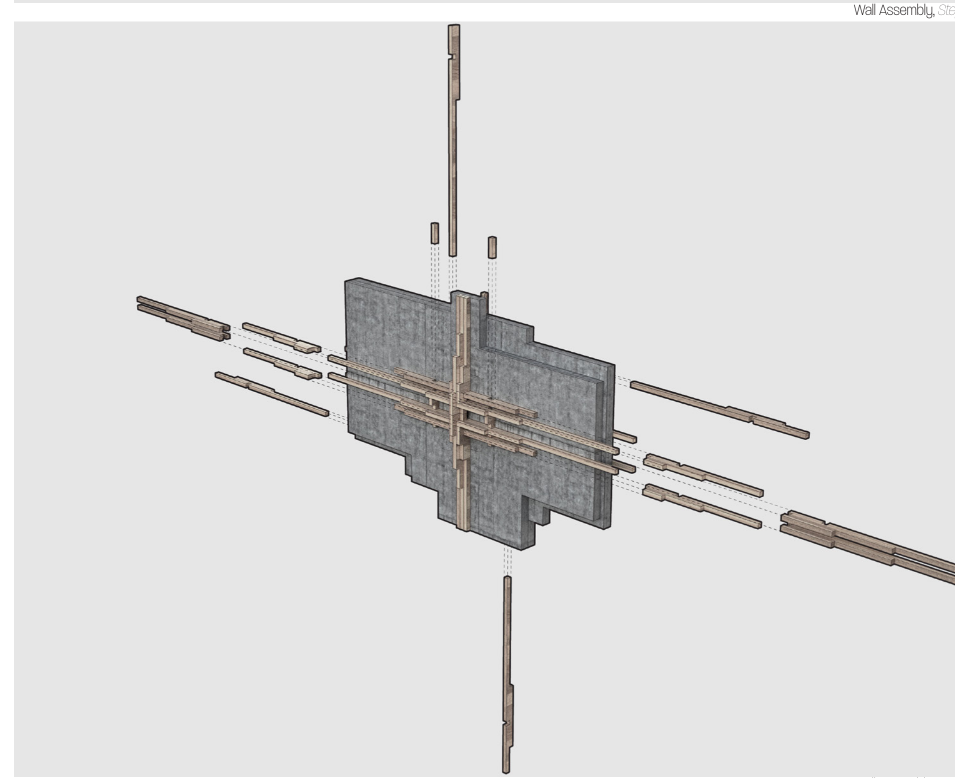
Wall Assembly, *Step-1*



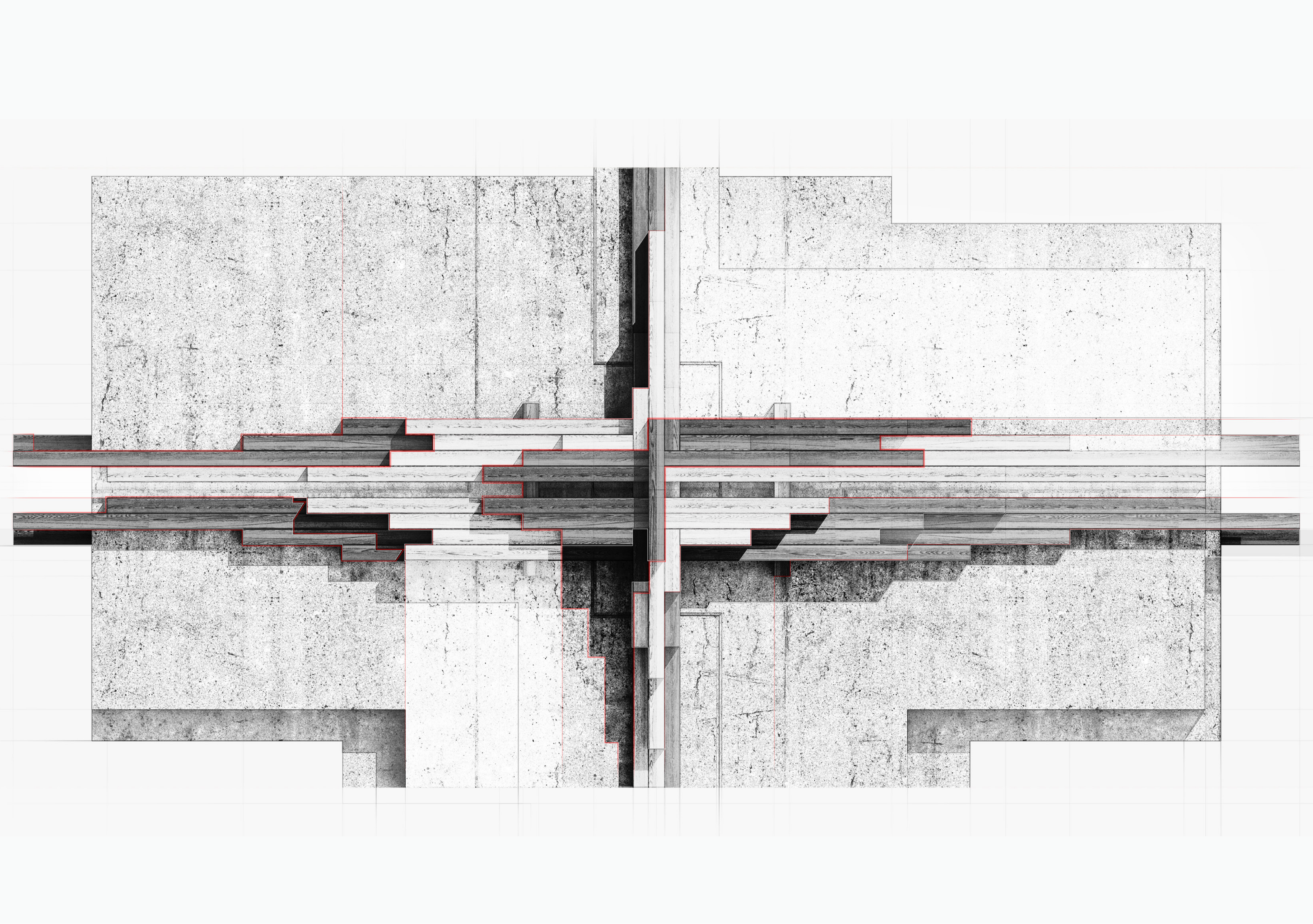
Wall Assembly, *Step-2*



Wall Assembly, *Step-3*



Wall Assembly, *Step-4*



Detail Speculative Drawing, Wall Assembly, *Study-1*

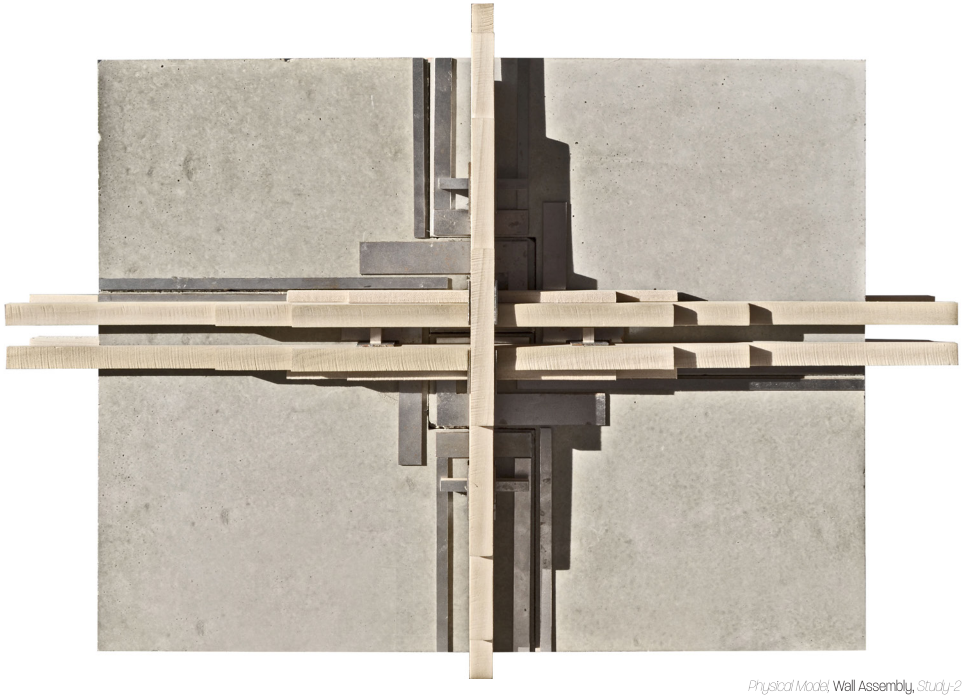
Wall Studies

Study-2

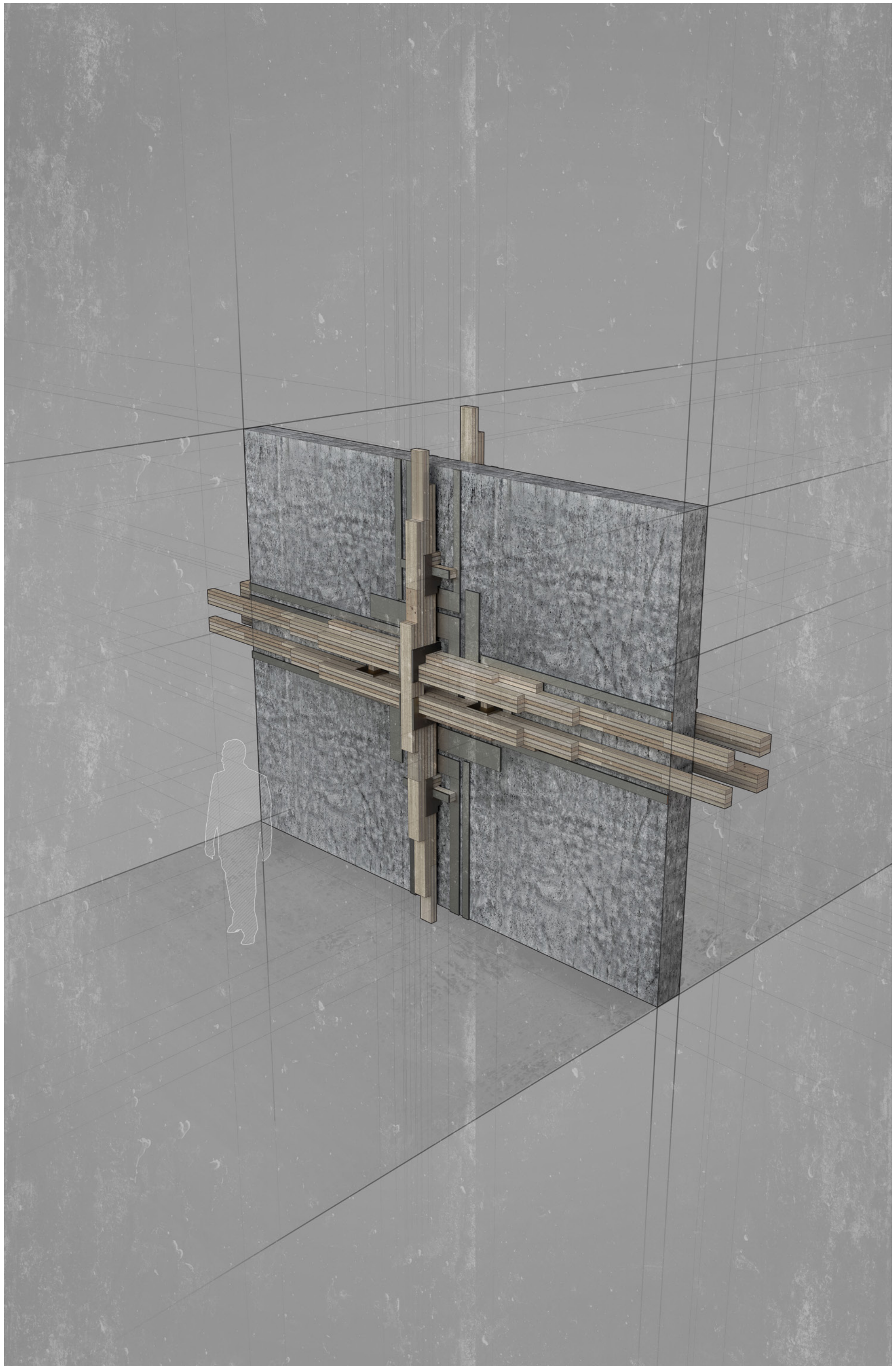
The final wall assemblage study continued the investigation and re-examination into the architectural joint and the architectural detail. Central to this study was the idea that the digital tools have not created new geometries and this was not an exercise in form finding, but rather the digital tools have changed the processes in which we work and create architecture. This assemblage was characterized by the relationships of materials, the relationships between the parts and the ability to address the cultural need that we live in a world of finite resources and materials.

Concrete, timber and steel are the common materials within this assembly and steel was introduced not only as reinforcement for the concrete but also as the interface between the concrete and timber parts. Since steel is a commodity in construction so the steel parts in these studies are formatted to fit within 4'x8' sheets to minimize the waste to a zero amount, refer to page 156 and 157. The parts reflect the relationships that must happen in conventional wall assemblies, supporting and reinforcing along the edges of the concrete and around cut openings in the concrete. The timber parts create the *frame* of the assemblage allowing the system to grow from the previous autonomous nature found in the first study. Each timber element is composed of 2x4 and 2x6 shorts to address issues of material waste and in turn those elements take a Mereological position, the parts are further composed of parts.

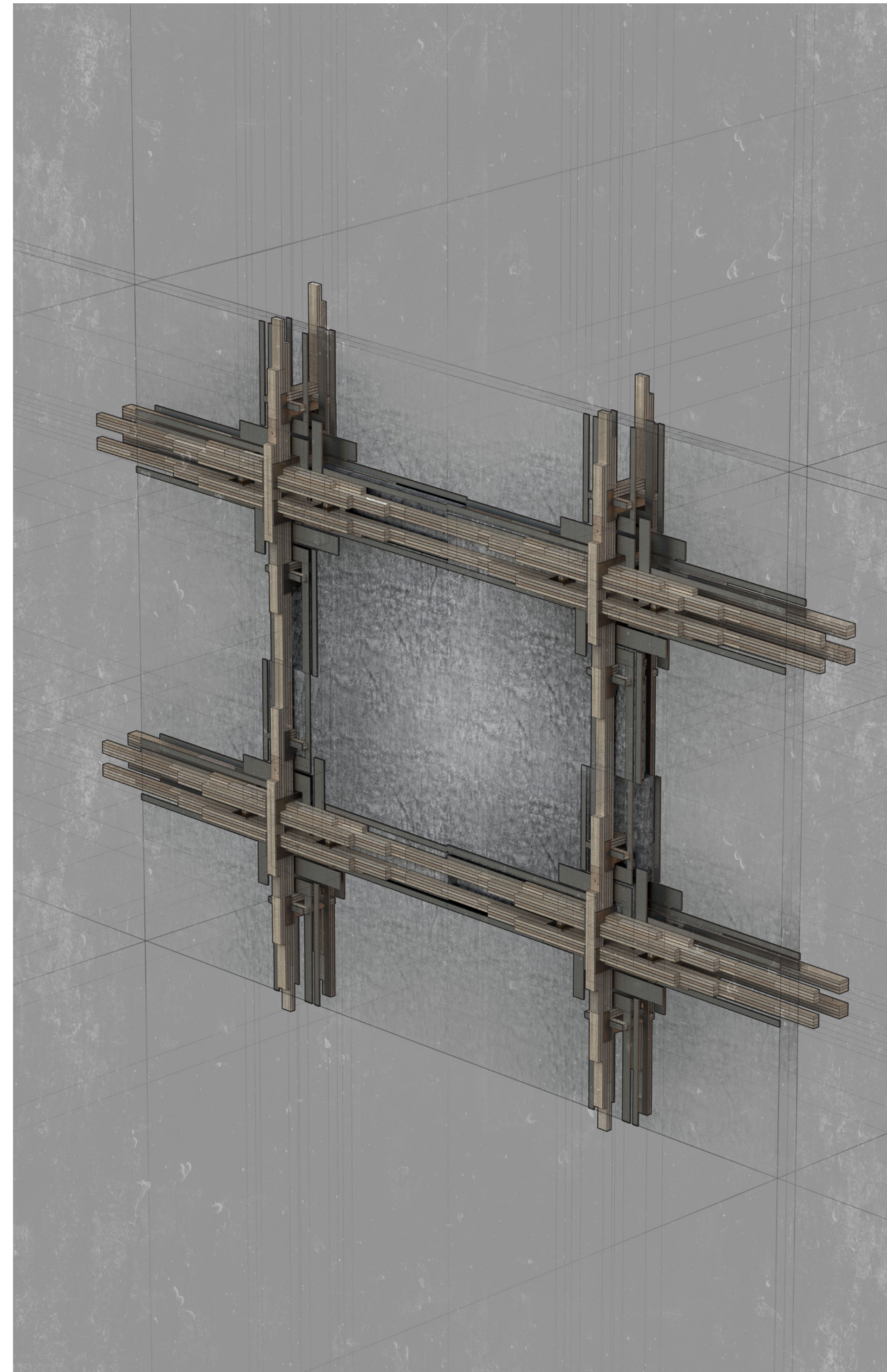
This study was not an exercise in forming finding and complexity, but rather gained complexity through the reorganization and unearthing of these conventional relationships between parts. So geometry is defined by the relationships of the parts to the whole, as architecture is itself a part-to-whole relationship. The parts are directly related to the fabrication processes and the need to address material waste and commodity. It becomes a truthful architecture, an architecture of complexity born through necessity.



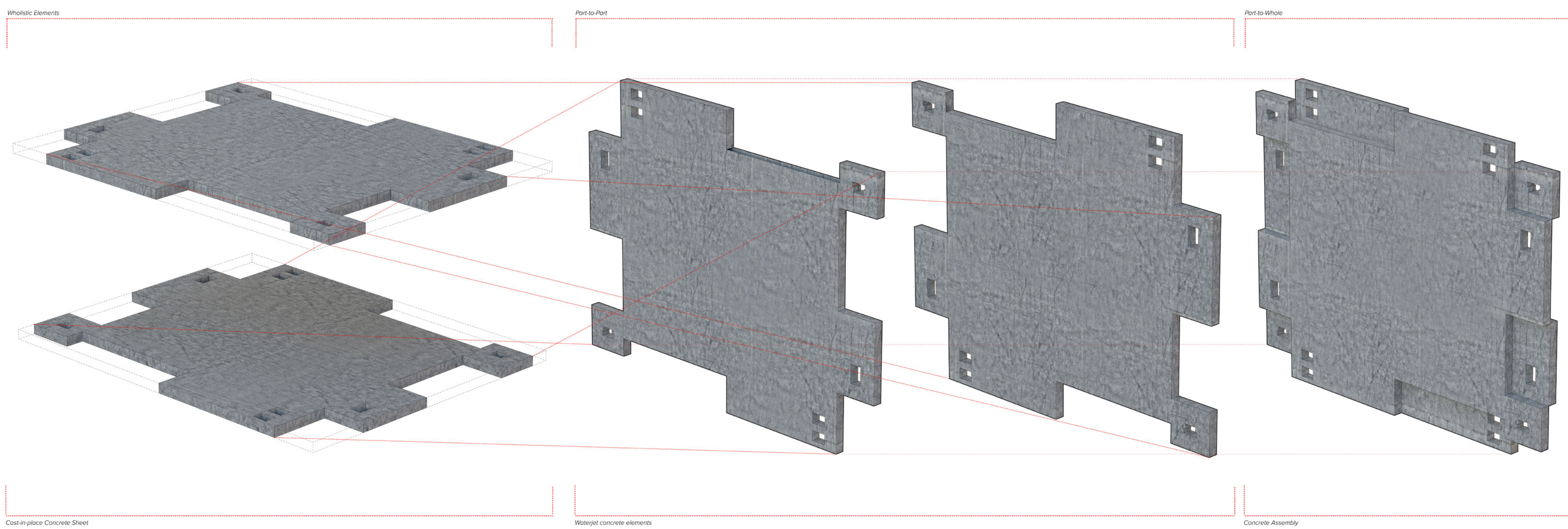
Physical Model, Wall Assembly, *Study-2*



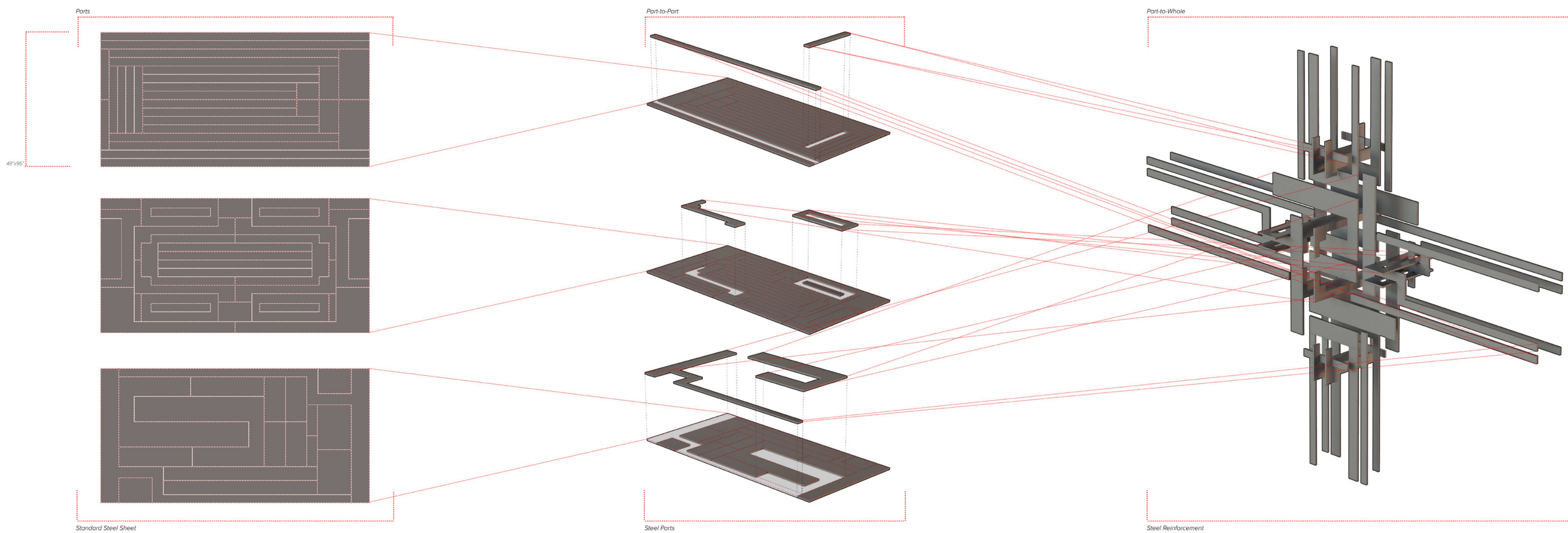
Wall Assemblage, Wall Assembly, *Study-2*



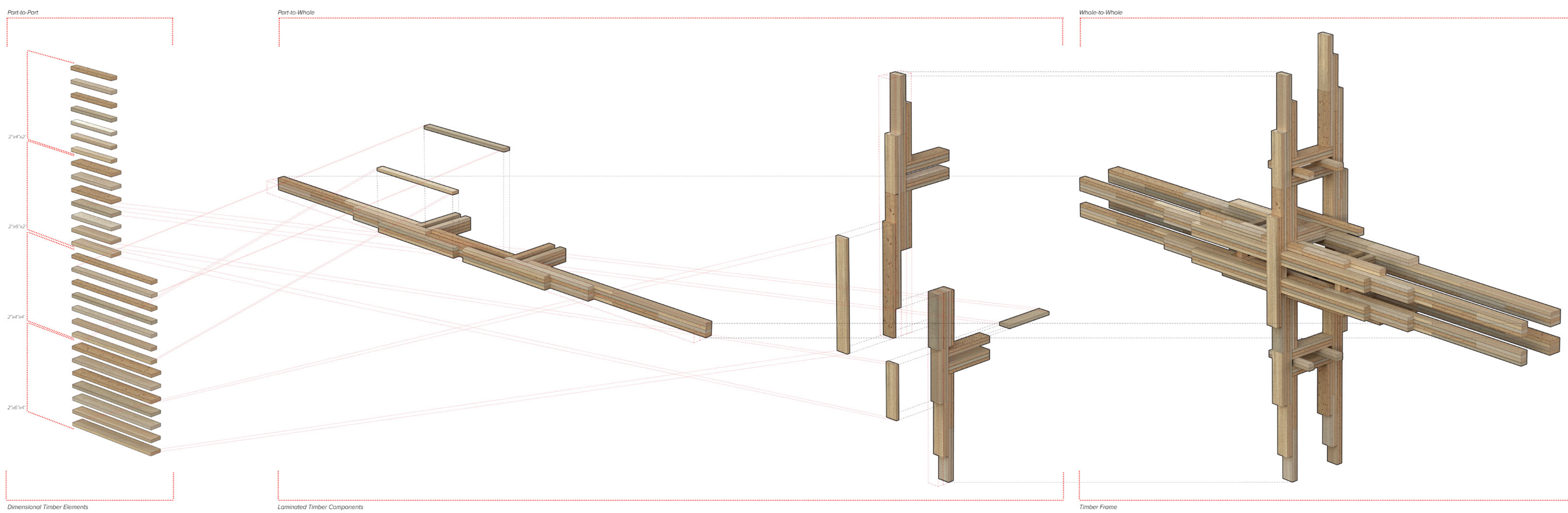
Wall System, Wall Assembly, *Study-2*



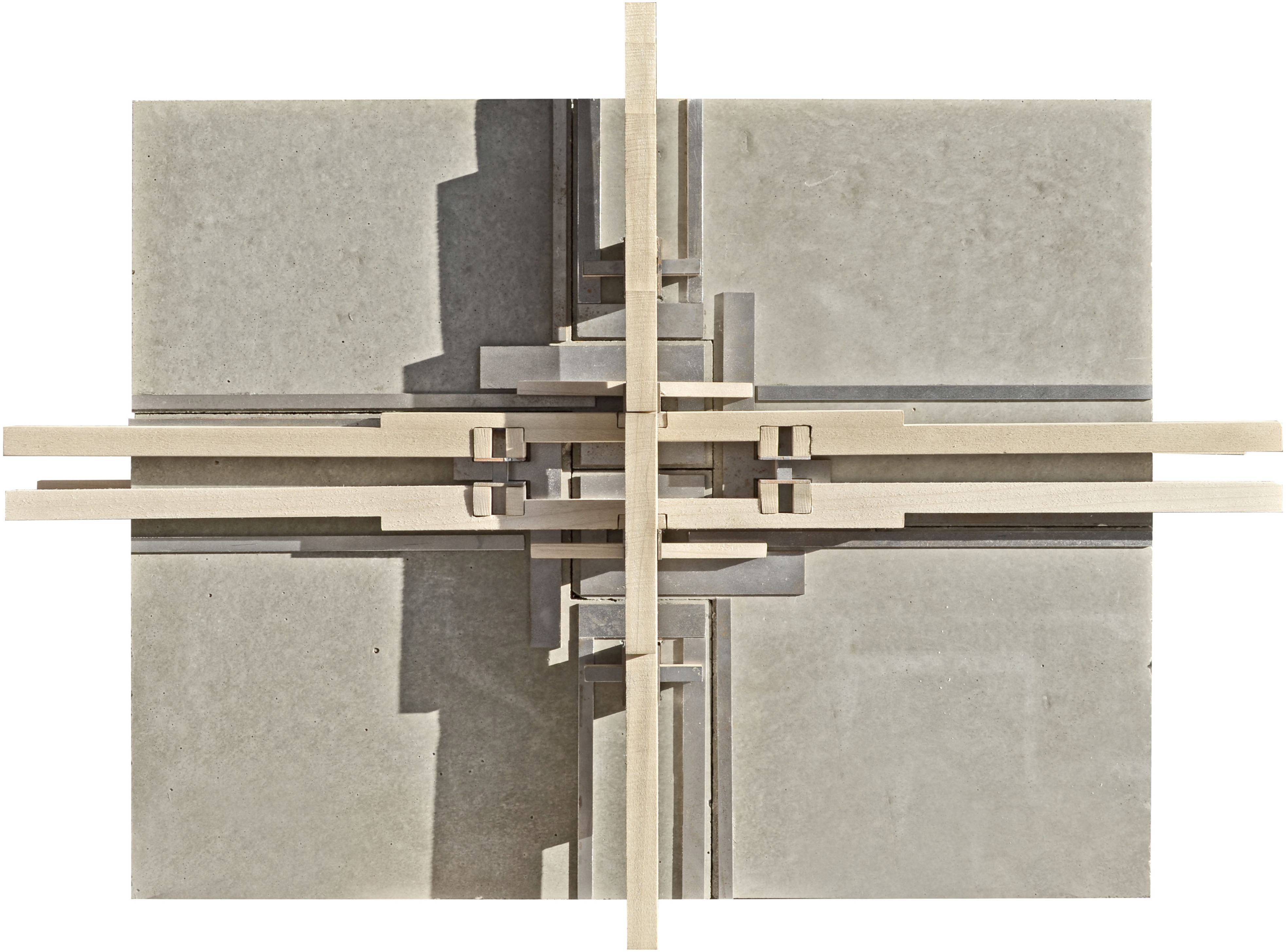
Concrete Parts, Wall Assembly, *Study-2*



Steel Parts, Wall Assembly, *Study-2*



Timber Parts, Wall Assembly, *Study-2*

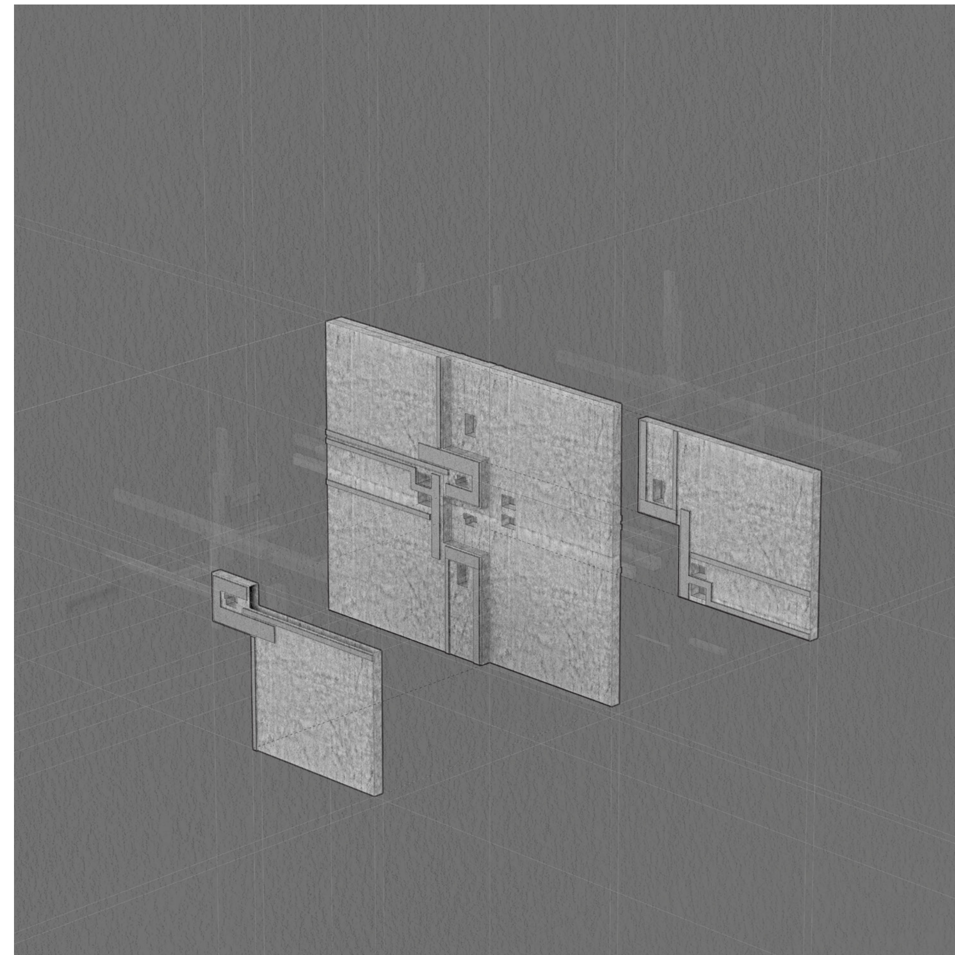


Physical Model, Wall Assembly, *Study-2*

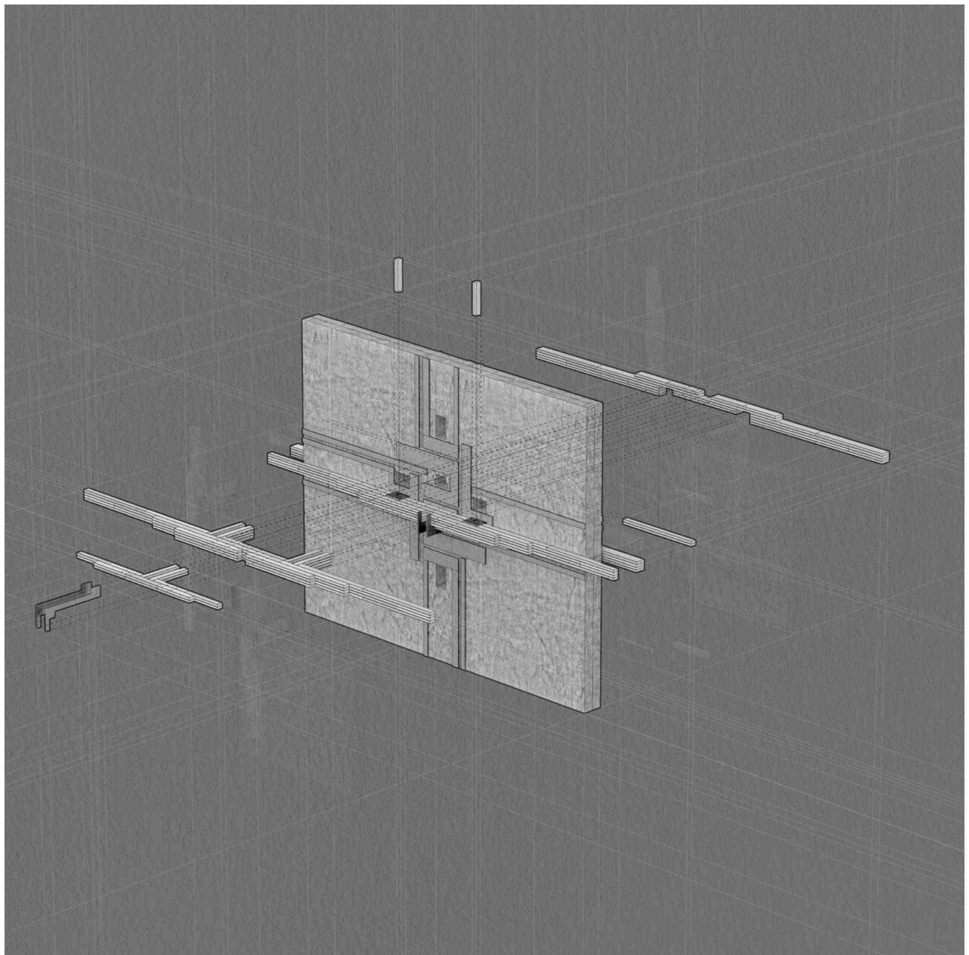
Assembly

Conventional methods of assembly can be typically defined by either stacking or layering. Stacking referring to masonry and layering referring to a frame that is then hidden by sheets of material. This assemblage challenges these methods by organizing the parts on a single datum and allowing each set of parts to exist equally yet autonomously. Concrete can not exist in this assemblage without the steel and the steel cannot exist without the concrete. Each material is reliant on the others as the parts characterize an entirely new whole.

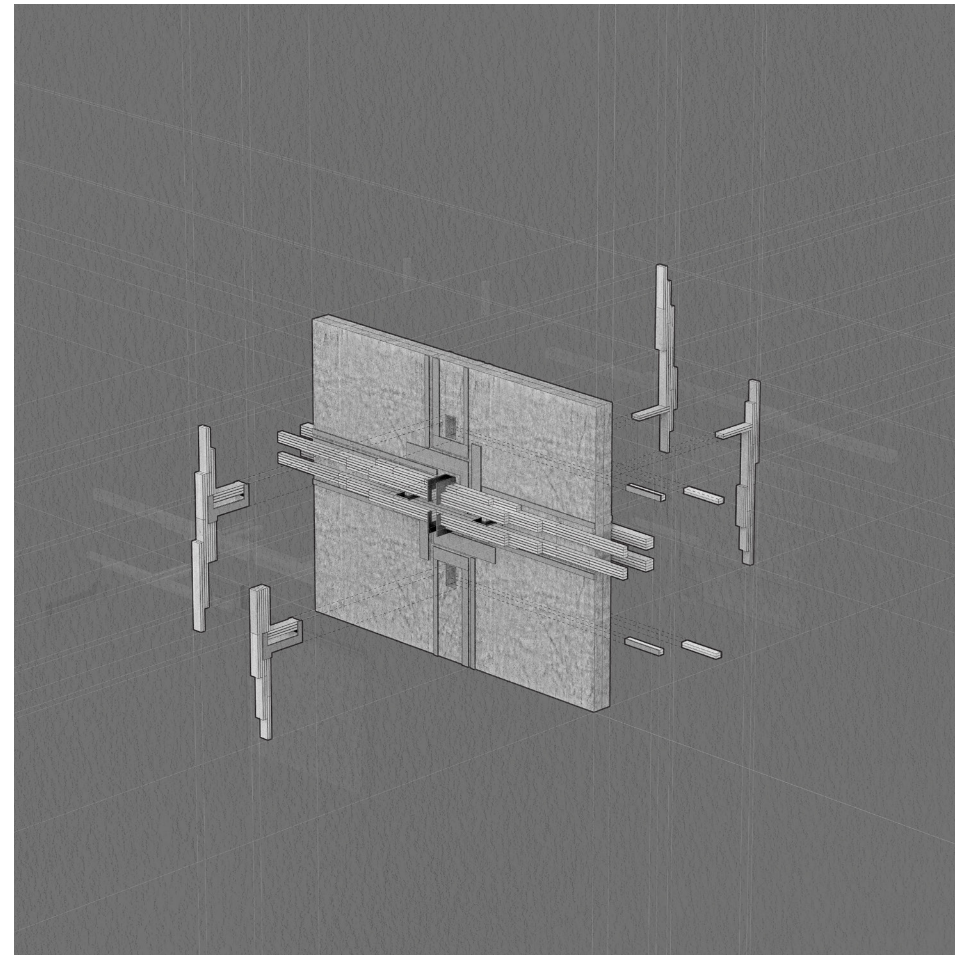
Concrete elements are first reinforced with steel parts so that they can be overlapped and locked together by the larger scale timber elements. The concrete allows the assemblage to address compressive forces while the timber elements give rigidity and stability to the system at the critical connection points where multiple panels come together. The timber parts have vertical and horizontal components, representing beam and column conditions, that allow this assemblage to form connections and relationships with other systems as it grows. Overlapping and notching is critical in this assemblage as it forms a friction fit system that reduces the need for mechanical fasteners and continues to address issues of material commodity. Where other discourses in architecture attempted to hide and conceal these relationships between parts, this assemblage reveals and celebrates the architectural joint and the architectural detail defined by the relationships between this kit-of-parts.



Wall Assembly, *Step-1*



Wall Assembly, *Step-2*



Wall Assembly, *Step-3*

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